



agency of Mahometanism and Christianity; the two great religious systems which then divided, as they still divide, the empire of the world; and which, during this prolonged term of nearly eight hundred years, successively rendered the arts of life, which they revived and cherished, instrumental to the revival also, and advancement, of the lights of knowledge. We have just examined the parallel effects of the two religions on agriculture, manufactures, and commerce: we will next contemplate them, as, through the instrumentality of these pursuits, giving a new birth to the several branches of intellectual cultivation: to arts, sciences, philosophy, and literature.

Nothing can be more exact than the parallel advances of the two creeds, toward that mental renovation of mankind, which issued in the production of the intellectual wealth and resources of modern Europe. The erection and aggrandizement, throughout the East and West, of numerous and populous cities, were, the reader will call to mind, among the first-fruits of the manufacturing and commercial prosperity which emanated from the Saracenic and Catholic crusades. The population of Bagdad or Cordova *, in the

* The census of Cordova was one million. *De Marlès*. The funeral of Ebn Hanbal, was followed by 800,000 men, and 60,000 women, inhabitants of Bagdad. *D'Herbelot*.



ninth and tenth centuries, equalled that of modern London or Paris; and the wealth of those immense capitals was proportioned to their population. The census and revenues of Venice, Genoa, Florence, not to mention other Italian states, will amply verify the corresponding effects of the Christian holy wars, on the enlargement and prosperity of cities. The cases instanced, are merely taken as specimens of the efficacious general agency of the religions of Christ and Mahomet, on a department of national improvement, which supplies, in fact, the foundation of all social progress. For it is notorious, that the influences of Mahometanism spread flourishing cities and towns over the Asiatic and African dominions of the Saracens; and that the influences of Christianity multiplied towns and cities not less flourishing, in the centre and north of Europe. The cities of Spain and Italy, however, were the chief seats of commerce: accordingly, we find Spain and Italy becoming, in their turns, the great providential sources of the general revival of letters. And we see, in these countries, the newly-arisen lights of Mahometanism and Christianity converging to illuminate, from its opposite extremities, the benighted nations of Europe. From these states, especially, we behold the two religions start as competitors in a new field of conflict: in these states,

the lamp of science was re-kindled from the East, by the influences of Mahometanism, in the progress of the great twofold crusade: but Mahometanism, having thus discharged its providential part, has long since yielded up its borrowed lustre, to heighten those earlier lights of Christianity, whence it originally drew its own illumination. Learning, indeed, it will freely be acknowledged, was revived in Europe, in the eighth century, by the direct, and in the fifteenth, by the indirect effects, of the primitive Saracenic holy war: but it should be equally remembered, that the rudiments of knowledge were introduced anew, by Mahometanism, from the East, only to be carried by western Christendom to the height of their perfection. Thus, in this, as in every former topic of comparison, nothing will be found wanting to complete the triumph, and to guard the inviolable supremacy of the Gospel.

An extraordinary increase in the number and population of cities has been noticed as a common effect of the great Saracenic irruption, and of the crusades. Respecting the Saracens, especially, the remark has been justly made, that, in the prosperous age of their empire, they never effected a new conquest, without laying, at the same time, the foundations of a city.* The

* Oelsner.

rise of a national taste for ARCHITECTURE was the necessary and immediate consequence of this wise and prospective policy. We will begin, then, with a survey of the relative influences of the Saracenic wars, and European crusades, on the progress of this noble decorative art.

In forming their peculiar school of architecture, the Saracens seem to have laid aside their propensity to imitate, and to have followed the bent of their national genius. Their architectural school, possessing distinctive features equally removed from the classic beauty of the Greek, and from the severe regularity of the Egyptian, has been appropriately characterized, as the union of elegance with boldness. At the height of their prosperity, the Arabs devoted themselves enthusiastically to the cultivation of an art, the study of which among them, as is attested by the erection of the celebrated mosque of Omar at Jerusalem, was nearly coeval with the period of their earliest conquests. Throughout Asia, Africa, and Spain, mosques, palaces, and public buildings arose, almost simultaneously, on a scale of magnificence, which caused them to surpass the chaster monuments of ancient Greece and Rome. Spain, in particular, from its situation peculiarly qualified to serve as a model for



the rest of Europe *, was distinguished, under the house of Moawiyah, by the multitude and splendour of its architectural works. For our object, it may suffice to give some idea of the progress of architecture during a limited period. In the erection of the palace and city of Azharat, founded by Abderahman III. the Arab historians relate †, that, besides the rougher materials, the consumption of cut stone, for twenty years together, amounted to six thousand blocks daily; the arched ceilings of the palace were sustained by four thousand three hundred columns of marble. Erija, Segovia, Tarragona, were indebted to this munificent Caliph, for splendid public or religious buildings. But the royal city of Cordova chiefly engrossed his care. The quays, the mosques, the baths, which embellished this proud capital, were principally the work of Abderahman. Cordova, in this reign, is stated to have

* Italy, however, had a nearer example, in the Saracen kingdom of Sicily: for the splendour of their architecture at Panormo, see Thes. Sic. tom. iv. p. 474. ap. Græv. et Gronov. Antiq. "Cum Panormum omni omnium deliciarum genere affluentem animadverterent Saraceni, non modo non delicias hostili crudelitate perdiderunt, sed eas etiam mirum quantum novis inventionibus auxerunt. Extant vel hodierna luce Saracenicarum deliciarum magnificentiarumque, vestigia, de quibus jam Primo Libro sermonem habuimus, quæ, cum egregia sint omnino, ac præclara satis, ostendunt, quanto in pretio, quantoque honore, habitam a Saracenis Panormum fuisse." De Panorm. Maj. Ib. t. xiii. p. 161.

† It was rivalled by the palace and gardens of Aziza, at Panormo, Cf. Thes. Sic. t. xiii. pp. 57—65.

‡ De Marlès, tom. i. p. 419, 420.



contained two hundred thousand houses, six hundred mosques, nine hundred public baths, fifty hospitals, and eighty public schools. Its great mosque exceeded in spaciousness, and equalled in splendour, the famous mosque Alaksa, at Jerusalem.* I have instanced here the products of a single reign : it were easy to enlarge the catalogue ; but, were no other memorial left of the architectural proficiency of the Spanish Arabs, the solitary remains of the Alhambra would competently indicate their leading share in the restoration of this art in modern Europe.†

In the tenth and eleventh centuries, the Europeans, including several highly-distinguished ecclesiastics, who visited Spain in pursuit of the science of the Arabians, had full opportunity of observing the superiority of the Saracenic architecture, to any thing that was then known or practised in Europe. From the epoch of the

* Like the mosque of Omar, that of Cordova was erected on the site of a Christian temple : its cost amounted to a hundred thousand pieces of gold. Cf. Abulfed. Annal. Muslem. tom. ii. pp. 60, 61.

† Has the attention of architects, or of writers on architecture, been directed sufficiently to Spain? A *comparison* of the genuine Saracenic remains in the peninsula, with the earliest specimens of Spanish architecture, in their details, might do more to illustrate the connection of the two schools, and the history of the pointed style, than has been effected, or is likely to be effected, by elaborate theories on the subject. The author was struck by the features of resemblance, discernible even in the plates given in books of travels : see especially Mr. Jacob's highly interesting "Travels in Spain." For a description of the Saracenic castle of Benevente, see Southey's History of the Peninsular War, vol. i. pp. 781, 782.



crusades, this partial acquaintance with the Arabesque style became general: the crusaders not only visited and frequented, but, for the space of nearly two centuries, dwelt and reigned in, some of the principal cities of the east. Now, as, during the entire period from the tenth to the fourteenth century, there was unquestionably a constant influx into the West, of the Arabian arts and sciences, it is not to be supposed, that objects so palpable as their buildings, and so connected with the comforts and convenience of life, could have passed altogether unimitated and unnoticed. Without entering on the controverted derivation, of what has been improperly termed the Gothic style, there can be no reasonable question, that the general and intimate acquaintance of the European nations with the splendid edifices of the Saracens, must have largely contributed to produce that new era in architecture, which arose in the twelfth century. The coincidence of the pointed style with the period of the crusades, is alone a strong presumption in favour of its Saracenic origin. But, however this may be, it is proved by facts, and admitted by the best and latest authorities, that modern Europe owes the restoration of architectural science to the Arabs and the holy wars.

Prior to this period, the art was at its lowest



ebb. From the time of Charlemagne, the Lombard style, variously modified by our Saxon and Norman ancestors, was the only one in use, or rather, in existence. The ecclesiastical, almost the sole public buildings, were heavy, or mean, in their construction: private architectural edifices there existed few or none. The age of the crusades introduced a general and complete revolution. The massive dulness of the Lombard school was now universally exchanged, for the bold and graceful forms of a style, singularly analogous, and closely allied, to the Saracenic. The low-roofed vault suddenly replaced by the long and lofty perspective of the pointed arch*, marks more expressively than any laboured detail of argument, the influence of their growing familiarity with the structures of the Saracens, on the minds of the Italian and German, the French and Norman, artists. None were now accounted able architects, but those who could dazzle and surprise, by the daring

* Westminster Hall, erected by William Rufus, A.D. 1097, might be instanced as a specimen of this transition since unequalled, could it be ascertained that the roof was restored by Richard II. on the model afforded by the original building. At all events, the dimensions of this matchless structure, taken in connection with its date, which coincides nearly with that of the first crusade, strongly indicate the influence exercised by the Spanish Saracens, on the French or Norman architects. It is a remarkable fact, that Saracen Spain had been visited and ravaged by the *Normans*, in the ninth century. Cf. Sect. xi, p. 194. *note*.

temerity of their conceptions. In the construction of their mosques, it was a favourite artifice of the Arabs, to sustain immense and ponderous masses of stone, by the support of pillars so slender, that the incumbent weight seemed, as it were, suspended in the air by an invisible hand. The forms of ecclesiastical architecture, first introduced in the twelfth and thirteenth centuries, betray how largely and successfully this peculiar artifice was caught and imitated, by the emulation of the crusaders. The towers of Pisa and Strasburgh, and the cathedral of Amiens, among the most perfect specimens extant of the pointed style, were also among the first-fruits of that great change which took place in this art, during the progress of the crusades. In the thirteenth century, it is recorded of Saint Louis, that he carried with him, on his expeditions into Asia, two favourite architects, Eudes de Montreuil, and Jousselin de Courvault; who there, in the school of the Saracens, enjoyed ample opportunities of perfecting themselves in their art. The famous holy chapel, the master-piece of the former of these artists, and the church of the Chartreux, at Paris, with eight others, are numbered among the results of his labours, after returning from the holy land. While, therefore, the revival of architecture was undoubtedly one



common effect of the influences of Mahometanism and Christianity, through the medium of their respective holy wars, — the connection between the opposed systems may be drawn still more closely, by the consideration, that the influences of the one appear to have created the first principles of that style, which those of the other carried to such unexampled perfection; and that the ecclesiastical architecture of modern Europe, in particular, owes some of its most characteristic features to imitation of the style which prevailed in the mosques of Mahometan Asia.

In the arts of sculpture and painting, the severe simplicity of their creed, and their superstitious dread of idolatry, precluded the Saracens from any competition with their masters, the Greeks. MUSIC, however, was not liable to the same exception; and in this art, accordingly, the Arabs, both in Asia and in Spain, are said to have attained great excellence. The history of the Arabian music is little known; but its connection with the revival of the art in Italy seems clear and undoubted. The connecting link may be traced to the monastery of Monte Casino. The monks of this celebrated seat of science, “who were distinguished before the year 1000, not only for their knowledge of the



sciences, but their attention to polite learning, and an acquaintance with the classics *,” and who unquestionably drew their learning from the Saracens, composed, we are told, among various other pieces, “learned treatises in music.”† From these truly venerable ecclesiastics, Italy, together with the graver sciences of the Arabs, it seems morally certain, received her earliest initiation in an art, which she has since brought to such a pitch of excellence; and which, from the great revival of letters to the present day, has, under the control of Christianity, served alternately to charm down the cares of life, and to exalt the noblest services of religion.

The influences of Mahometanism happily prepared the way for the successful progress of the European nations, in acquaintance, practical and theoretical, with the surface and form of our globe. By their discoveries to the south, east, and north, of the empire of the caliphs, the Saracens greatly enlarged the bounds of GEOGRAPHICAL SCIENCE. In one direction, their armies, or their caravans, penetrated into regions of Africa now unknown to Europeans, and which have hitherto remained inaccessible to the best-con-

* Turner.

† Turner. Compare Oelsner, *Effets de la Relig. de Moham.* p. 167., for a notice of the Arabic treatises on music; which may have served as precedents for the school of Monte Casino.

certed efforts of modern enterprize ; in another, their merchants and travellers visited the trackless wastes of Siberia, Russia, and Sclavonia. * Their discoveries along the coasts of India and Africa, have been noticed, in the preceding section, in tracing the history of their commerce. The *science* of geography, too, was a favourite study of the Arabians † : this sufficiently appears to European geographers from a single specimen, the geographical work of the illustrious Abulfeda ; whose love of knowledge conducted him, in the fourteenth century, into England ; and who, to illustrate his scientific survey of the region beyond the Oxus, cites a great number of Arabian authors. The spirit of proselytism, which prompted and accompanied all the undertakings of the Saracens, with its inseparable consequence, the obligation of pilgrimage to Mecca, ensured the permanence of their geographical knowledge ; by maintaining, as matter of religious duty, those communications, which conquest or commercial enterprize had once laid open. ‡

* The commercial intercourse of the Saracens with the north of Europe, is among the most interesting results of their indefatigable spirit of adventure. The learned orientalist, D.J.L. Rasmussen, refers to a treatise of his own on the subject : — “ cfr. dissertationem meam de commercio Arabum et Persarum medio ævo cum *Russia* et *Scandinavia*, Danice scriptam.” See *Hist. Arab. ante Islamismum*, p. 19. Hauniæ, 1817.

† Robertson, *Hist. Amer.* vol. i. p. 39.

‡ Oelsner, p. 203, 204.



The influences of Christianity, commencing at the period of the crusades, when they present a complete resemblance to those of Mahometanism, have raised geographical science to its present high perfection.* The crusades first restored and enlarged, in the West, the practical knowledge of geography; they unbarred and threw open to Europe the gates of Asia, which European barbarism and Mahometan bigotry, by their joint agency, had, from the fall of the western empire, to the end of the eleventh century, effectually closed. Religious zeal, commercial enterprize, and the rising spirit of inquiry, henceforward combined, to explore successfully the remotest regions of the East. Following in the train of the crusaders, the missionary or the merchant served as pioneers to more skilful travellers. In the thirteenth century, central Asia was visited and described by a Flemish missionary, and India and China, by an Italian merchant: the piety of Saint Louis gave birth to the voyage of Rubruquis; the commercial spirit of Venice, to those of Marco Polo. While their exaggerated reports of the riches and resources of Asia stimulated the cupidity, their animated and marvellous descriptions awak-

* Dr. Robertson has stated the *immediate* connection of the revival of the science of geography, and of the art of navigation, with the introduction of the Arabian sciences into Europe. See Hist. of America, vol. i. p. 59.



ened the laudable curiosity, of the western nations. By these, and succeeding voyagers, before the close of the fourteenth century, the entire continent and islands of Asia, with the exception, perhaps, of Thibet, and some provinces in the interior of India, had been traversed and delineated. In addition to written accounts, the imagination of the curious was further gratified and excited, by descriptive plans or maps, containing representations of the situation, products, and costumes, of the several countries. These first essays were rude in the extreme; the sciences of geometry and astronomy had not yet been applied to frame or illustrate that of geography: the positions and forms of the various regions were, therefore, strangely misrepresented. In these beginnings, however, was laid the ground-work of those advances in geographical science, which prompted, and, in return, were promoted by, the voyages of discovery in the fifteenth century.* The progress of geography, both in practice and theory, may, from that period, be reckoned among the most eminent triumphs of modern science and civilization. It has been remarked by the learned, that, under the reign of Mahometanism, geographical know-

* These enterprizes themselves owed their origin to the *geographical studies* of Don Henry. See Robertson, *Hist. Amer.* vol. i, p. 61. What a moment in the history of mankind, when the secrets of the old and new worlds lay in embryo, in the mind of this wonderful instrument of Providence!



ledge was materially aided by the pilgrimage to Mecca: it is certainly remarkable as an additional circumstance in the parallel, that, under Christianity, in the time of the crusades, this branch of science derived exactly similar aids from the pilgrimage to Jerusalem.

The congeniality of the MATHEMATICAL SCIENCES to the genius of the Saracens, gave the first spring to their mental energies and exertions.* Their earliest labours in this field, which commenced in Syria, consisted in translations from the works of Archimede, Ptolemy, and other Greek mathematicians. The zeal with which they applied themselves to the study of geometry in particular, contributed materially to the advancement of this primitive branch of the mathematics †, while it secured the permanent revival and diffusion of the previous knowledge of the Greeks. The study of the sciences of the ancients became soon the ruling passion of their mercurial imitators: the lights acquired in Asia were perfected in Spain, and, from this

* “*Studia Arabum in Hispania Australiora, et in Africa Septentrionaliori, et tunc temporis (cent. xii. xiii.) erant, et diu ante fuerant, florentissima, eaque summo habita in pretio. Nam et scientiæ liberales riteque institutæ, diu ante vocari solebant a nostris studia Arabum, et Arabica studia; veluti denominata a gente, ac locis, ubi tunc solum serio colebantur.*” Selden. Op. tom. ii. pp. 520, 521.

† Oelsner, p. 206. “*Trigonometry, which had never been known to the Greeks as a separate science, took that form in Arabia.*” Playfair, Suppl. Encycl. Brit. vol. ii. p. 4.



point of contact, diffused themselves over Europe; where Archimede and Ptolemy were first rendered into Latin from the Arabic versions. The state of mathematical science, at the present day, is the best evidence, how largely Christian Europe profited by these gifts of the Arabians; and with what interest Christianity has here repaid the loan, transmitted to her, through Mahometanism, from the ancients.

The mode of arithmetical notation, by the letters of the alphabet, the only one known in ancient Europe, presented an insuperable bar to the progress of the Greeks in numerical calculations.* For letters, the Arabs substituted those cyphers, or numerals, which, either they had themselves invented, or had adopted from the Indians and Chinese. And, from the time of this important change, may be dated that progress of arithmetical science, which has, ever since, continued its advances towards perfecting the art of calculation: an art which has extended such useful aids, both to the general progress of knowledge, and to the practical employments of ordinary life; and which, above all, has so contributed to improve and enlarge the commercial system and relations of Europe, as to render modern commerce an intellectual pursuit, and

† For a valuable dissertation on this subject by the learned Dr. Thomas Brett, see the "Bibliotheca Literaria," No. vii. pp. 22—25.



its conductors, the best patrons and protectors of the liberal arts, and of every species of mental cultivation. The passage of the Arabic cyphers, from Mahometan Spain, into Catholic Europe, took place in the tenth century.* Their first introduction seems satisfactorily traced to the illustrious Gerbert, afterwards Pope Sylvester II.† This is not the only instance in which the influences of Popery and Mahometanism, in the hands of their rival heads, the popes and caliphs, are to be seen conjointly operating for the good of mankind, by the encouragement of science and civilization.

The doctrine of equations is said to have been known to the Greeks : if so, it had not, among them, escaped from the state of infancy ; for it is certain, that they never applied this distinct branch of mathematics to any practical or useful purpose. Whether they were, or were not, its inventors, the Arabs were unquestionably the first who discovered the true utility and importance of the science of ALGEBRA ‡ ; and who em-

* Professor Leslie, in his Treatise on Arithmetic (Suppl. Encycl. Brit.), adopts a much later date. The authorities followed in the text, however, are supported by Professor Playfair, in the dissertation prefixed to vol. ii. of the same work.

† For our manifold obligations to this great man, compare Turner, H. M. A. vol. iv. p. 435.

‡ " L'usage d'Algèbre, enseigné par les Sarrazins, est un très-grand pas qu'ils ont fait faire à l'esprit humain." Oelsner, p. 213.



ployed it, as a new master-key to the yet unexplored treasures of mathematical knowledge. The ideas entertained of their proficiency in this profound and pregnant science, seem to become daily enlarged, with the growing knowledge of the long-neglected remains of Arabic learning. Among their algebraic discoveries, the invention of the solution of equations of the second degree, is ascribed by the learned to Mohammed ebn Musa : and the work of Omar ebn Ibrahim, on cubic equations, led Montucla to form a much higher estimate of the success of the Arabs in algebra, than the moderns had been in the habit of entertaining. Algebra was first imported into various parts of catholic Europe, at the same period with the other sciences of the Arabians*, by the churchmen and scholars, whom a noble spirit of inquiry had conducted into Saracen Spain. There is, perhaps, no branch of learning in which the modern has so surpassed the ancient world, as the mathematical : men of science are unanimous in acknowledging how largely this result is owing to the use of algebra ; and each fresh inquiry swells the amount of our debt, on this score, to the Spanish Saracens. But here,

* " It was not from Greece alone, that the light proceeded, which dispelled the darkness of the middle ages ; for, with the first dawn of that light, a mathematical science, of a nature and character unknown to the geometers of antiquity, was received in Europe from Arabia." Playfair; Diss. Suppl. Encycl. Brit. vol. ii. p. 11.



as in every preceding example, we may trace the final result to the same originating source; to the parallel influences of the kindred and conflicting creeds: Mahometanism, in the earlier stage of the providential process, still planting and nurturing the seeds of science; Christianity, in the later, causing them to spring up and flourish, and to bring forth fruits to perfection.

The earliest essays in astronomical science were made in the east; and among the eastern nations the Arabians were remarkable, for the study and observation of the heavenly bodies. When, therefore, under Mahometanism, learning became the national pursuit and passion of the Saracens, it is but natural to suppose, that ASTRONOMY would not be less cultivated*, than its kindred branches of science. It appears, accordingly, that the Saracen mathematicians applied themselves, with signal zeal and success, to this particular study. With their wonted penetration, they soon detected the errors of former systems; corrected or improved the imperfect lights of the Greeks; and drew conclusions of their own, from their own observations, respecting the laws and motions of the heavenly

* The Arabs have, in one respect, appropriated the dominion of this science. The astronomical vocabulary now in established use, is, to a great extent, of Arabic origin: it has happened to the author to be applied to, by an eminent astronomer, for explanations of the Arabic terms, with which this branch of science abounds.

bodies. The measurement of the earth, undertaken by the command of Almamon, remains an illustrious monument of the proficiency and zeal of the Arabian astronomers, and of the practical character of their observations and researches. Abulfeda has preserved the details of this great enterprize, and its merits have been attested by our most eminent modern mathematicians.* Among the discoveries of the Saracens, that of Albatagnus, which anticipated, in part, one of the greatest reaches of modern invention, may be deservedly classed the highest. This astronomer discovered that the apogee of the sun has a proper movement of its own, by which it advances uniformly along the ecliptic; whence, arguing analogically, he proceeded to establish the principle, that the apogees of all the planets have a proper movement in the same direction, only less sensible than that of the apogee of the sun. On this great discovery Bailly remarks, that it is the sterling mark which determines the value of the astronomical labours of the Arabs: a foundation-stone which they have laid, towards the construction of the true fabric of the world. The Arabian philosopher thus discovered a phe-

* "The next measurement [after that of Eratosthenes] is that of the astronomers of Almamon, in the plains of Mesopotamia; and the manner of conducting the operation appears to have been *far more accurate* than that of the Greek philosophers." Playfair, Prelim. Diss. Suppl. to Encycl. Brit. vol. ii. p. 106.



nomenon in the system of nature, of which it was reserved for Newton to penetrate the cause.

But the progress made by the Saracens, in their scientific researches, is to be measured, not so much by the amount of their actual discoveries, as by the surprising reach and justness of their conjectural anticipations, while criticizing the now-exploded systems of the ancients. It is observed of them, as their highest praise, that they already began to perceive the insufficiency of many of their own lights and attainments; to discern the defectiveness of the Ptolemaic system; and to have such presentiments of future discoveries in astronomy, as could be formed by those only, who had themselves made great advances.*

At the dawn of the great revival of European learning, astronomy was among the first of the Arabian sciences which engaged the attention of inquirers. The spirit of literary adventure, which now transported alternately, in a generous rivalry of research, natives of Germany and Italy, of France and England, into Mahometan Spain, brought back into these countries, with other first-fruits of their toils, not only the elements of astronomical science, but some of the standard works of the Arabian astronomers. In the stu-

* Mr. Gibbon has undertaken to depreciate the proficiency of the Arabians both in geometry and astronomy! See vol. x. pp. 46—48.



dies of the schools, which, after the example of what they had seen in Spain, Gerbert and his successors established every where over Europe, the knowledge of the Greeks came thus to be combined with the recent lights and discoveries of the Saracens. In no quarter, do these establishments appear to have flourished more, than in England: where the study of the Arabian sciences generally, and, in particular, that of astronomy, can be legitimately deduced, from the age of Robert Retinensis, to that of the celebrated Roger Bacon.* This prodigy of the middle ages, the prototype as well as the precursor of his great name-sake, was the genuine offspring of these new schools of science. Himself an orientalist, Bacon drank deeply of the Arabian learning at the fountain-head; and thence (as appears irrefragably from the authorities cited in his works,) drew all the chief resources of his genius. In the principles advanced by this extraordinary man, in his almost prophetic project for the emendation of the kalendar †, as the distinguished editor of the *Opus Majus*¹, the learned Doctor Samuel Jebb, has ably shown in his preface to that work, we find

* Cf. Brucker, *Hist. Crit. Philosoph.* tom. iii. pp. 683, 684.

† Even here, Bacon trod in the steps of the Arabians. The *Gelaltea* era, introduced in the reign of Malek Shah, A. D. 1079, stands as the middle term between the Julian, and the Gregorian, style. See Deel. and Fall, vol. x. p. 367.



the undoubted origin of the true astronomy, as afterwards unfolded in the Copernican system. The principles advanced by Paul, Bishop of Sempronia, at the council of Lateran, towards fixing the true period for the celebration of Easter, were taken, without acknowledgment, from the works of Bacon : at the instance of that prelate, Nicholas Copernicus, for the completion of this work, first bent his mind to the more exact observation of the motions of the heavenly bodies : the result of his labours it is needless to repeat : the reader will only remark their ascertained connection, through Friar Bacon, with the Arabian astronomy ; and the uniform recurrence of the same great moving cause, — the joint influence of Mahometanism and Christianity, — in first reviving, and finally perfecting, every branch of human science.

The parallel effects of the two religions, which have been just exemplified from the progress of astronomy, can be equally traced in the history of OPTICS. This kindred science was first restored by the Arabs, who attained great excellence in it, and made surprizing reaches for its advancement. The work of Al Hazen, in particular, is said to be a rich repository of optical discoveries and observations.*² This Arabian

* " An interval of nearly a thousand years divided Ptolemy from Al Hazen, who, in the history of optical discovery, appears as his immediate successor." Playfair, Suppl. Encycl. Brit. vol. ii. p. 113.



author explains the laws of refraction, with an enlargement and correctness of view, of which there is no precedent among the Greeks. He lays down the method of ascertaining the quantity of refraction; fixes the height of the atmosphere; and proves that, above its elevation, there exists a substance of greater rarity than the air. But, what is still more worthy of remark and consideration, the theory of the telescope may be found in the work of this astronomer, composed about A.D. 1100, nearly five centuries prior to its practical invention.

Still following in the steps of his masters, the Spanish Arabs, the science of optics was sedulously cultivated by Friar Bacon. The success of this great inventor, as usual, was answerable to his zeal. The *Opus Majus* contains ample proof of his profound acquaintance with the laws of refraction and perspective; in the study of which, he not only far outstripped the lights of his own age, but left a gap of centuries, between the theory of his several discoveries, and their verification in practice. The uses of magnifying glasses and telescopes, and the principle of their construction, are explained in the great work of Bacon, with a truth and clearness which have commanded universal admiration. He foresaw, also, and foretold, their application to the science of astronomy, and the influence they



must exercise on its advancement. In a word, the great invention of Galileo appears to have been little more than the practical revival of principles laid down by Roger Bacon ; which principles, again, he had derived from the Arabians ; a fact which once more retraces the stream of revived science, through the influences of Christianity, to those of Mahometanism, for its rise.

By their cultivation of the mathematical sciences, the Saracens only *restored* those branches of knowledge, which had been known and in use among the ancients. In the history of CHEMISTRY, they assume the undisputed rank of *inventors*. This important science, the primitive source of the experimental philosophy, was the genuine product of Arabian genius ; of that union of Oriental imagination, with a practical spirit of research, which properly distinguishes the intellectual character of the Saracens, from that of the ancient Greeks. The abstract intellect of the Greeks, which, in their best days, gave birth and maturity to their noble school of moral philosophy, degenerated, with their political decline, and with that of their imitators, the Romans, into the minute and contemptible subtleties of sophistry. The experimental intellect of the Arabs took a different course, and led to an opposite result. Their



ardent imagination first aimed at impossibilities : they began their peculiar career in science, by the pursuit of a visionary object. This object, however, it will be observed, though unattainable, was substantial ; and the practical nature of their researches soon corrected the errors of their imagination. In the process of the romantic quest after the philosopher's stone, and the elixir of immortality, the dreams of alchemy* originated, and gave place to, the realities of that great experimental science, which has proved, under the guidance of the moderns, at once the interpreter of the kingdom of nature, and the parent of the true system of philosophical investigation.

Such is the well-known history of chemistry. The indefatigable zeal and industry with which the Arabs devoted themselves to this novel and congenial art, found their recompense in a corresponding proficiency. They successfully analyzed the various substances of the animal, vegetable, and mineral kingdoms ; made experiments on air, fire, earth, and water ; ascertained the opposite and

* The reputation of the German chemists is matter of notoriety : they are among the first experimentalists in the world. It is a remarkable fact, that the modern Germans owe their eminence in this science to the same cause, which had operated so propitiously among the Arabians ; viz. the study of alchemy, and incessant researches to discover the process for transmuting the baser metals into gold.



kindred properties of alkalies and acids; invented, together with the alembic, various kinds of distillation and sublimation; discovered the volatile oils; and compensated their failure in the attempt to transmute the inferior metals into gold, by the discovery of the medicinal qualities of mercury, and by the more valuable transmutations of poisonous minerals into salutary medicines. The details of their progress in chemical science, however, are of little moment to the present argument, compared with the position, which the simple fact of their being the *inventors* of this art, necessarily assigns to the Saracens, in the providential history of the world. For this invention, we have seen, lies at the root of all our most celebrated modern discoveries and advances in philosophy: and, what is certainly not less worthy of observation, it appears, from the very nature of the pursuit in which it originated, that the fervid genius of Arabia was as indispensable to its first rise, as the phlegmatic temperament of Europe was essential to its full perfection. It was their credulous cupidity, united with their innate love of the marvellous and mysterious, which first prompted the Saracens to their indefatigable experiments in alchemy; and these experiments, again, corrected, in process of time, by the phlegm of the European



nations, have raised the science of chemistry to its present elevation and dominion.

With the knowledge of those ancient sciences, which they revived, the Saracens would naturally communicate to catholic Europe the art of chemistry, which they invented. The early introduction of this new science, and its derivation from the Arabs, are ascertained by every species of testimony. The East and West, the influences of the crusades and those of the Spanish Arabs, are, however, so intermingled in the history of European chemistry, that it seems difficult to apportion properly the account of our double debt, to the Saracens of Asia, and to those of Spain. In western Christendom, no less than in the Saracen empire, the progress of chemistry was long apparently obstructed, and secretly advanced, by the eccentric speculations of alchemy. But the more sober temperament of the European mind early abated the force of this delusion, and gradually extricated itself from its influence. In England, especially, the vast and practical genius of Roger Bacon rose superior to the shackles of a theory from which it could not wholly emancipate itself. His experiments, which anticipated the discovery of gunpowder, indicate an acquaintance with almost every operation now used in chemistry : so that, if to him



has been assigned the honour of introducing chemistry into Europe, to him also belongs the distinction of having advanced this science towards that perfection, which it has since attained. In the school of experimental knowledge, which Bacon thus founded, alchemy, like astrology, the superstition of true science, by degrees gave place to chemistry properly so called. The laboratories of the West, henceforward, not only exhibited all those processes, and furnished those various preparations, which before were confined exclusively to the Moors and Orientals ; — but chemical operations ceased to be the effects of chance, and were conducted according to fixed principles and rules. It was now, indeed, that the art of chemistry came to be raised into a science. Its subsequent history is linked with the whole intellectual progress of modern Europe. Essentially germinant in its character, from the epoch of its first rise to the present hour, every age, every year, almost every day, has been productive of some new advance or discovery, in chemical science. England, which lays claim to its original introduction in the thirteenth century, has, from that period to the present, maintained her just pretensions to this honour, by the fostering encouragement which she has especially extended to chemical inquiry ;



until, in the nineteenth century, by the consent of admiring Europe, the attainments of her chemists have surpassed all former excellence, and illustrated the reputation acquired, and bequeathed to his country, by the genius of Roger Bacon. The English reader needs not be reminded, that the prime ornament of the first philosophical society in Europe, the illustrious Robert Boyle, was also the great restorer of chemistry, and the first experimentalist of his age; or that the chair of that society has been since filled by the first experimentalist of our own.* Crowned in the mathematical sciences, at an intermediate stage, by the unrivalled fame of Newton, the Royal Society, it will by none be denied, in the person of its late president, has borne away the palm of chemistry from all competitors.

The success of the experiments on gas and steam, has given mankind a new control over the works of art and nature. The powers of the steam-engine †, in particular, an invention but of yesterday, have already superseded all known mechanical forces. On land, they have been identified with almost every branch of human industry; while they command the raging of the

* Sir Humphry Davy, Bart.

† In this practical department, the name of WATT will still maintain the supremacy of England.



sea, by the introduction of a wholly new system of navigation.* It is impossible to contemplate, without wonder and awe, these last and most astonishing results of experimental science. But, while we admire the practical effects, let us not lose sight of the great providential cause. Let it not be forgotten, that the science which has given birth to such unparalleled fruits in modern Europe, is indebted for its origin, to the peculiar genius of the Saracens of Spain and Asia: that if, without the aids of European judgment, chemistry might never have been perfected, without the enterprize, on the other hand, of Arabian enthusiasm, chemistry never might have been. This natural reflection brings us once more to our proper argument; to the parallel effects of Mahometanism and Christianity, on the advancement of human knowledge: in the single department of science here considered, as in the entire history of their twofold operation, the two systems appear so to act, and so to combine together; the one preparing the means, and the other accomplishing the end, as though Isaac,

* To acknowledge the eminent proficiency of America, in the application of steam, especially to the purposes of navigation, is only to pay an additional tribute to Great Britain. It is one and the same national spirit at work, on opposite sides of the Atlantic: and long may it be, before either country is willing to forget their honourable relation, as *parent and child*.



CSL

MAHOMETANISM UNVEILED. [SECT. XIII.]

without Ishmael, could not have been made perfect.

The highest medical authorities unite with the voice of common fame, in acknowledging the debt of Europe to the Arabs, for the recovery and improvement of the art of MEDICINE. The Saracens appear to have cultivated, with equal success, the precepts and the practice of medical science. They applied themselves, with extraordinary diligence, to the study of the ancients; until they had mastered, and made their own, whatever was known to the Greeks. Their advances in the newly-discovered science of chemistry soon enabled them to distance their preceptors.

In pharmacy, especially, or the art of preparing medicines, the inventions of chemistry daily enlarged the catalogue of remedies. Not only were the preparations of herbs and simples multiplied, but the precious metals, and precious stones, were now made to contribute to the real or supposed cure of diseases. Whatever there may have been of fanciful in some of these processes, the analysis of the properties of mercury, and the application of this metallic substance to the purposes of medicine, must alone suffice to vindicate the chemical researches of the Arab physicians, and to demonstrate the



value of their experiments on metals and minerals.

Among other important additions to the vegetable medicines, the Saracens first introduced into use rhubarb, tamarinds, cassia, senna, and camphire. For honey, the only substance of its kind known to the ancients, they advantageously substituted sugar; and, by its aid, compounded a great variety of healthful or agreeable preparations. They had early shown a strong propensity for horticulture, and a peculiar aptness for detecting the useful or healing virtues of plants. Their practical genius in this department was improved, by their growing skill in chemistry, into a considerable proficiency in botanical knowledge.*

In the science of medicine properly so termed, the doctrine of symptoms was the favourite and most successful study of the Arabs. The perfection to which their zeal and penetration brought this doctrine, enabled the Saracens to solve many obscure problems in medicine; to trace various diseases from their effects to their causes; and to apply suitable and effectual remedies. They appear to have been particularly conversant with the nature and treatment of affections of the

* Oelsner, p. 202. note 2.



skin; which is still considered the seat of most of the disorders incident to the human system. To the Saracen physicians, belongs the merit of having first investigated and described the small-pox. They also were the first who understood the nature and management of the measles. The inflammation and abscess of the mediastine, the abscess of the pericardium, and its adherence to the heart, the relaxation and other affections of the throat, with the elephantiasis, are classed, by the admission of the moderns, among those distempers, the symptoms and cures of which, were originally discovered by the medical skill of the Arabians. Besides the several classes of malady which they brought newly to light, the Saracens are said to have greatly improved on their predecessors, in the knowledge of apoplexy*; hydrophobia, and impediments of the speech; of sciatica, cancer, and sundry other diseases. In surgery too, although restrained by religious scruples from the practice of anatomy, they invented the critical operation of bronchotomy. Such, on the whole, was the deep and various proficiency of the Saracens in medicine, and its kindred arts, that, in the opinion of one equally eminent as a medical writer and an

* Their *remedies*, it must be confessed, are sometimes rather startling. See Brucker, *Hist. Philos.* tom. iii. p. 79. note x.



Orientalist, the learned Sprengel, medical science, even in its present advanced state, might derive important accessions, from the study of the Arabian authors.

The transmission of the art of medicine, from the Saracens, into Catholic Europe, is one of the best-authenticated facts in the history of the reciprocal influences of Mahometanism and Christianity. The medical seminaries of Africa, Spain, and Sicily, supplied the lights of the Norman school of Salerno; "the first," says Mr. Gibbon, "that arose in the darkness of Europe." In this illustrious seat of reviving science, the treasures of Grecian knowledge were first explored, in the works of the Arabian physicians and philosophers. The study of medicine, here, was especially countenanced by the church; and encouraged, not only by the sanction, but by the example, of the Christian ministry. Monks and prelates embraced the medical profession; adding the then venerated dignity of their sacred order, to augment the reputation of a school, of which they were, themselves, among the earliest and brightest ornaments. The most eminent of the physicians of Salerno, almost the father of this school, was a monk of Monte Casino; the celebrated Constantine, a Christian native of Africa, and a pupil