

BIOGRAPHY OF ROGER BACON.¹

EXTANT FRAGMENTS OF HIS WORKS.

SOME part of this biography will make the rest more intelligible if made a preliminary explanation. Before the appearance of Wood's *History of Oxford* (1674), no one had added anything to the summaries of Leland, Bale, and Pits, which are little more than ill-understood lists of works. The name of Bacon was known far and wide as a magician; and the better informed could only judge from such fragments as had been published, and from the traditional reputation of what remained in manuscript, that he was a philosopher of the highest genius. These printed fragments are as follows, so far as we can collect them, being all that was published down to the appearance of Dr. Jebb's edition of the *Opus majus* which closes the list:

1. *De mirabili potestate artis et naturæ et nullitate magicæ*, Paris, 1542, 4to; Basil., 1593, 8vo; in English,¹ Lond., 1597, 4to; Hamb. 1608 and 1618, 8vo; in French, Par., 1612, 8vo; also in French, by Girard, Par., 1557 and 1629; in Vol. V of Zetzner's *Theatrum chemicum*, Argent., 1622, 8vo, and 1659 (?); in English, by T. M., London, 1659, 12mo.

2. *Perspectiva*, *Specula mathematica*, and *De speculis ustoriis*, Francof., 1614, 4to, whether as one book or three we do not know; the *Perspectiva* was reprinted in 1671, also at Frankfort.

3. *De retardatione senectutis*, Oxon., 1590, 8vo.; translated, *The Cure of Old Age*, by R. Browne, M. D., Lond., 1683, 12mo.

4. *De secretis operibus artis et naturæ*, Hamb., 1618, 8vo, edited by John Dee.

5. The *Thesaurus chemicus*, Frankfort, 1603 and 1620, 8v (?) contains the *Specula mathematica*, the *Speculum alchymicæ*, and some other tracts, which Tanner puts down altogether as *Scripta sanioris medicinæ in arte chemiæ*.

¹ Reprinted from an anonymous article in *Old England's Worthies*, London, 1853.

6. *Speculum alchymia*, Norimb., 1581, 4to; Basil., 1561, 4to; Ursellis, 1602, 8vo; in English, in *Collectanea chymica*, Lond., 1684, 8vo; also¹ in English, Lond., 1597, 4to.

7. *Practica Magistri Rogerii*, Venet., 1513 and 1519.

8. *Epistolas notis illustratas* (we take the title from Tanner), Hamb., 1618, 8vo.

9. *Fratris Rogeri Bacon, Ordinis Minorum, Opus majus, ad Clementem IV. Pontif. Rom.*, Londini, 1733, fol. By Dr. Jebb.

HIS AGE AND CONTEMPORARIES.

The little that is known of the greatest of English philosophers before the time of his celebrated namesake, shows how long the effects of contemporary malice might last, before the invention of printing had made an appeal to posterity easy. His writings, destroyed or overlooked, only existed in manuscript or mutilated printed versions, till nearly the middle of the eighteenth century. In the meantime tradition framed his character on the vulgar notions entertained in his day of the results of experimental science; and the learned monk, searching for the philosopher's stone in his laboratory, aided only by infernal spirits, was substituted for the sagacious advocate of reform in education, reading, and reasoning; and—what was equally rare—the real inquirer into the phenomena of nature.

Roger Bacon died in 1292, in about the seventy-eighth year of his age, which places his birth near the year 1214; roughly speaking, he lived from the time of the Interdict in the reign of John, to the beginning of the interference with Scotland in that of Edward I. His age is that of Cardinal Cusa, Thomas à Kempis, Matthew Paris, Albertus Magnus, Raymond Lully, Sacrobosco etc., to whom we add, as they are sometimes confounded with him, and not for their own note, two theologians, Robert Bacon and John Bacon (died about 1346). The former was a priest of the thirteenth century, whom it would be hardly necessary to notice but for the fact that some of our historians have made him the brother of Roger Bacon, and the two have been often confounded. He is stated to have studied successively at Oxford and Paris; and in 1233, when his friend and teacher, Edmund Rich, was removed from the treasurership of Salisbury Cathedral to the archbishopric of Canterbury, Robert Bacon was his successor. The archbishop was canonized by the title of St. Edmund; and Bacon wrote his life. Matthew Paris states that in 1233 Robert Bacon preached

¹ These two are in the same book.

before Henry III at Oxford, and spoke openly against the favorite, Peter des Roches (or De Rupibus), of Poitou, Bishop of Winchester, who had given great offence by the introduction and promotion of many of his countrymen. Serious disturbance was apprehended, and the king appeared to waver; on which, says the historian, a witty court chaplain, called *Roger Bacon*, asked his Majesty what was most dangerous to seamen. The king answered that seamen best knew, on which the chaplain rejoined, "*Petræ et Rupes; ac diceretur, Petrus de Rupibus.*" This story is the likely origin of the connection between Robert and Roger, and also of the account which states that Roger Bacon, the subject of this article, preached before the king on the same occasion. Robert Bacon joined the order of preaching friars in his old age, and died in 1248, whence the story (certainly false) that Roger died in that year. (*Biogr. Britann.*; Tanner, *Biblioth. Britan. Hibern.*; Wood, *Hist. et Ant. Oxon.*)

EDUCATION.

Roger Bacon was born near Ilchester, in Somersetshire, of a respectable family. He was educated at Oxford, and, according to the usual custom of his day, proceeded to Paris, which was then the first university in the world. The course of study in vogue, however unfavorable to independence of thought, did not give so great a preponderance to the works of Aristotle as was afterwards the case. The theology of the day had set strongly against philosophy of every species. In 1209 a council at Paris condemned and burnt, if not the works of Aristotle, at least the mutilated and interpolated translations from the Arabic which then existed. But when, towards the middle of the century, Latin versions from the Greek began to appear, and the philosophy contained in them to be warmly advocated by the new orders of Franciscans and Dominicans, and particularly by Albertus Magnus (died 1282), the reputation of Aristotle advanced so rapidly, that he had gained the exclusive title of "the philosopher" by the time Roger Bacon wrote his *Opus majus*. But Bacon in no sense became an Aristotelian, except in that which comprehends all who are acquainted with the opinions and methods of the Greek philosopher. Better versed in the original than most of his contemporaries, he freely criticises all he meets with (especially the merit of the translations, which he says he would burn if he could), and is himself an early and sufficient proof that the absurdities of his successors ought not to be called "Aristo-

telian," any more than Aristotle himself "the philosopher." Bacon could read Aristotle without danger of falling into idolatry: his antagonists could have erected a system of verbal disputes upon the *Principia* of Newton, if they had possessed it.

After his return to Oxford, with a doctor's degree granted at Paris, which was immediately also confirmed by the former university, he took the vows of a Franciscan in a convent possessed by that order at Oxford, on the persuasion, it is said, of Robert Greathead or Grostête, Bishop of Lincoln, of whom we shall presently speak. It has been conjectured that he had already done so before his return to Oxford, but this appears to have arisen from his having been known to have resided in a Franciscan convent while at Paris. From the time of his return, which is stated to have been A. D. 1240, he applied himself closely to the study of languages, as well as to experimental philosophy. In spite of the vow of poverty, he does not appear to have wanted means, for he says himself that in twenty years he spent 2000 livres (French) in books and instruments; a very large sum in those days.

The vow of the Franciscans was poverty, manual labor, and study; but the first two were soon abandoned. On this subject we notice a writing of Bacon, of which (except in Dr. Jebb's list) we can find only one casual notice (in Vossius, *De his. lat.* article "Bacon"). It is said that he answered a work of St. Bonaventure, general of his order, which treated of the above-mentioned vow: but which side either party adopted is not stated.

ENEMIES AND FRIENDS.

The enmity of his brethren soon began to show itself: the lectures which he gave in the university were prohibited, as well as the transmission of any of his writings beyond the walls of his convent. The charge made against him was that of magic, which was then frequently brought against those who studied the sciences, and particularly chemistry. The ignorance of the clergy of that time as to mathematics or physics was afterwards described by Anthony-à-Wood, who says that they knew no property of the circle except that of keeping out the devil, and thought the points of a triangle would wound religion. Brought up to consider philosophy as nearly allied to, if not identical with, heresy itself, many of them might perhaps be honest believers in its magical power: but we can hardly doubt that there were a few more acute minds, who saw that Roger Bacon was in reality endeavoring to evoke a

spirit whose influence would upset the power they had acquired over the thoughts of men, and allow them to read and reflect, without fear of excommunication, or the necessity of inquiring what council had authorized the book. Not that we mean to charge those minds in every instance with desiring such power for their own private ends: there has always been honest belief in the wickedness of knowledge, and it is not extinct in our own day. The following detached passages of the *Opus majus* no doubt contain opinions which its author was in the habit of expressing:

"Most students have no worthy exercise for their heads, and therefore languish and stupefy upon bad translations, which lose them both time and money. Appearances alone rule them, and they care not what they know, but what they are thought to know by a senseless multitude.... There are four principal stumbling-blocks in the way of arriving at knowledge—authority, habit, appearances as they present themselves to the vulgar eye, and concealment of ignorance combined with ostentation of knowledge.... Even if the first three could be got over by some great effort of reason, the fourth remains ready.... Men presume to teach before they have learnt, and fall into so many errors, that the idle think themselves happy in comparison; and hence both in science and in common life we see a thousand falsehoods for one truth.... And this being the case, we must not stick to what we hear or read, but must examine most strictly the opinions of our ancestors, that we may add what is lacking, and correct what is erroneous, but with all modesty and allowance.... We must, with all our strength, prefer reason to custom, and the opinions of the wise and good to the perceptions of the vulgar: and we must not use the triple argument; that is to say, this has been laid down, this has been usual, this has been common, therefore it is to be held by. For the very opposite conclusion does much better follow from the premises. And though the whole world be possessed by these causes of error, let us freely hear opinions contrary to established usage."

As might be supposed, Roger Bacon cultivated the acquaintance of men who held sentiments similar to the above, which could not please his brethren. Among them we have mentioned Gros-tête, Bishop of Lincoln, who usually resided at Oxford. This prelate, who was a good mathematician, and a resolute opponent of undue interference on the part of the see of Rome (*terrificus papà redargutor*, says Camden), had opposed Innocent IV, who attempted to appoint his nephew, a boy, to a prebend at Lincoln. On being excommunicated, Gros-tête appealed from the tribunal of Rome to

that of Christ; and so prevalent was the opinion of his antipathy to the pope, that a story is gravely told by Knyghton (cited by Blount, *Censura*, etc.), that the Bishop of Lincoln, after his death, appeared to Innocent in a dream, and exclaiming, "*Surge miser, veni in judicium!*" actually stabbed his Holiness, who was found dead next morning. It is needless to say that Innocent IV died a natural death, and useless to speculate upon the means by which such a circumstance as the preceding, if true, could come to be known. But perhaps the memory of Grostête may have been one reason of the willingness with which succeeding popes continued Bacon's imprisonment, to which we shall soon come; for though they might hold his spirit guiltless of the death of Innocent, they long remembered what he had done in the flesh; and when Edward I and the University of Oxford, long after, applied to Clement V for the canonization of Grostête, they received for answer that the pope would rather his bones were thrown out of consecrated ground.

In the meantime a pope was elected to whom we owe the production of the *Opus majus*. This was Clement IV (elected 1265), who had previously, when cardinal-bishop of Sabina, been legate in England. Here he had heard of Bacon's discoveries, and earnestly desired to see his writings; but, as before stated, the prohibition of the Franciscans prevented his wish being complied with. After his election as head of the church, Bacon, conceiving that there would be no danger nor impropriety in disobeying his immediate superiors at the command of the pope, wrote to him, stating that he was now ready to send him whatever he wished for. The answer was a repetition of the former request; and Bacon accordingly drew up the *Opus majus*, of which it may be presumed he had the materials ready. It appears that he had mentioned the circumstances in which he stood; for Clement's answer requires him to send the work with haste, any command of his superiors or constitution of his order notwithstanding, and also to point out, with all secrecy, how the danger mentioned by him might be avoided. The book was sent in the year 1267, by the hands of John of London, a pupil of whom he speaks highly, and who has usually obtained some notice from the very great praise which Bacon in one place appears to give him, when he says that he only knows two good mathematicians, one of whom he calls John of London. But from some other circumstances Dr. Jebb concludes, with great probability, that this John was not the pupil above mentioned, but John Peccam, a London Franciscan, afterwards Archbishop of Canterbury, who was well known as a mathematician, and whose treatise on optics, *Perspectivæ communis*

libri tres, was printed at least six times between 1542 and 1627, at Nuremberg, Venice, Paris, and Cologne.

Before the *Opus majus*, Bacon, according to his own account, had written nothing except a few slight treatises, "*capitula quædam*." Before he took the vows he wrote nothing whatever; and afterwards, as he says to Clement, he would have composed many books for his brother and his friends, but when he despaired of ever being able to communicate them, he neglected to write.

With the *Opus majus* he sent also two other works, the *Opus minus* and the *Opus tertium*, the second a sort of abstract of the first, and the third a supplement to it. These exist in manuscript in the Cottonian Library, but have not been printed. It appears that, after the death of Clement, which took place in November, 1268 (not 1271, as stated by some; the latter date is that of the election of Clement's successor, the see having been vacant two years and three-quarters), he revised and augmented the second of these works. What reception Clement gave them is not known: some say he was highly gratified and provided for the bearer; others, that he at least permitted an accusation of heresy against the writer. Both stories are unlikely: for Clement could hardly have received the work before he was seized with his last illness.

Till the year 1278 Bacon was allowed to remain free from open persecution; but in that year Jerome of Ascoli, general of the Franciscan order, afterwards pope, under the title of Nicholas IV, being appointed legate to the court of France, this was thought a proper opportunity to commence proceedings. Bacon, then sixty-four years old, was accordingly summoned to Paris (Dr. Jebb implies that he had already removed his residence there, to another convent of his order), where a council of Franciscans, with Jerome at their head, condemned his writings, and committed him to close confinement. According to Bale, or Balæus (cited by Dr. Jebb), the charge of innovation was the pretext, but of what kind was not specified; according to others, the writings of Bacon upon astrology were the particular ground of accusation. We cannot learn that any offer of pardon was made to the accused upon his recantation of the obnoxious opinions, as usual in such cases; which, if we may judge from the *Opus majus*, Bacon would have conceived himself bound to accept, at least if he recognized the legality of the tribunal. A confirmation of the proceeding was immediately obtained from the court of Rome. During ten years, every effort made by him to procure his enlargement was without success. The two succeeding pontiffs had short and busy reigns; but on the accession of Jerome

(Nicholas IV), Bacon once more tried to attract notice. He sent to that pope, it is said, a treatise on the method of retarding the infirmities of old age, the only consequence of which was increased rigor and closer confinement. But that which was not to be obtained from the justice of the pope, was conceded to private interest, and Bacon was at last restored to liberty by the intercession of some powerful nobles, but who they were is not mentioned. Some say he died in prison; but the best authorities unite in stating that he returned to Oxford, where he wrote a compendium of theology, and died some months, or perhaps a year and a half, after Nicholas IV (who died April, 1292). We have adopted 1292 from Anthony-à-Wood, as the most probable year of his death, though foreign works frequently state that he died in 1284. He was buried in the church of the Franciscans at Oxford. The manuscripts which he left behind him were immediately put under lock and key by the magic-fearing survivors of his order, until, not so lucky as those of another wizard, Michael Scott, they are said to have been eaten by insects.

HIS WORKS.

Of the asserted works of Bacon there is a very large catalogue, cited mostly from Bale and Pits, in the preface to Dr. Jebb's edition of the *Opus majus*. They amount to five on grammar, six on pure mathematics, seventeen on mechanics and general physics, ten on optics, six on geography, seven on astronomy, one on chronology, nine on chemistry and alchemy, five on magic, eight on logic and metaphysics, nine on medicine, six on theology, twelve miscellaneous; a hundred and one in all. But it is most likely that the greater part of these were extracts from the *Opus majus*, etc., with separate titles, that some are not genuine, and that others are more properly attributable to the two other Bacons already mentioned. The principal manuscripts of the *Opus majus* are, one in Trinity College Library, Dublin, discovered by Dr. Jebb, which forms the text of his edition, two in the Cottonian Library, one in the Harleian, one in the library of Corpus Christi College, Cambridge, one in that of Magdalen College, two in the King's Library, all containing various parts of the work. These are independent of the *Opus minus* and *Opus tertium* in the Cottonian Library, already mentioned, of some in Lambeth Palace, in the Bodleian Library at Oxford, and a host of others at home and abroad which we cannot specify. The Dublin manuscript is the only entire one

with which Dr. Jebb was acquainted. It is a folio of 249 leaves, beautifully written on thick paper, with a good margin, and in double columns. It is not dated, but from the character of the writing it is judged to be of the reign of Henry VIII, or perhaps the early part of that of Elizabeth. The geometrical figures are neatly drawn in the margin. Pope Clement's letters are in the Vatican Library.

It only remains for us to take a general view of the character of Roger Bacon's writings, and of the contents of the *Opus majus*. It is surprising how little is known of this work, the only one in print to which we can appeal, if we would show that philosophy was successfully cultivated in an English university during the thirteenth century. It is of course in Latin, but in Latin of so simple a character, that we know of none in the middle ages more easy to read; and it forms a brilliant exception to the stiff and barbarous style of that and succeeding times. We think we see the thoughts of the author untranslated, though the idiom is often that of an Anglo-Norman; by which we mean that we frequently find Latin words used in their modern English sense, as, for instance, *intendere* for *in animo habere*, meaning the same as our word "to intend"; *presumere* for *sibi arrogare* in the sense of "to presume." We should perhaps rather say that the English words receive their meaning from the corrupted Latin, and not *vice versa*, in which case the work of Roger Bacon may become useful in tracing the change, and the more so on account of the great simplicity of the style.

THE CHARGE OF HERESY.

The charge of heresy appears to be by no means so well founded as a Protestant would wish. Throughout the whole of his writings Bacon is a strict Roman Catholic, that is, he expressly submits matters of opinion to the authority of the church, saying (Cott. MSS. cited by Jebb) that if the respect due to the vicar of the Saviour, *vicarius Salvatoris*, alone, and the benefit of the world, could be consulted in any other way than by the progress of philosophy, he would not, under such impediments as lay in his way, proceed with his undertaking for the whole church of God, however much it might entreat or insist. His zeal for Christianity, in its Latin or Western form, breaks out in every page; and all science is considered with direct reference to theology, and not otherwise. But at the same time, to the credit of his principles, considering

the book-burning, heretic-hunting age in which he lived, there is not a word of any other force except that of persuasion. He takes care to have both authority and reason for every proposition that he advances: perhaps, indeed, he might have experienced forbearance at the hand of those who were his persecutors, had he not so clearly made out prophets, apostles, and fathers to have been partakers of his opinions. "But let not your Serenity imagine," he says, "that I intend to excite the *clemency* of you Holiness, in order that the papal majesty should employ force against weak authors and the multitude, or that my unworthy self should raise any stumbling-block to study." Indeed the whole scope of the first part of the work is to prove, from authority and from reason, that philosophy and Christianity cannot disagree; a sentiment altogether of his own revival, in an age in which all philosophers, and mathematicians in particular, were considered as at best of dubious orthodoxy.

The reasoning of Bacon is generally directly dependent upon his premises, which, though often wrong, seldom lead him to the prevailing extreme of absurdity. Even his astrology and alchemy, those two great blots upon his character, as they are usually called, are, when considered by the side of a later age, harmless modifications, irrational only because unproved, and neither impossible nor unworthy of the investigation of a philosopher, in the absence of preceding experiments. His astrology is *physical*. "With regard to human affairs, true mathematicians do not presume to make certain, but consider how the body is altered by the heavens, and the body being altered, the mind is excited to public and private acts, free will existing all the same." An age which is divided upon the question of the effect of the moon upon lunatics, and of which the philosophers have collected no facts decisive against many alleged effects of the same planet upon plants, can ask no more of a philosopher of the thirteenth century than that he should not be too positive. The fame of Leibnitz has not suffered from the *pre-established harmony* one-half as much as that of Bacon from his astrology and alchemy, which were believed in to a much greater extent by many of the learned of his time, and the united effect of which would seem to us sense and logic, compared with the metaphysical folly, all his own, of the eminent philosopher just cited.

This planetary influence appears to have been firmly believed in by Bacon, and in particular the effect of the constellations on the several parts of the human body. Perhaps he was rather prejudiced in favor of a doctrine which was condemned by the same men who

thought mathematics and philosophy savored of heresy. And it must be remembered that the pretended science was almost universally allowed existence, even by those who considered its use unlawful; nor can we infer that the church disbelieved it, because that body discouraged it, any more than that it rejected infernal spirits, because it anathematized magic.

We must draw a wide distinction between the things which Bacon relates as upon credible authority, and the opinions which he professes himself to entertain from his own investigation. In almost every page we meet with something now considered extremely absurd, and with reason. But before the day of *printing* there was very little *publishing*: a book which was written in one country found its way but slowly into others, one copy at a time; and a man of learning seldom met those with whom he could discuss the probability of any narrative. The adoption of the principle that a story must be rejected because it is strange, would then have amounted to a disbelief of all that had been written on physics; a state of mind to which we cannot conceive any one of that age bringing himself. Nor can we rightly decide what opinion to form of Bacon as a philosopher, until we know how much he rejected, as well as how much he believed. These remarks apply particularly to his alchemy: he does not say he had made gold himself, but that others had asserted themselves to have made it; and his account of the drink by which men had lived hundreds of years is a relation taken from another. Voltaire, in his "Philosophical Dictionary," has overlooked this distinction, and has much to say in consequence. It was, however, no very strange matter that Bacon, who (if the *Speculum alchemiæ* be really his, of which, from the style, we doubt) believed with many others that sulphur and mercury were the first principles of all bodies, should endeavor to compound gold, or should give credit to the assertions of those who professed to have done so. But there is not in Bacon's alchemy any direction for the use of prayers, fasting, or planetary hours.

ALLEGED INVENTIONS.

The great points by which Bacon is known are his reputed knowledge of gunpowder and of the telescope. With regard to the former, it is not at all clear that what we call gunpowder is intended, though some detonating mixture, of which saltpeter is an ingredient, is spoken of as commonly known. The passage is as follows:

"Some things disturb the ear so much, that if they were made

to happen suddenly by night, and with sufficient skill, no city or army could bear them. No noise of thunder could compare with them. Some things strike terror on the sight, so that the flashes of the clouds are beyond comparison less disturbing; works similar to which Gideon is thought to have performed in the camp of the Midianites. And an instance we take from a childish amusement, which exists in many parts of the world, to wit, that with an instrument as large as the human thumb, by the violence of the salt called saltpeter, so horrible a noise is made by the rupture of so slight a thing as a bit of parchment, that it is thought to exceed loud thunder, and the flash is stronger than the brightest lightning.” —*Opus majus*, p. 474.

There are passages in the work *De secretis operibus*, etc. (cited by Hutton, *Dictionary*, article “Gunpowder”), which expressly mention sulphur, charcoal, and saltpeter as ingredients. But independently of the claim of the Chinese and Indians, there is an author, Marcus Græcus, whose work, *Liber ignium* (now existing only in Latin translations from the Greek), is cited by Dr. Jebb from a manuscript in the possession of Dr. Mead, and who appears to have been considered by both as older than Bacon. Dr. Hutton, into whose hands Dr. Mead’s manuscripts passed, found this writer mentioned by an Arabic physician of the ninth century. Græcus gives the receipt for gunpowder, namely, one part of sulphur, two of willow-charcoal, and six of saltpeter. Two manuscript copies of Græcus were also found in the Royal Library of Paris. But it does not appear that Græcus was known for a long time after Bacon: even Tartaglia knew nothing of him; for he says, in his work on artillery, that the oldest writers known to him use equal parts of the three ingredients.

With regard to the telescope, it must be admitted that Bacon had *conceived* the instrument, though there is no proof that he carried his conception into practice, or *invented* it. His words are these: “We can so shape transparent substances, and so arrange them with respect to our sight and objects, that rays can be broken and bent as we please, so that objects may be seen far off or near, under whatever angle we please; and thus from an incredible distance we may read the smallest letters, and number the grains of dust and sand, on account of the greatness of the angle under which we see them; and we may manage so as hardly to see bodies, when near to us, on account of the smallness of the angle under which we cause them to be seen: for vision of this sort is not a consequence of distance, except as that affects the magnitude of the

angle. And thus a boy may seem a giant, and a man a mountain, etc." The above contains a true description of a telescope; but if Bacon had constructed one, he would have found that there are impediments to the indefinite increase of the magnifying power; and still more that a boy does not appear a giant, but a boy at a smaller distance.

That the remarks of Bacon are derived from reflection and imagination only, is further apparent from his asserting that a small army could be made to appear very large, and that the sun and moon could be made to descend, to all appearance, down below, and stand over the head of the enemy. At the same time it is worth notice, that these ideas of Bacon did, in after times, produce either the telescope, or some modification of it, consisting in the magnifying of images produced by reflection, and that before the date either of Jansen or Galileo. Thomas Digges, son of Leonard Digges, in his *Stratiorikos*, London, 1590, page 359 (second edition, the first being 1579), thus speaks of what his father had done, in the presence, as he asserts, of numerous living eye-witnesses:

"And such was his Felicitie and happie successe, not only in these conclusions, but also in y^e Optikes and Catoptikes, that he was able by Perspective Glasses, duely scituate upon conuenient angles, in such sort to discouer every particularitie of the country round about, wheresoeuer the Sunne beames might pearse: as sithence Archimedes (Bakon of Oxford onely excepted) I have not read of any in action euer able by means natural to perform the like. Which partly grew by the aid he had by one old written book of the same Bakon's Experiments, that by strange aduenture, or rather Destinie, came to his hands, though chiefly by conioyning continuall laborious Practise with his Mathematicall Studies."

And the same Thomas Digges, in his *Pantometria*, London, 1571, Preface (republished in 1591), had previously given the same story, with more detail, omitting, however, all mention of Bacon. He says that his father—"sundrie times hath by proportionall Glasses duely situate in conuenient angles, not onely discouered things farre off, read letters, numbered peeces of money with the very coyne and superscription thereof, cast by some of his freends of purpose upon Downes in open Fields, but also seuen miles off declared what hath beene doone at that instant in priuate places. There are yet living diuerse (of these his dooings) *oculati testes*."

The question has been agitated whether the invention of spectacles is due to Bacon, or whether they had been introduced just before he wrote. He certainly describes them, and explains why a

plane-convex glass magnifies. But he seems to us to speak of them as already in use. "Hence this instrument is useful to old persons and those who have weak eyes."

THE OPUS MAJUS.

The *Opus majus* begins with a book on the necessity of advancing knowledge, and a dissertation on the use of philosophy in theology. It is followed by books on the utility of grammar and mathematics, in the latter of which he runs through the various sciences of astronomy, chronology, geography, and music. The account of the inhabited world is long and curious, and though frequently based on that of Ptolemy, or the writings of Pliny, contains many new facts from travelers of his own and preceding times. His account of the defects in the calendar was variously cited in the discussions which took place on the subject two centuries after. The remainder of the work consists of a treatise on optics and on experimental philosophy, insisting on the peculiar advantages of the latter. The explanation of the phenomena of the rainbow, though very imperfect, was an original effort of a character altogether foreign to the philosophy of his day. He attributes it to the reflection of the sun's rays from the cloud; and the chief merit of his theory is in the clear and philosophical manner in which he proves that the phenomenon is an appearance, and not a reality. Between the two last-mentioned books is a treatise, *De multiplicatione specierum*, entirely filled with discussions somewhat metaphysical upon the connection and causes of phenomena.

Our limits will not allow us to enter further into details: nor could we, in any moderate space, do justice to the varied learning of the author, or distinctly mark even the chief of the numerous singular and now exploded notions which are introduced; nor, as far as we know, does there exist any full account of the contests to which we can refer the reader.

THE STORY OF THE BRASS HEAD.

The following amusing extract will show the sort of reputation which Roger Bacon had acquired:

"How Friar Bacon made a brazen head to speak, by the which he would have walled England about with brass.

"Friar Bacon reading one day of the many conquests of England, bethought himself how he might keep it hereafter from the

like conquests, and to make himself famous hereafter to all posterities. This (after great study) he found could be no way so well done as one; which was to make a head of brass, and if he could make this head to speak (and hear it when it speaks) then might he be able to wall all England about with brass. To this purpose he got one Friar Bungey to assist him, who was a great scholar and a magician (but not to be compared with Friar Bacon), these two, with great pains, so framed a head of brass that in the inward parts thereof there was all things like as in a natural man's head: this being done, they were as far from perfection of the work as they were before, for they knew not how to give those parts that they had made motion, without which it was impossible that it should speak. Many books they read, but yet could not find out any hope of what they sought, that at the last they concluded to raise a spirit, and to know of him that which they could not attain to by their own studies. To do this they prepared all things ready, and went one evening to a wood thereby, and, after many ceremonies used, they spake the words of conjuration, which the devil straight obeyed, and appeared unto them, asking what they would. Know, said Friar Bacon, that we have made an artificial head of brass, which we would have to speak, to the furtherance of which we have raised thee, and, being raised, we will here keep thee, unless thou tell to us the way and manner how to make this head to speak. The devil told him that he had not that power of himself. Beginner of lies, said Friar Bacon, I know that thou dost dissemble, and therefore tell it us quickly, or else we will here bind thee to remain during our pleasures. At these threatenings the devil consented to do it, and told them, that with a continual fume of the six hottest simples it should have motion, and in one month's space speak, the time of the month or day he knew not: also he told them, that if they heard it not before it had done speaking all their labor should be lost; they, being satisfied, licensed the spirit for to depart.

"Then went these two learned friars home again, and prepared the simples ready, and made the fumes, and with continual watching attended when this brazen head would speak. Thus watched they for three weeks without any rest, so that they were so weary and sleepy that they could not any longer refrain from rest. Then called Friar Bacon his man Miles, and told him that it was not unknown to him what pains Friar Bungey and himself had taken for three weeks' space, only to make and to hear the brazen head speak, which, if they did not, then had they lost all their labor, and all England had a great loss thereby: therefore he

entreated Miles that he would watch whilst that they slept, and call them if the head speak."

Miles then begins his watch, and keeps himself from sleeping by merrily singing.

"After some noise the head spake these two words, *Time is*. Miles, hearing it to speak no more, thought his master would be angry if he waked him for that, and therefore he let them both sleep, and began to mock the head. . . . After half an hour had passed, the head did speak again two words, which were these, *Time was*. Miles respected these words as little as he did the former, and would not wake them, but still scoffed at the brazen head, that it had learned no better words, and have such a tutor as his master. . . . Miles talked and sung till another half hour was gone, then the brazen head spake again these words, *Time is past*, and therewith fell down, and presently followed a terrible noise, with strange flashes of fire, so that Miles was half dead with fear. At this noise the two friars awaked, and wondered to see the whole room so full of smoke; but that being vanished they might perceive the brazen head broken and lying on the ground. At this sight they grieved, and called Miles to know how this came. Miles, half dead with fear, said that it fell down of itself, and that, with the noise and fire that followed, he was almost frightened out of his wits. Friar Bacon asked if he did not speak. Yes, quoth Miles, it spake, but to no purpose; I'll have a parrot speak better in that time that you have been teaching this brazen head. Out on thee, villain, said Friar Bacon, thou hast undone us both: hadst thou but called us when it did speak, all England had been walled round about with brass, to its glory and our eternal fames. What were the words it spake? Very few, said Miles; and those were none of the wisest that I have heard, neither. First he said, *Time is*. Hadst thou called us then, said Friar Bacon, we had been made for ever. Then, said Miles, half an hour after it spake again, and said, *Time was*. And wouldst thou not call us then? said Bungey. Alas, said Miles, I thought he would have told me some long tale, and then I purposed to have called you: then after an hour after he cried, *Time is past*, and made such a noise that he hath waked you himself, methinks. At this Friar Bacon was in such a rage that would have beaten his man, but he was restrained by Bungey; but, nevertheless, for his punishment he, with his art, struck him dumb for one whole month's space. Thus the great work of these learned friars was overthrown, to their great griefs, by this simple fellow."—From *The Famous Historie of Fryer Bacon*.