Jean-Baptiste Biot, the last of that powerful school of science which grew up during the first French revolution, cannot here be the subject of a detailed scientific biography. The wide extent of his labours would alone render this difficult; and when it is added that a large part of this extent contains matters in which the position of Biot and of others could not be discriminated in few words, difficulty merges in practical impossibility. And this is rendered still more obvious when we state that we do not so much refer to actual points of disagreement commenced and continuing, as to matters in which anything short of a minute and cautious handling would probably create new discussions which had better find a natural origin in the statements of professed historians. Of these matters some are of very old date, and may therefore be said to have passed into history; while this very circumstance makes it more desirable to dwell especially upon the personal life of one who was born under Louis XV. and lived to the age of eighty-eight in the full enjoyment of high faculties. Of this personal life we are able to give some account from documents on which we can rely.

Biot was born at Paris, April 21, 1774. His father, Joseph Biot, was an *employé* at the Treasury, whose ancestors had been farmers in Lorraine. The son, after a classical education at the college Louis-le-Grand, and some instruction in mathematics from Mauduit, was placed, against his wish, with a merchant at Havre, who employed him in copying letters by the thousand. Disgusted with this occupation, he volunteered for the army as soon as the legal age of eighteen was attained, and served as an artilleryman in the army of the North at the battle of Hondschoote in 1793. Declining the promotion offered on condition of permanently engaging himself, he remained a few months, at the end of which a severe illness made him desirous of returning to his parents. The military authorities were very slow about the dismissal of volunteers who were likely to be useful, so Biot took his departure for Paris, with nothing but his serjeant's certificate, in September 1793. Walking feebly along the road, he was overtaken by a smartly dressed person in a cabriolet, who invited him into his carriage, and entered into conversation with him. Finding that he was going to Paris, the stranger pointed out the danger of his purpose, a recent ordinance having made it death for soldiers to approach the capital. Biot

persisted, and his companion then offered to take him all the way. This stranger, whoever he was, gained their free passage through military posts, and sent patrols about their business by a mere whisper. At Compiègne, the young volunteer was summoned before a revolutionary committee, then and there sitting, on the evidence of his uniform. But his examination had hardly commenced when his companion entered the room in violent anger and addressed strong reproaches to the Committee, which were answered by humble apologies. When they arrived at Paris, Biot desired to know the name and address of his protector, and was answered *St. Just*, Rue de la Michodière, Hotel X———. The story, one would suppose, ends here with full explanation of all that had taken place. But when Biot, after an illness of several weeks, presented himself at the address given, he was told that no such person had ever lived there. In later years Biot made many efforts to clear up the mystery, but never could get beyond a doubt. So far the notes from which we write. We add that it is notorious that the formidable leader of the revolution was on his way to Paris about the time in question, having been commissioner to the army of the North; and he was the *élégant* which Biot describes his friend to have been; but this was, of course, known to Biot. It may be surmised that the person really was the colleague of Robespierre, who, knowing that the power he had shown would necessitate the inference that he was very high in the state, and render his detection easy, chose to give his real name, but also to hint that further acquaintance would be inconvenient, by giving a wrong address. He was guillotined in July 1794, so that Biot, enfeebled by illness, probably had no opportunity of seeing him in public.

Biot was admitted into the school of *Ponts et Chaussées*, and into the Polytechnic School at its opening. He formed the acquaintance of Poisson, and the two became the favourite pupils of Monge. But Biot, Malus, and some others who had smelt powder, took part in the insurrection of October 1795, the suppression of which by grape-shot was the first very notorious achievement of Napoleon Bonaparte. Biot found refuge at Melun; but the names of the insurgent students were known, and they would have been expelled from the Polytechnic School if Monge had not interfered by the declaration that they were among his best pupils, and that if they

were dismissed he would retire with them. Monge was more than once the protector of the school. The Emperor, when he gained this title, felt strongly that the students were his enemies, and seems to have meditated their dispersion. "We had work enough," said Monge to him, "to make them republicans; give us a little time to form them into monarchists: you yourself must agree that you have turned that corner rather sharply." Napoleon did nothing: and he lived to call the school the goose which laid him the golden eggs.

Biot's next step in life was to a chair of mathematics at Beauvais. At this place he gained the acquaintance and correspondence of Laplace by an offer to correct the sheets of the 'Mécanique Céleste.' He has given, in the Journal des Savans, an anecdote which is very honourable to Laplace. While at Beauvais he married the sister of his friend Brisson, whose family resided there. Neither had any money, either in possession or reversion; so that all except lawyers will share Biot's wonder when he found that the notary had contrived a contract of marriage twelve pages long. Madame Biot had been very well educated, and the little stories and dramas which she wrote for her children were celebrated in her circle. She learnt German in order that her husband, at the desire of Berthollet, might publish a French edition of Fischer's work on physics; but the actual translation, watched of course by her husband, was her own. The first edition was published in 1805. In 1799 Biot was appointed an examiner of the Polytechnic School; in 1800 he was removed to Paris as Professor of Physics at the Collége de France, and was made an associate of the Institute, of which he became a member in 1803. The other dates which we ought to give are as follows. He was appointed, with Arago, to the continuation of the measure of the meridian, in August 1806; with Mathieu, to determine the pendulum at Bordeaux, August 1808. He became editor of the Journal des Savants, May 1816. He went to Scotland and the Shetland Islands for the measurement of the pendulum in 1817; to Dunkirk, with Arago, to act in concert with an English commission for the determination of the latitude, in 1818; to Illyria and the Balearic Islands, for the pendulum, and to Spain for the repetition of measures connected with the great survey, in 1824–25. He was made a Foreign Member of this Society in

1815, and obtained the Copley Medal in 1840. He died at Paris, February 3, 1862.

The other dates, &c. of his life will be found, given by M. Lefort (the son of his daughter's daughter), in the 'Nouvelles Annales de Mathématiques,' 2nd series, vol. i. The list of his writings, associated and separate, is under 477 heads; and this list, says the collector, is certainly incomplete. Of his separate works should be especially mentioned the 'Astronomie Physique,' 1st ed., 1805; 2nd, in 3 vols., 1810–11; 3rd, in 5 vols., 1841–57; the 'Traité de Physique Expérimentale,' 4 vols., 1816; the 'Précis' of the same, 1st ed., 1817; 3rd, in 2 vols., 1824; 'Recueil d'Observations Géodésiques' (vol. iv. of the 'Base du Système Métrique'), 4to, 1821; the edition (in conjunction with M. Lefort) of the 'Commercium Epistolicum,' &c., with additions, 4to, 1856. The works on Indian and Chinese astronomy can hardly be given apart, without the writings on the same subject in the journals.

How completely Biot was devoted to his occupations sufficiently appears. The indomitable energy of his character was associated with a strong feeling of personal independence. With the pride of a republican he refused, before his election to the Academy of Sciences, to pay the usual visits of ceremony to his future colleagues. This he afterwards regretted; and, as a kind of expiation, he made it a rule, until at last his friends insisted that he should spare his extreme old age the fatigue, to pay a visit to every new member of the Academy, so soon as his election was made certain.

In 1803, his son Edward was born. This son, after a respectable career in science and engineering, took a dislike to such pursuits, and applied himself to literature, and especially to the study of Chinese. He died in 1850, a member of the Academy of Inscriptions, in which he found himself the colleague of his father; for it should be noted, as a thing which is, we believe, unique, that Biot died a member of three of the four academies, being also elected to the Académie Française in 1856. The mother survived her son two years; and these losses were the great misfortunes of the father's life.

The name of Arago will always be associated with that of Biot. Arago in his early youth (he was but twenty-four years old when he gained his place at the Institute, after his return from captivity

at Algiers) had distinguished himself to an extent which induced Biot to make it almost a condition that the young man should be appointed his assistant, before he would undertake the conduct of the survey. When a place in the astronomical section of the Institute became vacant, Poisson was thought of as a successor to Lalande, with every chance of success. Biot protested, and urged strongly to both Lagrange and Laplace, that the astronomer ought to be a person conversant with astronomy, and that Poisson's future chair ought to be one of geometry. Lagrange gave way at once—"Vous avez raison," he said, "c'est la lunette qui fait l'astronome." Laplace was harder to convince, but yielded at last.

In 1809 Biot obtained those apartments in the Collége de France which he occupied with hardly any intermission until his death. We have heard it said that he never left Paris for one single night during fifty years: this is probably not literally true, but is certainly very near it. In the same year (April) an imperial decree named him professor of astronomy in the new University then founded. Biot had not been an Imperialist; and the appointment was a free testimony to his merit. In 1804 he had endeavoured to prevent the Institute from expressing an opinion in favour of the new *régime*, on the ground that a scientific body should not meddle with politics: this opinion he always maintained. The police were well aware that he had assisted Benjamin Constant, Andrieu, and perhaps other frequenters of the house of Madame de Staël, in the composition of a satirical piece which had great success in such private circulation as could be safely given. Fouché had charged Laplace to tell his young friend to be a little less witty and a little more prudent. Biot, as might be expected, obtained no very great patronage from the Emperor. He had a turn for dry satire, which, under very effective restraint, is visible in his controversial writings; and he had the mode of delivering a sarcasm which tells. In 1800, Roederer, then high in the direction of public instruction, paid a visit to the Collége de France, and, surrounded by the professors, read them a lecture on their functions, recommended practice in preference to theory, and pointed out geometry and algebra as not good for much. "Cependant," quietly remarked Biot, "la géométrie a du bon pour l'arpentage," to which the other was unfortunate enough to assent in a manner which showed he did not understand

the answer. The amusement which this excited led Laplace to tell the story to the First Consul, among whose few objects of reverence the mathematics stood very high. Roederer accordingly had to encounter one of those *bourrasques* by which Napoleon is so well known. "You are a pretty ignoramus not to know that mathematics is the root of human knowledge. The young man served you right when he turned you into ridicule; and you could not even see what he was at."

If such anecdotes appear to be unusual in our notices, it may be remembered that these accompaniments would, in most cases, be of too recent a character. We insert nothing but what is more than half a century old, and we proceed to a few words on Biot's scientific life.

Over and above separate works, fifteen in number, the scientific life of Biot is recorded in 60 articles of the Journal Philomathique, 119 of the Comptes Rendus, 3 of the Journal of the Polytechnic School, 8 of the Connaissance des Tems, 41 of the Annales de Chimie, &c., 22 of the Memoirs of the Academy, 1 of the Savans Etrangers, 83 of the Journal des Savans; and of accounts and criticisms, 37 in the Moniteur Universel, 35 in the Mercure de France, 1 in the Journal des Débats, 5 in the Journal des Mines, with 23 articles in the Biographie Universelle, 9 in the Mémoires, &c. d'Arcueil, 1 in the Academy of Inscriptions, 2 in the Revue Britannique, 6 in the Revue ou décade Philosophique, &c., and 8 in the Nouvelles Annales du Muséum d'Histoire Naturelle. In this large mass of results the author appears as an observer and experimenter, as a critic and historian, and as a teacher and elementary writer.

As an astronomical and geodetical observer, Biot has long had his place in history; to discuss that place would require the discussion of critics, historians, and subsequent observers. As an experimenter, we cannot undertake to describe that long train of which Professor Forbes, in his elaborate sixth dissertation of the 'Encyclopædia Britannica,' says "the number and variety of his experiments and writings almost baffles enumeration." There is no part of physics into which he did not carry his researches; but of all he was most devoted to optics. Here the point which has been most signalized by historical writers is the effect of the rotatory action of fluids, to

which he attended for forty years. All acknowledge the sagacity, perseverance, and honesty which are conspicuous in this prominent part of Biot's life, as in others.

As a critic and historian, Biot's field of labour was even wider than that of his life as an experimenter and observer. Had he published nothing whatever except his papers on Egyptian, Hindoo, and Chinese astronomy, he would have been known as an inquirer the amount of whose labours was fully equal to that of several whose reputation is entirely founded upon oriental astronomy. Had he produced nothing except the long series of articles on contemporary science and history of science which adorns the Journal des Savans, he would have been remarkable as the most continuous and varied scientific critic of his time. And in all these articles there is a close and discriminating production of the whole subject, relieved by legitimate satire, and by a tone of occasional pleasantry which is the true vehicle of certain parts of good criticism. Three volumes of 'Mélanges Scientifiques et Littéraires' were published in 1858; but it may be hoped that this will be superseded by a more complete reprint.

It is natural that a notice in these pages should make allusion to Biot's part in a controversy which, more than any other, concerns this Society: we mean the never-ending question of Newton and his opponents. From the time when the life of Newton appeared in the 'Biographie Universelle,' its author was what we may here call the chief of the opposite party. His views were strong, and ably supported; his mode of opposition was fair and downright. Biot was one of those disputants who cannot fail to forward sound conclusion, take which side they may.

As an elementary writer, this country is under especial obligations to Biot. In 1816, just after the termination of the long struggle which had isolated Great Britain from the continent, he produced those treatises on physics, full and abridged, which laid all the recent physical improvements before those who could not have sought them in scattered organs of announcement. Very many of those whose youth belongs to this period will remember Biot's 'Traité' and especially his 'Précis,' as the first sources of their acquaintance with modern experimental methods and results. The treatise on astronomy, not so much known in this country, filled up a void

which had been left open in the large mathematical work of Delambre.

It is not often that a death at the age of eighty-eight leaves a blank in the scientific world; but this must be said of Biot. To the end of his long life he was in perpetual activity. A volume on Indian and Chinese astronomy appeared in 1861, closing the list which began with "Elements of Arithmetic," prefixed to Clairaut's 'Algebra,' in 1797.

William Borrer, Esq., the eldest of the three sons of William Borrer, Esq., of Parkyns-manor, Hurstpierpoint, was born at Henfield in Sussex on the 13th of June 1781. He passed his long life in the country, discharging the duties incident to a landed proprietor and county magistrate, and earning the respect and attachment of his neighbourhood for his well-considered acts of local beneficence. Amidst his rural occupations Mr. Borrer found ample scope for the pursuit of botany, to which he was enthusiastically devoted, and earned for himself a considerable reputation among British botanists for his extensive and accurate knowledge of indigenous plants. To the great repertory of that species of knowledge, the 'English Botany,' and especially to the Supplement of that work, he contributed valuable materials; and, in association with his friend Mr. Dawson Turner, commenced a 'History of British Lichens,' which, however, was stopped in its progress by the death of the printer and other untoward circumstances. After lying dormant for a quarter of a century, the fragment of this work actually printed was brought out by Mr. Turner for private circulation, and mainly, as he expresses himself, that it might serve as a monument of Mr. Borrer's industry, ability, and profound knowledge of the family of plants to which it refers.

Mr. Borrer was elected into the Royal Society in 1835. He was also a Fellow of the Linnean Society and of the Wernerian Natural History Society of Edinburgh. He died on the 10th of January 1862.

The life of our late President, Sir Benjamin Collins Brodie, Baronet, Serjeant-Surgeon to the Queen, has not been ended long enough to allow even those who are best acquainted with it, fully or, perhaps, correctly to estimate its precise value.