

APPENDIX A.

BREWSTER'S WORK AT ST. ANDREWS.¹—See p. 169.

“WHEN Sir David Brewster took up his residence in St. Andrews, that venerable city had long been in the condition of a literary and ecclesiastical ‘Sleepy Hollow,’ remote from the din and bustle of the world, and little affected by the changes which had passed over the country during the present century. Successive generations of certain well-known clerical families, and their relatives by blood or marriage, had occupied the chairs in its colleges. The Senatus were the patrons of most of these chairs as well as of several parishes, and there is too much reason to suspect that the public interest was the last thing considered by them in the exercise of their patronage. Various unauthorized if not illegal changes had been made by them on the constitution of the College, one of which seriously affected the rights of the bursars. Bursaries had been systematically mismanaged, and the most valuable of them conferred on students who had no claim to them except their relationship to some Professor, or influential patron. In some cases the funds had disappeared in whole or in part, in consequence mainly of the carelessness or negligence of the Senatus. One of the bursaries had through an oversight been swallowed up in the gulf of the common fund, and the interest of the money had for a considerable number of years been paid by the Senatus, who had thus been made to suffer for the fault of their predecessors. The patronage of some others had been sold by the patron in direct violation of the deed of the founder, and one-half of the funds had been lost through the bankruptcy of the purchaser—the provost of a neighbouring burgh—to whom the money had been lent without

¹ Communicated by the Rev. Dr. James Taylor of Glasgow.

adequate security. These may be taken as samples of the abuses which had crept into the management of the College. Other departments stood not less in need of reform. The mode in which honorary degrees were granted had long been a scandal. No Dissenter, however distinguished for ability and learning, had within the memory of man ever received from the University an acknowledgment of his merits, but dozens of parish ministers, who had never been heard of beyond the bounds of their respective presbyteries, most readily obtained the honour of a degree on payment of a handsome honorarium. Professor Gillespie informed me that not long before this time the friends of a clergyman, of most respectable character no doubt, but of slender abilities, and corresponding attainments, had subscribed a sum of money for a testimonial to him, and had devoted it to the purchase of a degree from St. Andrews, as the most acceptable token of their esteem which they could devise. The popular estimate of the divines whom the University delighted to honour had been embodied in the following epigram, which I remember to have heard about this time :—

‘ Doctor Green and Doctor Gray,
St. Andrews doctors both were they ;
Doctor Gray and Doctor Green,
Sic twa doctors ne'er were seen.’

The brief sojourn of Dr. Chalmers, who held the office of Professor of Moral Philosophy from 1824 to 1828, had for a season troubled the waters and roused the College and the town into a state of temporary activity ; but on the removal of that great and good man to Edinburgh, matters had at once relapsed into their former condition.

It is scarcely possible to conceive a more striking example of retributive justice than the appointment of a man of Sir David Brewster's character and temperament to the office of head of an institution which, for more than a century, had thus slumbered and slept and jobbed, unaffected by public opinion (which indeed could scarcely be said to exist in that quarter), and undisturbed by any apprehensions of reform. The Professors who filled the chairs of the United College at the time of Sir David's appointment to the office of Principal, were for the most part pleasant, easy-going men, much more alive to the pleasures than to the duties of life, and very reluctant to mend their jog trot pace or to move out of the beaten track. Though they were not responsible for the abuses

which their predecessors had originated, it can scarcely be a matter of surprise that they should not have been forward in promoting measures for their removal. Sir David, however, had no toleration for evils which it was in his power to redress ; and he set himself at once with his characteristic ardour and energy (not always tempered by prudence and patience) to abolish sinecures, to recover lost bursaries, and to extirpate the whole mass of time-honoured abuses which the indolence and neglect of his predecessors had allowed to accumulate in that ancient seat of learning.

He first of all set an example to his colleagues, in the diligence and assiduity with which he discharged his own official duties. The office of Principal had up to this time been virtually a sinecure, and had not unfrequently been held in connection with the pastoral charge of the parish of St. Leonard's, but he at once made it a sphere of active exertion and usefulness. For one thing, he commenced a series of gratuitous lectures on optics and mineralogy, which were attended not only by great numbers of the students but of the townspeople also, and were perfect models of simple, clear, and felicitous expositions of those interesting branches of science. He then did what he could to induce the other members of the University to follow his example. One of the Professors was the incumbent of a large parish about a dozen of miles from St. Andrews, and as attendance at his class was not required by any of the Presbyterian Churches, the students were disinclined to pay the usual fee, and no lectures were delivered, or any duty performed by the occupant of the chair. A quiet but firm remonstrance from the Principal induced him also to try the experiment of gratuitous lectures, which, as they were able and instructive, were largely attended by the students. It is to the honour of this Professor, a man of powerful intellect and great activity in the discharge of his parochial duties, that so far from resenting the Principal's interference he was the only member of the University who stood firmly by Sir David when the Senatus attempted to eject him from his office. Another of the Professors (whose appointment by the Crown to the incumbency of the College Church was strenuously but ineffectually resisted), not content with this plurality of offices, neither of which he filled with much acceptance, had also obtained the Librarianship of the University, devolving its duties upon a preacher with a salary of £20 a year. He was now however constrained to resign this office, which was conferred upon his deputy.

A still more important reform was effected by Sir David on the system of conferring honorary degrees. The fees hitherto exacted were entirely abolished in the departments of divinity and of the arts, much to the relief of the competitors for the degree of A.M., who are not usually overburdened with cash at the close of their curriculum. Sir David insisted that henceforth merit alone should be the qualification for University honours, and that these should be conferred impartially upon Churchmen and Dissenters alike. It is only fair to say that a majority of the *Senatus* readily coincided in these reforms, though a section of them for a time doggedly adhered to their old opinions and feelings; and when a degree was conferred on Professor Balmer, a clergyman of eminent piety and learning, Principal Haldane and other two or three members of the *Senatus* refused to sign his diploma, solely on the ground that he was a Dissenter. This fact was brought under the notice of the Royal Commission. These prejudices, however, were gradually dispelled, and in a few years Dr. Haldane and his conservative friends were quite as ready to confer a degree on a meritorious Dissenter as on a deserving Churchman. It is proper to state that the other Universities of Scotland had manifested a good deal of the same sectarian feeling, though Edinburgh and Glasgow had not carried it quite so far as St. Andrews had done; but after the lapse of a few years they also began to exhibit a more liberal spirit, though as far as the exaction of large fees for diplomas is concerned the example of St. Andrews still remains unique.

At the outset, the majority of the *Senatus*, influenced no doubt partly by the illustrious reputation of their new Principal, partly by his energy, partly also by their consciousness that certain changes in the management were really necessary, acquiesced with more or less reluctance in the reforms which Sir David proposed. But he pressed on his schemes so rapidly and so keenly, and the alterations which he proposed were so numerous and extensive, that ere long his colleagues began to hesitate, then to remonstrate, and finally to resist with all their might. Brewster was always impatient of opposition, and the doubts and difficulties of his colleagues made him only the more resolute in carrying out his proposals, and the less inclined to forbear with the feelings and prejudices of his colleagues. The results which had been predicted by Lord Jeffrey, who was well acquainted with Sir David's character, and the condition of the University, speedily followed. Wars and rumours of

wars were heard on all sides. Stormy meetings of the Senatus were succeeded by uproarious meetings of the students. Fierce controversies and lawsuits for a time destroyed the peace, and even threatened the prosperity, of the University. An unprejudiced spectator of the internecine war would have decided, as Mrs. Gordon candidly admits, that 'while in many cases the Principal was right in the main, he was often wrong in his way of carrying out the right thing, and always thoroughly and singularly unconscious of any fault in himself.' He saw so clearly the justice and propriety of the measures which he thought fit to adopt, that he could not comprehend how any man, unless blinded by self-interest or prejudice, could fail to approve of his procedure, and hence he never hesitated to denounce in the most unmeasured terms the motives and the conduct of his opponents. He professed, indeed, to act upon a theory which he used to defend with great ingenuity—that the public are so apathetic and indifferent that it is necessary to employ the strongest language to rouse them to a sense of the existence of even the most flagrant abuses. He had no belief in the efficacy of 'the soft answer which turneth away wrath,' and was not sparing in the use of his great powers of sarcasm, which told with tremendous effect on those who had the misfortune to incur his displeasure.

I remember that on one occasion, after a keen though friendly discussion of this topic, during our daily walk, in which he bore with great good-humour my remonstrances respecting the vehemence of the language he was in the habit of employing towards his colleagues, he sent for my perusal a volume of the *Edinburgh Review*, containing the celebrated article on Dr. Hampden's case, by Dr. Arnold of Rugby, with all the abusive epithets and denunciations it contained—and they were not few—underlined. He heartily enjoyed the triumph he had thus gained over me in being able to adduce such high authority in favour of his own opinion and practice.

But though irascible and pugnacious to an unusual degree, Brewster was not vindictive. And it was no uncommon occurrence when, after my removal to Glasgow, I paid a visit to St. Andrews, to find him at one time full of indignation against some member of the Senatus who had opposed or failed to support some of his schemes, and on returning a few months later, to find the peccant Professor completely reinstated in the Principal's good graces, and

regarded by him as one of his most trustworthy friends. Long before Sir David's removal from St. Andrews the strife between him and the Professors had exhausted itself. The requisite reforms had to a great extent been carried out. A new generation had arisen who were in no way implicated in the original disputes, and to some of whom, especially to Professor Ferrier and Principal Tulloch, he was most tenderly attached.

Sir David Brewster could never rest satisfied with a superficial knowledge of any subject to which he directed his attention. He liked to have firm ground beneath his feet. This must always have been the case from his student days onward. I have no reason to suppose that he had paid much attention to the study of theology after he quitted the Divinity Hall; but he possessed an extensive knowledge—which must have been acquired there—of those 'grand old truths' which are embodied in the Standards of the Presbyterian Churches of Scotland, and are still tenaciously held by the Scottish people. He took a deep interest in the controversy respecting the extent of the Atonement which was at that time (1840-43) raging fiercely in Scotland, and, though he had no sympathy with the opinions of the ultra-Calvinists, he showed great acuteness and ingenuity in pointing out the objections which could be urged against the views held on this subject by Drs. Balmer and Brown. Sir David was fond of a good sermon, but he disliked scientific and philosophical discussions from the pulpit. A number of the Free Church ministers who officiated in St. Andrews before Dr. Hetherington's settlement there, knowing that the Principal of the College and a number of the students would form part of their audience, selected such topics, rather than the simple truths of the gospel, for the subjects of their discourses, much to Sir David's annoyance. He repeatedly complained to me of this procedure. He went to church, he said, not to listen to elaborate disquisitions on philosophy, but to hear the gospel, and the more plainly and simply it was preached the better. He was a most attentive hearer, but Dr. Hetherington, whose sermons were very able but very long, not unfrequently tried his patience. He told me he could listen to the Doctor's discourses for an hour with interest and pleasure, but he could not command his attention beyond that time.

With all his vast attainments and great celebrity Sir David was a modest and humble-minded man. He was always ready to do full justice to others; and indeed, like Sir Walter Scott and other

men of great genius, he not unfrequently formed too high an opinion of the talents and attainments of his friends. This was especially the case with respect to those qualities in which he thought himself deficient. He had no readiness in extempore speaking on ordinary topics, and shrank with terror from any call to take part in a public meeting, or to return thanks when his health was proposed at a public dinner. Hence he frequently said that he regarded the ability to deliver off-hand a good speech with ease and fluency as a proof of the possession of extraordinary talent. It seems never to have occurred to him that the power which he possessed in a very high degree of delivering an extempore lecture, explaining with the utmost clearness and simplicity the most abstruse scientific experiment, was a talent of the very same kind, and that it was quite as remarkable in the estimation of the uninitiated hearer.

Sir David was a stanch, though not an extreme Liberal, and took a deep interest in the abolition of War and Slavery, and of the Corn-Laws and all restrictions on trade and commerce. Though the noise and heat of public meetings were most uncongenial to his taste, and every moment of his time was precious and fully occupied, he never hesitated to sacrifice time and money, and to undergo the toil of travel, in order to countenance meetings held to denounce any great evil, or unjust law, or to promote any important social reform. He was present at the great anti-Corn-Law meeting at Dundee, in which Messrs. Cobden and Bright and General Thompson took part. He was particularly impressed with Mr. Bright's appearance on that occasion as prognosticating his future eminence. His efforts on behalf of the Peace Society have been noticed by Mrs. Gordon; but he was equally active in promoting all social improvements to which it was in his power to lend a helping hand. He was a most zealous friend of national education on a liberal and comprehensive basis; and until his death was President of the National Education Association of Scotland, established in 1850, of which Sir William Hamilton and Professors Pillans, Trail, Fleming, Kelland, Blackie, with Drs. Brown, Guthrie, and other men of eminence in literature and science, were Vice-Presidents or Directors.

Brewster took the deepest interest in the Non-Intrusion controversy. He was a strenuous supporter of the spiritual independence of the Church and the rights of the Christian people; and at the

Disruption he joined the seceding party, and took a prominent part in establishing a Free Church congregation in St. Andrews. He well knew the danger to which this step exposed him, and he had little reason to expect either sympathy or support from his professional brethren. The question which Sir Walter Scott puts into the mouth of Saddletree, 'Wha ever heard of a lawyer's suffering either for ae religion or another?' might have been quite as appropriately asked with reference to not a few of the Scottish Professors of those days—

'Trojan and Tyrian were alike to them.'

The Principal of one of the National Colleges had indeed expressed his intention to cast in his lot with the Free Church, and had actually crossed the threshold when he suddenly drew back in terror at the consequences which seemed likely to ensue. But Sir David was made of sterner stuff, and resolutely adhered to the cause which he had embraced, in spite of all warnings and threatenings. He was speedily made to feel that if these were not fulfilled it would not be from want of will on the part of his assailants. The Presbytery of St. Andrews lost no time in directing their ecclesiastical artillery against him, and the Senatus, with the single exception of the Rev. Dr. Ferrie, memorialized the Government to eject the Principal from his office, on account of his adherence to the Free Church. Sir David satisfied himself, by a careful study of the Acts of Parliament bearing on his case, and by consultation with eminent legal friends, that the Church Courts had no jurisdiction in the matter. But he had reason to believe that he might have been removed from his office by a Royal Commission, duly authorized to adjudicate on the memorial of the Senatus; and it seemed at one time not unlikely that this authority would be given. The Conservative Government, deeply mortified at the failure of their Scottish ecclesiastical policy, had after the Disruption exhibited a feeling of bitter hostility towards the Free Church, and had deprived Dr. Welsh of the Secretaryship of the Bible Board, though the law did not limit that office to members of the Established Church. Sir David had therefore no reason to expect any favour at their hands, and the answer which was returned by the Home Secretary, Sir James Graham, to an appeal which the Principal made to the Government respecting the memorial of the Senatus, was, to say the least of it, most unsatisfactory. But no

sooner did it transpire that the men who for years, in open violation of the law, had appointed or connived at the appointment of a large number of Episcopalians to Chairs in the Scottish Universities, were now proposing to expel from his office the most illustrious member of these Academical institutions, on account of his conscientious adherence to what he believed to be the original and true principles of the Church of Scotland, than a storm of indignation burst on them from all parts of the kingdom, which made even the stoutest quail. The Government shrank from an attempt which they felt to be as unwise as it was unworthy. The Senatus took no further step in the matter, and though the Church Courts continued for some time to talk of their privileges and their powers, they too by-and-by held their peace. The Principal was thenceforth allowed to hold his office without molestation, but the effort made to eject him led to an agitation against all University Tests in Scotland, which ultimately effected their entire abolition.

Mrs. Gordon has noticed the prominent part which her father took in the establishment of the *North British Review*, but she does not seem to be aware of the fact that this step led to his separation from the *Edinburgh Review*, to which he had long been a regular contributor. Professor Napier was deeply hurt and offended when he learned that his old ally had promised his support to the new, and, as he considered it, rival periodical, and remonstrated with him on the subject both by letter and in a personal interview. Sir David, however, was displeased with the attacks which the *Edinburgh Review* had made on the evangelical doctrines to which he was strongly attached, and informed the editor that he had resolved to give his assistance to the new Review, because he could rely on its defending these doctrines if they should be assailed. A day or two afterwards he related to me this conversation, and said he was sure that Professor Napier would never again ask him to contribute to the *Edinburgh Review*,—a great loss to him, he added, as his contributions to that periodical were very highly remunerated.

Sir David Brewster was a singularly accomplished and many-sided man in literature as well as in science. He was the most indefatigable worker I ever knew, and I have been acquainted with some of the most laborious men of the day. His life was one of untiring industry, his energy seemed inexhaustible. Call upon him at almost any hour of the day or evening, you never found

him unemployed; yet he always seemed fresh and vigorous. Busy as he was, he was ever ready cheerfully to lay aside his work and to give his valuable time, his best advice, encouragement, and assistance to those who had any claim upon him.

In general society Brewster was simple, courteous, and genial in his manners; and his long experience of the world, his intimate acquaintance with many other eminent men, his retentive memory, great conversational powers, and entire forgetfulness of self, made him one of the most delightful of companions. His manner towards the gentler sex, old and young, had in it an indescribable air of deference and chivalrous respect which was singularly winning, and made him a universal favourite among them. He was almost equally popular with young aspirants to literary or scientific fame, to whom he was always most willing, without any air of condescension, to give not only warm sympathy and wise counsel, but valuable assistance. His moral courage was invincible. From youth to old age he was ever ready to face any adversary, or any odds, when he felt himself constrained by a sense of duty to buckle on his armour. He retained to the last his zeal in the pursuit of truth, his deep interest in scientific discoveries, and in the progress of society, and his indignant reprobation of falsehood and imposture. The discreditable attempt made by a French literary forger to blacken the memory of Newton, in order to exalt the reputation of Pascal, kindled in Brewster a perfect blaze of indignation; and the ability with which he vindicated the character of his illustrious master, and the acuteness he displayed in pointing out the marks of forgery in the spurious documents, are remarkable proofs how little age had abated the fire or 'withered' the energy of his intellect.

'HEU! QUANTO MINUS EST CUM RELIQUIS VERSARI, QUAM TUI MEMINISSE!'

APPENDIX B.

IN order to give some tangible proof of the extent and variety of my father's labours, I add a list of his miscellaneous writings, so far as I have been able to ascertain their nature and number :—

1. Remarks on Achromatic Eyepieces.—Nicholson, Journ. xiv., 1806, pp. 388, 389.

2. Description of a new Astrometer for finding the Rising and Setting of the Stars and Planets, and their Position in the Heavens.—Nicholson, Journ. xvi., 1807, pp. 320-324.

3. Description of a Circular Mother-of-pearl Micrometer.—Tilloch, Phil. Mag. xxix., 1807, pp. 48-52.

4. Remarks on M. Buerkhardt's Contrivance for Shortening Reflecting Telescopes; with a new method of making Refracting Telescopes with a Tube only one-third of the focal length of the Object-Glass.—Tilloch, Phil. Mag. xxxiii., 1809, pp. 290-292.

5. On the Fibres used in Micrometers; with an account of a method of removing the Error arising from the Inflection of Light, by employing Hollow Fibres of Glass.—Tilloch, Phil. Mag. xxxiii., 1809, pp. 383, 384.

6. Demonstration of the Fundamental Property of the Lever (1810).—Edinb. Roy. Soc. Trans. vi., 1812, pp. 397-404; Nicholson, Journ. xxx., 1812, pp. 280-285.

7. On some Properties of Light.—Phil. Trans., 1813, pp. 101-109.

8. On the Affections of Light transmitted through Crystallized Bodies (1813).—Phil. Trans., 1814, pp. 187-218.

9. On the Polarization of Light by Oblique transmission through all Bodies, whether Crystallized or Uncrystallized.—Phil. Trans. 1814, pp. 219-230.

10. On the New Properties of Light exhibited in the Optical Phenomena of Mother-of-pearl and other Bodies to which the

Superficial Structure of that substance can be communicated.—Phil. Trans., 1814, pp. 397-418; Thomson, Ann. Phil. iii., 1814, pp. 190-196.

11. Results of some recent Experiments on the Properties impressed upon Light by the action of Glass raised to different Temperatures, and cooled under different circumstances.—Phil. Trans., 1814, pp. 436-439.

12. On the Optical Properties of Sulphuret of Carbon, Carbonate of Barytes, and Nitrate of Potash, with inferences respecting the Structure of Doubly Refracting Crystals (1814).—Edinb. Roy. Soc. Trans. vii., 1815, pp. 285-302.

13. On a new Species of Coloured Fringes produced by the Reflection of Light between two Plates of Glass of equal thickness.—Edinb. Roy. Soc. Trans. vii., 1815, pp. 435-444.

14. Expériences sur la Lumière.—Paris Soc. Philom., Bull, 1815, pp. 44-46.

15. Additional Observations on the Optical Properties and Structure of Heated Glass and Unannealed Glass Drops (1814).—Phil. Trans., 1815, pp. 1-8.

16. Experiments on the Depolarization of Light, as exhibited by various Mineral, Animal, and Vegetable Bodies, with a reference of the Phenomena to the General Principles of Polarization (1814).—Phil. Trans., 1815, pp. 29-53.

17. On the Effects of Simple Pressure in producing that Species of Crystallization which forms two oppositely Polarized Images, and exhibits the Complementary Colours by Polarized Light.—Phil. Trans., 1815, pp. 60-64.

18. On the Laws which regulate the Polarization of Light by Reflection from Transparent Bodies.—Phil. Trans., 1815, pp. 125-159.

19. On the Multiplication of Images, and the Colours which accompany them, in some Specimens of Calcareous Spar.—Phil. Trans., 1815, pp. 270-292.

20. On new Properties of Heat as exhibited in its Propagation along Glass Plates.—Phil. Trans., 1816, pp. 46-114.

21. On the Communication of the Structure of Doubly Refracting Crystals to Glass, Muriate of Soda, Fluor-Spar, and other substances, by Mechanical Compression and Dilatation.—Phil. Trans., 1816, pp. 156-178.

22. On the Structure of the Crystalline Lens in Fishes and Quad-

rupeds, as ascertained by its action on Polarized Light.—Phil. Trans., 1816, pp. 311-317.

23. On the Effects produced in Astronomical and Trigonometrical Observations, etc., by the Descent of the Fluid which lubricates the Cornea.—Quart. Journ. Sci. ii., 1817, pp. 127-131.

24. On the Decomposition of Light by Simple Reflection.—Quart. Journ. Sci. ii., 1817, p. 211.

25. On the Connection between the Primitive Forms of Crystals, and the Number of their Axes of Double Refraction (1819).—Edinb. Mem. Wern. Soc. iii., 1817-20, pp. 50-74.

26. Sur le mouvement perpétuel.—Annal. de Chimie, ix., 1818, pp. 219, 220.

27. Description du Kaleidoscope.—Bibl. Univ. viii., 1818, pp. 155-160.

28. On the Action of Transparent Bodies upon the differently coloured Rays of Light (1815).—Edinb. Roy. Soc. Trans. viii., 1818, pp. 1-23.

29. Description of a New Darkening Glass for Solar Observations, which has also the property of Polarizing the whole of the transmitted Light (1815).—Edinb. Roy. Soc. Trans. viii., 1818, pp. 25-30.

30. On the Optical Properties of Muriate of Soda, Fluat of Lime, and the Diamond, as exhibited in their action upon Polarized Light (1815).—Edinb. Roy. Soc. Trans. viii., 1818, pp. 157-164.

31. On a new Optical and Mineralogical Property of Calcareous Spar (1816).—Edinb. Roy. Soc. Trans. viii., 1818, pp. 165-170.

32. On the Effects of Compression and Dilatation in altering the Polarizing structure of Doubly Refracting Crystals (1816).—Edinb. Roy. Soc. Trans. viii., 1818, pp. 281-286.

33. On the Laws which regulate the distribution of the Polarizing Force in Plates, Tubes, and Cylinders of Glass that have received the Polarizing Structure (1816).—Edinb. Roy. Soc. Trans. viii., 1818, pp. 353-372.

34. On the Laws of Polarization and Double Refraction in regularly Crystallized Bodies.—Phil. Trans., 1818, pp. 199-272.

35. Description of a method of making Doubly Refracting Prisms perfectly Achromatic.—Thomson, Ann. Phil. xi., 1818, pp. 175-177.

36. On the difference between the Optical Properties of Arragonite and Calcareous Spar.—Quart. Journ. Sci. iv., 1818, pp. 112-114.

37. Optical structure of Ice.—Quart. Journ. Sci. iv., 1818, p. 155.

38. On a new Optical and Mineralogical Structure, exhibited in certain Specimens of Apophyllite and other Minerals.—Edinb. Phil. Journ. i., 1819, pp. 1-8; Edinb. Roy. Soc. Trans. ix., 1823, pp. 317-336.

39. On the Phosphorescence of Minerals.—Edinb. Phil. Journ. i., 1819, pp. 383-388.

40. On the Laws which regulate the Absorption of Polarized Light by Doubly Refracting Crystals (1818).—Phil. Trans., 1819, pp. 11-28; Edinb. Phil. Journ. ii., 1820, pp. 341-348.

41. On the action of Crystallized Surfaces upon Light.—Phil. Trans., 1819, pp. 145-160.

42. On the Optical and Physical Properties of Tabasheer.—Phil. Trans., 1819, pp. 283-299; Edinb. Phil. Journ. i., 1819, pp. 147-150; ii., 1820, pp. 97-102.

43. On a singular Development of Crystalline Structure by Phosphorescence.—Edinb. Phil. Journ. ii., 1820, pp. 171, 172.

44. On the Optical Properties and Mechanical Condition of Amber.—Edinb. Phil. Journ. ii., 1820, pp. 332-334.

45. Account of some Single Microscopes upon a new construction.—Edinb. Phil. Journ. iii., 1820, pp. 74-77.

46. Notice respecting a singular Structure in the Diamond.—Edinb. Phil. Journ. iii., 1820, pp. 98-100.

47. Notice respecting some new species of Lead-Ore from Wanlochhead and Leadhills.—Edinb. Phil. Journ. iii., 1820, pp. 138-140.

48. On the Phenomena of Dichroism, or the Absorption of Common Light by Crystallized Bodies.—Edinb. Phil. Journ. iii., 1820, pp. 243-247.

49. On a singular Luminous Property of Wood, etc., steeped in Solutions of Lime and Magnesia.—Edinb. Phil. Journ. iii., 1820, pp. 343-344.

50. Additions aux Observations sur les Rapports entre la Forme Primitive des Minéraux et le Nombre de leurs Axes de Double Réfraction.—Journ. de Phys. xci., 1820, pp. 300-309.

51. Account of Comptonite, a new Mineral from Vesuvius.—Edinb. Phil. Journ. iv., 1821, pp. 131-133.

52. Description of a new Double Image Micrometer for Measuring the Distance of Celestial Objects.—Edinb. Phil. Journ. iv., 1821, pp. 164-167.

53. Reply to a Note in the "Annales de Chimie," by M. Arago,

on the Phosphorescence of Fluor-Spar.—Edinb. Phil. Journ. iv., 1821, pp. 180-185.

54. Account of the new Hydrate of Magnesia discovered in Shetland.—Edinb. Phil. Journ. iv. 1821, pp. 352-355; Edinb. Roy. Soc. Trans. ix., 1823, pp. 239-242.

55. Account of the Atuah-Kudda, or Natural Fire Temples of the Guebrea, formed by Burning Springs of Naphtha, with a Notice respecting the Naphtha Wells in Pegu.—Edinb. Phil. Journ. v., 1821, pp. 21-27.

56. On the Connection between the Optical Structure and Chemical Composition of Minerals.—Edinb. Phil. Journ. v., 1821, pp. 1-8.

57. On the Form of the Integrant Molecule of Carbonate of Lime (1818).—Geol. Soc. Trans. v., 1821, pp. 83-86.

58. Observation on Vision through Coloured Glasses, and on their Application to Telescopes and Microscopes of great magnitude.—Edinb. Phil. Journ. vi., 1822, pp. 102-107.

59. Description of a Teinoscope for altering the Lineal Proportions of Objects; with Observations on Professor Amici's Memoir on Telescopes without Lenses.—Edinb. Phil. Journ. vi., 1822, pp. 334-338.

60. Observations on the Relations between the Optical Structure and the Chemical Composition of the Apophyllite, and other Minerals of the Zeolite Family, in reference to the Analyses of M. Berzelius.—Edinb. Phil. Journ. vii., 1822, pp. 12-18.

61. Account of a singular Experiment depending on the Polarization of Light by Reflection.—Edinb. Phil. Journ. vii. 1822, pp. 146, 147.

62. Description of a new Reflecting Telescope.—Edinb. Phil. Journ. vii., 1822, pp. 323-328; viii., 1823, pp. 326, 327.

63. On the Construction of Polyzonal Lenses and Mirrors of great magnitude for Lighthouses and for Burning Instruments, and on the Formation of a great National Burning Apparatus.—Edinb. Phil. Journ. viii., 1823, pp. 160-169; Edinb. Roy. Soc. Trans. xi., 1831, pp. 33-72.

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268. On the Absorption of Matter by the Surfaces of Bodies.—Brit. Assoc. Rep., 1855 (Pt. 2), p. 9.
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The following are among his contributions to the *North British Review*, but it is now difficult to ascertain the nature and number of his serial productions:—

1. Flourens's *Éloge Historique de Baron Cuvier*.
2. *Pascal's Life, Writings, and Discoveries*.
3. *Lord Rosse's Reflecting Telescopes*.
4. *Eusèbe Salverte on the Occult Sciences*.
5. *Vestiges of the Natural History of Creation*.
6. *Explanations of the same*.
7. *Baron Humboldt's Kosmos*.
8. *Arago's Éloge Historique de Baron Fourier*.
9. *Murchison's Geology of Russia*.
10. *Baron Humboldt's Central Asia*.
11. *The Revelations of Astronomy*.
12. *Composition of Water*. Watt and Cavendish.
13. *Neptune*. Adams and Leverrier.
14. *Photography*.
15. *Sir John Ross's Antarctic Expedition*.
16. *On the Construction and Use of Microscopes*.
17. *Sir John Herschel's Astronomical Observations*.
18. *Mrs. Somerville's Physical Geography*.
19. *Johnston's Physical Atlas*.
20. *Rajah Brooke's Residence in Borneo*.
21. *Britton's Authorship of Junius*.
22. *Macaulay's History of England*.
23. *Layard's Nineveh and its Remains*.
24. *Railway System of Great Britain*.
25. *Baron Humboldt's Aspects of Nature*.
26. *Hugh Miller's Footprints of the Creator*.
27. *Hunt's Poetry of Science*.
28. *Tubular Bridges*. Stephenson and Fairbairn.
29. *British Association*.
30. *Sir Charles Lyell's Travels in North America*.
31. *Babbage's Exposition of 1851*.
32. *Arago's Life of Carnot*.
33. *Binocular Vision and the Stereoscope*.
34. *Prize Essays on the Peace Congress*.
35. *Search for Sir John Franklin*.
36. *Prince Albert's Industrial College*.

37. Grant's Physical Astronomy.
38. History, Properties, and Origin of the Diamond.
39. Layard's Discoveries in Nineveh and Babylon.
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42. Life and Discoveries of François Arago.
- 43. Of the Plurality of Worlds.
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50. Wilson on Colour-Blindness.
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- 63. Form and Colour. Sir J. G. Wilkinson.
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67. Martyrdom of Galileo.
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