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Source: *The Mathematical Gazette*, Vol. 10, No. 147 (Jul., 1920), pp. 119-128

Published by: The Mathematical Association

Stable URL: <http://www.jstor.org/stable/3604392>

Accessed: 17-04-2018 15:06 UTC

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## LIFE OF JAMES STIRLING, THE VENETIAN.

By CHARLES TWEEDIE, M.A., B.Sc., Carnegie Fellow.

JAMES STIRLING, who takes rank with Maclaurin and Napier among the great Scottish mathematicians, belonged to the Garden branch of the family of Stirling. The Stirling family is one of the oldest of the landed families of Scotland. They appear as proprietors of land in the twelfth century.

In 1180, during the reign of William the Lion, they acquired the estate of Cawder (Cader or Calder) in Lanarkshire, and it has been in the possession of the family ever since. Among the 64 different ways of spelling the word Stirling, as recorded in the *Family History*, a common one in these early days of the family was a variation of Striveling. In 1448 the estate of Keir in Perthshire came into the possession of a Stirling. In 1534 or 1535 the Cawder and Keir branches of the family were united by the marriage of James Striveling of Keir with Janet Striveling, heiress of Cawder. Since then the main family has been, and remains, the Stirlings of Keir and Cawder. By his second wife, Jean Chisholm, James had a family, and his second daughter Elizabeth married (1571-2) the famous inventor of Logarithms, John Napier, Baron of Merchiston (near Edinburgh), whose estates in the Menteith marched with those of the Barony of Keir. This was not the first connection by marriage between the two families, for in the old Napier residence of Wright's Houses in Edinburgh (now Gillespie's Hospital) there is preserved a stone, the armorial bearings on which record a marriage of a Napier to a Stirling (I.S.) in 1399.

In 1613, Garden \* in the parish of Kippen (Stirlingshire) first became a separate estate, being the gift of Sir Archibald Stirling of Keir to his son (Sir) John Stirling. The son of the latter, Sir Archibald Stirling, was a conspicuous Royalist in the Civil War, and was heavily fined by Cromwell; but his fortunes improved at the Restoration, and he ascended the Scottish bench with the title of Lord Garden. He succeeded to the estate of Keir, and a younger son Archibald (1651-1715) was given the Garden estate in 1668. Archibald's eventful career was one long chapter of misfortunes. Like the rest of the Stirlings he was a staunch Jacobite. In 1708, he took part in the rising known as the Gathering of the Brig of Turk. He was carried a prisoner to London, and then brought to Edinburgh, where he was tried for high treason but acquitted. He died in 1715, just about the outbreak of the Rebellion. By his first wife he had a son Archibald, who succeeded him. By his second marriage he had four sons and five daughters.

The subject of this sketch, James Stirling, the Mathematician, was the second surviving son of the second marriage. The sons were James, who died in infancy; John, who acquired the Garden estate from Archibald, 1718-9; James the Mathematician; and Charles.

The Armorial Bearings of the Garden branch of the Stirlings are:

*Shield*: Argent on a Bend azure, three Buckles or; in chief, a crescent, gules.

*Crest*: A Moor's Head in profile.

*Motto*: Gang Forward.†

## YOUTH OF STIRLING; OXFORD.

Save for the account given by Ramsay of Stirling in *Scotland and Scotsmen in the Eighteenth Century* (not always trustworthy) little is known of the early years of Stirling prior to his journey to Oxford. Ramsay, it is true, says that Stirling studied for a time at Glasgow University. This would have been quite in accordance with Stirling tradition, for those of the family who became students had invariably begun their career at Glasgow University; and the fact that Stirling was a Snell Exhibitioner at Oxford lends some

\* Pronounced Gardenne.

† Scotisé for *Allez en avant*.

It reminds one forcibly of D'Alembert's famous advice to a timid mathematician: "Allez en avant. La foi vous viendra."

colour to the statement. But there is no trace of his name in the University records.

Addison in his book on the *Snell Exhibitioners* states that "Stirling is said to have studied at the University of Glasgow, but his name does not appear in the Matriculation Album."

But from the time that he proceeds on his journey to Oxford his career can be more definitely followed though the accounts hitherto given of him require correction in several details.

Several of his letters, written at this period, have fortunately been preserved. This fact alone sufficiently indicates the esteem in which he was held by his family, and their expectation of a promising future for the lad. Letters to his parents indicate his experience on the journey to London, and his endeavour to keep down expenses. "I spent as little money on the road as I could. I could spend no less, seeing I went with such company, for they lived on the best meat and drink the road could afford. None of them came so near the price of their horses as I did, altho' they kept them 14 days here and payed every night 16 pence for the piece of them."

He reached Oxford towards the close of the year 1710. He was nominated Snell Exhibitioner on Dec. 7, 1710, and matriculated on Jan. 18, 1710-11, paying £7 caution money. On the recommendation of the Earl of Mar he was nominated Warner Exhibitioner and entered Balliol College on Nov. 27, 1711. In a letter of the same year to his father (Feb. 20, 1711) he gives some idea of his life at Oxford. "Every Thing is very dear here. My shirts coast me 14 shillings Sterling a piece, and they are so course I can hardly wear them, and I had as fit hands for buying them as I could. . . . We have a very pleasant life here as well as profiteable. We have very much to do, but there is nothing here like strickness. I was lately matriculate, and with the help of my tutor, I escaped the oaths, but with much ado."

He thus began academic life at Oxford in good spirits but as a Non-juring Student. At this period Oxford University was not conspicuous for its intellectual activity. Fellows seem to have lived lives of comfortable ease without much regard to the requirements of the students under their care. As we shall see in Stirling's case, the rules imposed upon Scholars were very loosely applied, and, naturally, complaint was made at any stringency later. At the time we speak of political questions were prominent in the thoughts of both the students and College authorities.

The University had always been faithful to the house of Stuart. It had received benefits from James I., and for a time had been, during the Civil War, the headquarters of King Charles I., whose Cavaliers it remembered with regret when the town was occupied by the Parliamentary forces and had to endure the impositions of Cromwell.

At the time of Stirling's entry the reign of Queen Anne was drawing to a close. Partisan feeling between Whigs and Tories was strong, and of all the Colleges, Balliol was most conspicuously Tory. According to Davis (*Hist. of Balliol College*) Balliol "was for the first half of the eighteenth century a stronghold of the most reactionary Toryism" and "county families anxious to place their sons in a home of sound Tory principles naturally turned to Balliol," although from 1704 to 1721 Baron the master was a stout Whig.

It is therefore abundantly clear that Stirling had every reason to be content with his political surroundings at Balliol, with what results we shall see presently.

Perhaps the best picture of the state of affairs is to be gathered from the pages of the invaluable *Diary* of T. Hearne, the antiquarian sub-librarian of the Bodleian. For Hearne all Tories were "honest men," and nothing good was ever to be found in the "vile Whigges." His outspoken Tory sentiments led to his being deprived of his office and almost of the privilege of consulting books in the library, and yet he was on familiar terms with most of the scholars of his day. Luckily for us, Jas. Stirling was one of his acquaintance, and mention of Stirling's name occurs frequently enough to enable us to form some idea of his career. Doubtless their common bond of sympathy arose from their Tory, nay, their Jacobite, principles, but it speaks well for the intellectual vigour of the younger man that he associated with a man of Hearne's scholarship. Stirling must have been a diligent

student or he could never have acquired the scholarship that bore its fruits in 1717 in the production of his *Lineae Tertii Ordinis*, which is still a recognised commentary on Newton's *Curves of the Third Order*. But he was not the sort of man to let his light stay under a bushel, and he took a leading part among the Balliol students in the student riots that were to follow.

The accession of George of Hanover to the English throne was extremely unpopular in Oxford, and Hearne relates how, on May 28, 1715, an attempt to celebrate the King's birthday was a stormy failure, while rioting on a large scale broke out next day. "The people run up and down, crying *King James the Third! The True King! No usurper!* The Duke of Ormond! etc., and healths were everywhere drunk suitable to the occasion, and every one at the same time drank to a new restauration, which I heartily wish may speedily happen, etc. . . ."

June 5. King George being informed of the proceedings of the cavaliers at Oxford on Saturday and Sunday (May 28, 29) he is very angry, and by his order Townshend, one of the Secretaries of State, hath sent rattling letters to Dr. Charlett, pro-vice-chancellor, and the Mayor. Dr. Charlett showed me his this morning. This Lord Townshend says his majesty (for so they will stile this silly usurper) hath been fully assured that the riots both nights were begun by scholars, and that scholars promoted them, and that he (Dr. Charlett) was so far from discountenancing them, that he did not endeavour in the least to suppress them. He likewise observes, that his majesty was as well informed that the other magistrates were not less remiss on these occasions. The heads have had several meetings upon this affair, and they have drawn up a programme (for they are obliged to do something) to prevent the like hereafter; and this morning very early, old Sherwin the yeoman beadle was sent to London to represent the truth of the matter."

These measures had a marked effect upon the celebration on June 10 of "King James the III'd's" birthday. Special precautions were taken to prevent riotous outbreak. "So that all honest men were obliged to drink King James's health, and to shew other tokens of loyalty, very privately in their own houses or else in their own chambers, or else out of town. For my own part I walked out of town to Foxcomb, with honest Will Fullerton, and Mr. Sterling and Mr. Eccles, all three non-juring civilians of Balliol College, and with honest Mr. John Leake, formerly of Hart Hall, and Rich. Clements (son to old Harry Clements the bookseller), he being a cavalier. We were very merry at Foxcomb, and came home between nine and ten." Several of the party were challenged on their return, but no mention is made further of Stirling.

Rioting broke out again at Oxford on August 18, in which a prominent part was taken by scholars of Balliol.

There can be little doubt that Stirling was implicated in these disturbances, though he seems to have displayed a commendable caution on the 10th of June by going out of town with a man so well known as Hearne. His own account of events is given in the following letter to his father, which is the only trace of Jacobite correspondence with Scotland that has been preserved, if it can be so termed.

"OXON, 23rd July, 1715.

SIR,

I wrote to you not long ago but I have had no letter this pretty while. The Bishop of Rochester and our Master have renewed an old quarrel; the Bishop vents his wrath on my countrymen and me in stopping the paying of our Exhibitions; it's true we ought to take Batchelours degrees by the foundation of these exhibitions, and quite them when we are of age to go into orders: Rochester stands on all those things, which his Praedeceassours use not to mind, and is resolved to keep every nicety to the rigor of the statutes, and accordingly he hath stoped our Exhibitions for a whole year, and so ows us 20 lib. apiece. He insists on knowing our ages, degrees, and wants security for our going into orders. I suppose those things may come to nought in a little while, the Bishop is no enemy to our principles. In the meantime I've borrowed money of my friends, till I'm ashamed to borrow any more. I was resolved not to trouble you while I could otherwise subsist: but now I am forced to ask about 5 lib. or what in reason you think fit to supply my

present needs : for ye little debts I have I can delay them I hope till the good humor shall take the Bishop. I doubt not to have the money one time or another, it's out out of no ill will against us that he stops it, but he expects our wanting the money will make us sollicite our Master to cringe to him which is all he wants.

No doubt you know what a generall change of the affections of the people of England the late proceedings hath occasion : the mobbs begun on the 28 of May to pull down meeting houses and Whiggs houses, and to this very day they continue doing the same, the mobb in Yorkshire and Lancashire amounted to severall thousands, and would have beat of the forces sent against them had they not been diswaded by the more prudent sort and they are now raging in Coventry and Baintry : so as the court saith the nation is just ripe for a rebellion ; etc.

Sir,

Your most dutifull Son,

J. STIRLING."

As Prof. Whittaker has informed me it was in the same year (1715) that we have the first indication of Stirling's power as a mathematician.

John Keill, of Oxford, in a letter to Newton of date Feb. 24, 1715, mentions that the problem of *orthogonal trajectories* which had been proposed by Leibniz had recently been solved by "Mr. Stirling an under-graduate here."

The statement commonly made that he was expelled from Oxford and driven to take refuge in Venice seems totally devoid of foundation. Again Hearne's *Diary* comes to our aid, and indicates that Stirling was certainly under the observation of the authorities of the government.

"1715, Dec. 30 (Fri.).

On Wednesday night last Mr. Sterling, a Scotchman of Balliol Coll. and Mr. Gery, Gentleman Commoner of the same College, were taken up by the Guard of the Souldiers now at Oxford, and not released till last night. They are both honest, non-juring Gentlemen of my acquaintance."

Also :

"1716, July 21 (Sat.).

One Mr. Sterling a non-juror of Bal. Coll. (and a Scotchman) having been prosecuted for cursing K. George (as they call the Duke of Brunswick) he was tried this Assizes at Oxford, and the Jury brought him in not guilty."

The College records bear witness to the fact of his tenure of the Snell and Warner Exhibitions down to September 1716. As S.C.L. of one year's standing on Sept. 1715, and as S.C.L. in Sept. 1716.

There is no indication, however, of his expulsion, though the last mention we have of him in Hearne's *Diary* informs us that he lost his Scholarship for refusing to "take the Oaths."

"1717, March 28 (Fri.).

Mr. Stirling of Balliol College, one of those turned out of their Scholarships upon account of the Oaths, hath the offer of a Professorship of Mathematicks in Italy, w<sup>ch</sup> he hath accepted of, and is about going thither. This Gentleman is printing a Book in the Mathematical way at the Theatre."\*

#### VENICE.

Far from being expelled, he leaves Oxford with colours flying, though, as we shall see presently, after getting to Venice he found himself compelled on religious grounds to refuse the proffered chair.

The circumstances in which he had this offer are somewhat obscure : and whether he played any part in the Leibniz-Newton controversy is not certain. In the later stages of the controversy an intermediary between Newton and Leibniz was found in the Abbé Conti (1677-1749), a noble Venetian born at Padua, who, after spending nine years as a Priest in Venice, left the church and took up residence in Paris, where he became a favourite of Society. In 1715 he proceeded to London accompanied by Montmort. The two savants received a warm welcome from Newton and other English scientists. In

\* The Sheldon Theatre, Oxford.

a letter to Brook Taylor, dated Paris 1721, Conti relates how "Mr. Newton me pria d'assembler à la Société les Ambassadeurs et les autres ministres étrangers." Conti and Nicholas Tron, the Venetian ambassador at the English court, became Fellows of the Royal Society at the same time in 1715.

How Conti came to meet Stirling is unknown to us, but he must have formed a high opinion of Stirling's ability and personal accomplishments, for Newton, in a letter quoted in Brewster's *Newton* (ii p. 308) querulously charges Conti with sending "Mr. Sterling to Italy, a person then unknown to me to be ready to defend me there, if I would have contributed to his maintenance."

The fact that Newton was a subscriber to Stirling's first venture, *The Enumeration of Cubics*, would suggest that Newton and Stirling met before Stirling had left England. This little book is dedicated to Tron, to whom Stirling acknowledges his indebtedness: and it was on the Ambassador's invitation that Stirling accompanied him to Venice with a view to a chair in one of the Universities of the Republic.

This book is sufficient evidence that he had not been idling at Oxford, and the long list of subscribers, nearly all of whom were either Fellows or Students of Oxford, bears eloquent testimony to the reputation which he had acquired in Oxford as a good mathematician.

It was printed at the Sheldon Theatre and bears the *Imprimatur*, dated April 11, 1717, of John Baron, D.D., the Vice-Chancellor of the University, and the (Whig) Master of his own College of Balliol, who was also subscriber for six copies. Forty-five of the subscribers are associated with Balliol College. Richard Rawlinson of St. John's is also a subscriber, and H. Clements, the Bookseller in London, takes six copies.

Thus Stirling leaves Oxford without a degree, but is the author of a work in Mathematics which earns him a reputation abroad. The invitation to Italy and the refusal are thus recorded in the *Rawlinson MSS.* in the Bodleian (materials collected by Dr. Richard Rawlinson for a continuation of Ward's *Athenae Oxonienses* up to 1750).

"Jacobus Stirling, e coll. Balliol, exhibit. Scot. a Snell jurament R.G. recus 1714, et in Italiam nobilem virum Nicolaum Tron Venetiarum Reipublicae ergo apud Anglos Legatum, secutus est ubi religionis causa Matheseos professorium munus sibi oblatum respuit."

The religious difficulty must have been a severe blow to Stirling's hopes and placed him in great embarrassment, for his means were of the scantiest. But adherence to the Anglican Church was one of the most important principles of the Tories, which had caused so much of their wavering for the Chevalier, who was a Catholic, and there was no getting over the difficulty for Stirling.

We need not be surprised, therefore, that he got into serious difficulties, from which he was rescued, in 1719, by the help of Newton, who thereafter, at least, had in Stirling one of his most devoted friends. Stirling's letter (1719) expressing his gratitude, is printed in Brewster's *Life of Newton*.

I have endeavoured to ascertain the university to which Stirling was called. Professor Loria has informed me that it was very probably Padua, Padua being the only University in the Republic of Venice,—the *Quartier Latin* of Venice according to Renan. It had been customary to appoint a foreigner to the chair of Mathematics. A foreigner\* held it and resigned it in 1713. It was then vacant until 1716, when Nicholas Bernoulli was appointed. Professor Favaro of Padua confirms the above, and adds that possibly some information might be gathered from the reports of the Ambassador or from the records of the *Reformatores Studii* (the patrons of chairs in a Mediæval University). To get this information it would be necessary to visit Venice.

My chief difficulty here is to reconcile the dates of Stirling's visit to Italy and the date of the vacancy. It may be added that a College for Scotch and English students still flourished at Padua about this time. But in 1719 Stirling was certainly resident in Venice, and he is known in the Family records as "The Venetian."

Life in the cultured society of Venice must otherwise have been very congenial. It was a favourite haunt of the different members of the Bernoulli

\* Hermann.

family and of Goldbach; and the earliest letter of a mathematical nature to Stirling is one in 1719 from Nich. Bernoulli, F.R.S., then Professor of Mathematics in the University of Padua. One is tempted to enquire whether Stirling did not meet Bernoulli and Goldbach when they visited Oxford together in 1712. The letter in question by N. Bernoulli specially refers to their meeting in Venice, and also conveys the good wishes of Professor Poleni, Professor of Astronomy in Padua. At this time also Riccati was resident in Venice, which he refused to leave when offered a chair outside Venice.

How long Stirling lived there after his letter to Newton was written is not known, nor is the cause of his difficulty which he does not trouble Newton with having already given an account to Desaguliers. While in Venice he sent to the Royal Society his paper on the *Methodus Differentialis*, printed in the *Philosophical Transactions* in 1719.

#### LONDON.

From 1719 to 1724 there is a gap in our information regarding Stirling. But a fragment of a letter of his to his brother, Mr. John Stirling of Garden, shows that he was at Cader in July 1724. Certainly early in 1725 he was in London, as a letter, somewhat imperfect, to Mr. John Garden informs us (London, 5th June, 1725). He was then making an effort towards "getting into business. It's not so easily done, all these things require patience and diligence at the beginning. In the meantime, that he may not be 'quite idle,' he is preparing for the press an edition of . . . \* Astronomy to which he is adding some things; but for half a year the money will not come in, and he hopes his mother will provide towards his subsistence.

"So I cannot go to the country this summer but I have changed my lodgings and am now in a French house and frequent French coffee houses in order to obtain the language which is altogether necessary. So I have given over thoughts of making a living by teaching Mathematiks, but at present I am looking out sharp for any chub I can get to support me till I can do another way. S. Isaac Newton lives a little way of in the country. I go frequently to see him, and find him extremely kind and serviceable in every thing I desire, but he is much failed and not able to do as he has done. My first way of living was expensive etc. . . . Direct your letters to be left at Forrest's Coffee House near Charing Cross."

Thus in 1725, at 32 years of age, Stirling had not yet found a settled occupation which would furnish a competency. Some time after he seems to have taken a share in Watt's Academy in Little Tower Street (in which Thomson, the poet, wrote part of "The Seasons" while attached as a tutor in 1726). It was to this address for the next ten years that the letters to Stirling (that have been preserved) from contemporary mathematicians were directed.

They form part of a larger collection that was lost by fire. Those that were saved nearly went astray altogether in the nineteenth century, through the carelessness of Sir John Leslie of Edinburgh University, for whom they had been obtained by Professor Wallace. They were returned only after the death of Leslie by his executors.

There are also a few letters to his friends in Scotland, and from these we can gather a certain amount of information. In the earlier days of his struggle in London he had to depend upon his relatives for assistance, but as his affairs improved he showed as great, or greater, generosity in return. By 1729, he could look forward with confidence to the future, for by that time he was able to wipe off his indebtedness in connection with his installation in the Academy, as the following extracts show.

In April 1728 in a letter to his mother he writes: "I had 100 lib to pay down here when I came first to this Academy and now have 70 Lib more, all this for instruments, and besides the expences I was at in fitting up apartments for my former project still ly over my head."

Again on 22nd July, 1729, he writes: "Besides with what money I am to pay next Michaelmas I shall have paid about 250 Lib. since I came to this

\* The name is torn out.

house, for my share of the Instruments after which time I shall be in a way of saving, for I find my business brings in about 200 L. a year, and is rather increasing, and 60 or 70 L. serves me for cloaths and pocket money. I designed to have spent some time this summer among you, but on second thoughts I choose to publish some papers during my Leisure time which have long lain by me. But I intend to execute my design in seeing you next summer, if I find that my affairs will permit."

He had always a warm side for his friends in Scotland, and his letters to them are written in a bright and cheerful style. The reference to Newton is the only one he makes regarding his friends at the Royal Society, and the "papers" he speaks of publishing are almost certainly his well known Treatise the *Methodus Differentialis* (1730), the first part of which he had drawn up some 8 or 9 years before (v. Letter to Cramer).

He was admitted to the Royal Society in 1726, a distinction that put him on an equal footing with the Scientists that lived in, or frequented, London. It is most probable that his acquaintance with Maclaurin began at this time. They were both intimate friends of Newton and fervent admirers of his genius, and both eagerly followed in his foot-steps. The correspondence between them begins in 1728 when Maclaurin and Stirling had taken an interest in G. Campbell, with whom Maclaurin was to have such an unfortunate dispute.

Maclaurin placed great reliance upon Stirling's judgment, and frequently consulted him while his *Treatise of Fluxions* was in the press. The later letters that passed between Stirling and Maclaurin have much to do with their researches upon the Figure of the Earth and upon the Theory of Attraction.

In 1738, Stirling, at Maclaurin's special request, joined the Edinburgh Philosophical Society, which Maclaurin had been so instrumental in founding in 1737. Maclaurin also begged for a contribution, but if Stirling gave a paper to the Society it has not been preserved and printed.

In 1727, Gabriel Cramer, Professor of Mathematics at Geneva, received a kindly welcome from the Royal Society on his visit to London. He formed a warm friendship for Stirling, who was his senior by about twelve years, and several of his letters to Stirling are preserved. A copy of a letter to him from Stirling has been preserved and furnishes interesting information regarding Stirling's own views of the *Methodus Differentialis* which appeared in 1730, and also regarding the date at which the Supplement to De Moivre's *Miscellanea Analytica* was printed. Stirling had sent two copies of his work to Cramer, one of the copies being for Nich. Bernoulli, by this time Professor of Law at Bâle. Letters from Bernoulli to Stirling were sent through the hands of Cramer, who thus obtained the benefit of the correspondence as well. There are a few letters from N. Bernoulli, the last bearing the date 1733. In this letter, while pointing out Errata in Stirling's book of 1717, Bernoulli observes the omission made by both Stirling and Newton of a species of a Cubic. In Newton's enumeration 72 species are given. Stirling in his little work of 1717 added four more. But there were still two more species, one of which was noted by Nicol in 1731. The discovery of the remaining one announced by Bernoulli in 1733 gives Bernoulli precedence over Stone's discovery of it in 1736. Murdoch in his *Newtoni Genesis Curvarum per Umbras* mentions that Cramer had told him of Bernoulli's discovery, but does not give a date. The letter to Stirling not only confirms Cramer's statement, but its date gives Bernoulli undoubted precedence over Stone.

About this time Stirling's life must have been one of considerable comfort, as his business was prosperous, while he was an active member of the Royal Society where his opinions carried weight.

He was not a prolific writer, and what he did write was usually devoid of any needless verbiage. After the publication of his book in 1730 he turned his attention more particularly to the study of the Figure of the Earth, regarding which there was considerable discussion, there being two theories, (1) that of Newton that the Earth was flatter at the Pole than at the Equator, and (2) the theory of the Cassinis, who held exactly the opposite view. Stirling wrote for the *Philosophical Transactions* a short but important note on the subject which led Clairaut to seek correspondence with Stirling after the publication of a paper in the *Philosophical Transactions* on the same subject in which he had come to similar conclusions.



Euler's correspondence with Stirling is of a later date (1736-38), and has already been referred to by me in the *Mathematical Gazette*.

The last of the letters of a scientific character is one in 1747, in which Folkes, P.R.S., informs Stirling that he (Stirling) has been made a member of the Prussian Academy. It contains an interesting reference to the aged De Moivre.

#### RETURN TO SCOTLAND.

In 1735, a great change occurred in his fortunes by his appointment to the Managership of the Lead Hills Mines in Scotland, and from 1735 onwards we may follow his career with more certainty, there being fairly full records of the part he played in Scotland, in which, in the opinion of some, he eclipsed his earlier fame as a scholar by the skill of the administrative ability he displayed in his control of the mines.

From this point on we have much more definite information regarding Stirling's life. In particular, he is taken as one of the best types of the Scotchmen of his day by Ramsay in his *Scotland and Scotsmen*. Ramsay met him frequently when Stirling was on visits to his relatives at Keir and elsewhere, and had a profound regard for the courtly and genial society of Stirling. Stirling had had a wide experience of the world from the academic atmosphere of Oxford with its political strife, and the scholarly life in Venice, where he made numerous friends among the Italian *savants*, to his life in London and the scientific associations of the Royal Society. He had thus acquired a deep insight into human character, and he was a *persona grata* in the best society of Scotland. Ramsay narrates a number of anecdotes illustrating the kindly humour of Stirling.

Before Stirling left Venice he had, at the request of certain London merchants obtained information regarding the manufacture of plate glass. Indeed, it is asserted by some that he had to flee from Venice for fear of assassination for his discovery, though Ramsay makes no mention of it. In London, on his return, this paved the way for an acquaintance with a number of merchants, who formed a high opinion of his abilities and led to his selection as Manager of the Lead Hills Mines for the Scots Mining Coy. about 1735. This Company had been founded some twenty years before by Sir John Erskine of Alva. Most of the capital came from London merchants associated with the Sun Fire Office. The Company had for its object the development of the metal mining in Scotland. They had taken various leases in different parts of the country, but these were all given up with the exception of the lease of the Lead Hills Mines, the property of the Hopetoun family, which had been worked for more than a century. The manager for them was Sir John himself, but though he was a man of genius, he failed in the business capacity to put his ideas into practice on a remunerative footing, and, when Stirling was appointed, the affairs of the Company were at a low ebb. The appointment, though a strange one, was fully justified by its success.

For the first year or two Stirling only resided at the mines for a few weeks to arrange matters with the miners, but about 1736 he took up definite residence, devoting his energies entirely to the interests of the Company.

Bit by bit the debts which had accumulated in his predecessor's time were cleared off, and the mines became a source of profit to the shareholders.

We find him in his letters to Maclaurin, with whom he still frequently corresponded, complaining that he had no time to devote to their researches, and often writes in haste; and, when writing to Euler, he tells Euler that he is so much engrossed in business that he finds difficulty in concentrating his thoughts on Mathematical Subjects in the little time at his disposal.

The village in which he and the miners resided was a bleak spot in bare moorland, nearly 1300 feet above sea level. There was no road to it, hardly even a track, and provisions and garden produce had to be sent from Edinburgh and Leith. In spite of these disadvantages Stirling has left indelible traces of his wise government of the mines and the miners, and many of the improvements have a wonderful smack of modernity.

The miners at the time of his appointment were a rough disreputable set of men, who had good wages but few of the comforts of life. Stirling's first care was to add to these comforts and to lead them by wise regulations to attend to their own physical and mental requirements.

In the first place he grouped the men in four classes: (1) Miners proper, each older miner being allowed an apprentice at his own cost and profit; (2) Labourers; (3) Washers, with boys under them; (4) Smelters.

The men worked in shifts of six hours, so that with a six hours' day they had ample time at their disposal if they wished. By a system of payment by results the men were willing to do their best to promote production.

In order to turn their leisure to profit Stirling took advantage of a clause in the lease which allowed the Company to provide the miners with suitable gardens. Thus a miner could trench and plant practically as much land as he found it possible for him to work, there being no statement as to the size of the "allotment." Under careful cultivation the gardens or crofts produced fair crops, and assumed a value in which the miner himself had a special claim, so much so that he could sell his right to the ground to another miner without any interference being feared from the proprietor. Stirling thus stimulated the industry and economy of the miners, while at the same time furnishing them with a restful and healthy relaxation from their underground toil.

The miners were also subject to a system of rules which were drawn up for their guidance, and by which disputes could be amicably settled. They had to make contributions towards provision for their sick and aged,—in other words, they formed an Insurance Society.

For their mental improvement he instituted, doubtless with the help of Allan Ramsay, who was a native of the place, a library, to the upkeep of which each miner had to make a small subscription. He is thus an early precursor of Carnegie in the foundation of this—one of the first free libraries. When Ramsay of Ochertyre visited it in 1790, it contained several hundred volumes in the various departments of literature, and it still exists as a specimen of Stirling's provision for the men under his care.

Stirling's own requirements, on the other hand, were well provided for by the Company, whose affairs were so prosperous under his management. They saw to it that he was well housed. They more than once filled his cellar with wine, while the salary he obtained enabled him to amass what he considered a considerable competency. When he began to fail with the increase of years they supplied him with a carriage.

#### THE REBELLION OF 1745.

Stirling does not appear to have taken any part in the rebellion of 1745. His Uncle and Cousin of Keir were kept out of it by their apprehension and imprisonment. It may be questioned whether he was still a Jacobite: for in London he was one of the brilliant coterie that surrounded Bolingbroke on the return of the latter from exile, and if he at all shared the politician's opinions he would realise that a Stuart restoration was hopeless. (Stirling most esteemed Berkeley of all the men in this set.)

If I recollect aright, Carlyle in his *Autobiography* relates that, on the death of Maclaurin in 1746, he was spoken of as a likely successor, only the feeling against anyone connected with the Jacobites was too strong to admit of his nomination.

In 1754 he demitted his fellowship of the Royal Society.

#### THE GLASGOW KETTLE.

A new sphere for Stirling's activities arose in connection with the development of the city of Glasgow.

Towards the middle of the eighteenth century the trade of the city with the West Indies had undergone enormous expansion, and great sums were spent in improving the River and Harbour. A separate account was kept of these expenses, and the first item of the Ledger is dated 1st July, 1752, and runs thus:

"Paid for a compliment made by the Town to James Stirling, Mathematician, for his service, pains, and trouble, in surveying the River towards deepening by locks, viz.:

For a silver Tea Kettle and Lamp weighing 66½ oz.	
At 8s. per oz.	£26 10 0
For Chasing and Engraving the Town's arms	1 14 4
	<u>£28 4 4</u>

Apparently Stirling had given his services gratuitously. The Kettle is still at Garden, and on festive occasions the City rejoices to exhibit it in memory of its gratitude to Stirling for his services.

By his marriage with Barbara Watson, daughter of Watson of Thirty Acres near Stirling, he had one daughter Christian, who married her cousin, Archibald of Garden, Stirling's successor as manager of the Lead Hills Mines. The estate of Garden is in the possession of their descendants.

Stirling died in Edinburgh in 1770, and he lies buried in Greyfriars Churchyard, where his friend Maclaurin had long before him been laid to rest. (It also contains the tomb of Matthew Stewart, Maclaurin's successor.) The spot where he is buried cannot be difficult to locate, for the Register Records describe it somewhat grimly as "Twa corpse-lengths west of Laing's Tomb," Laing's tomb being a large mural monument (1614) on the wall to the right on entering the Churchyard.

Thus closed a career filled with early romantic adventure and brilliant academic distinction, followed in later years by as marked success in the industrial field. As a Mathematician, Stirling is still a living power, and, in recent years, there has sprung up, more particularly in Scandinavian countries, quite a Stirling cult. His is a record of successful achievement of which any family might well be proud.

*Note.*—In obtaining information regarding the life of Stirling I have had the kind assistance of many friends and correspondents. I am particularly indebted to Mr. Henry Barker of Edinburgh University; Professor Gibson, Glasgow; Mr. Pickard-Cambridge of Balliol College; and Mr. F. Madon of the Bodleian Library, Oxford. C. T.

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