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JOSEPH BLACK AND SOME ASPECTS OF MEDICINE IN THE EIGHTEENTH CENTURY

THE year 1728 is a notable one in the annals of British medicine, for during it were born two men who later made outstanding contributions to the advancement of medicine and natural science.

The story of the life and work of John Hunter has been recounted in detail by successive generations of Hunterian orators and is well known, but the personality and achievements of Joseph Black are less familiar. Hunter did not make any great discovery, but he took surgery out of the hands of the barber-surgeons and elevated it from a craft to a science. Black made fundamental discoveries in chemistry and physics, opening up vast fields for further exploration in those subjects and laying one of the foundation stones in the building of modern physiology. Both had the experimental outlook and an abhorrence of scholastic dogmatism. Both were great teachers and had the gift of stimulating enthusiasm and affection in their pupils, so that they left after them a band of workers to follow up and extend their observations. These great contemporaries lived through almost three-quarters of the eighteenth century. John Hunter died in 1793 and Joseph Black six years later.

Black has been written about mostly by Scotsmen, who have claimed him for their own. Admittedly the roots were in Scotland but there is no doubt that the tree flourished in Ulster. The family probably came to Ulster from the Scottish Lowlands at the time of the plantation of James I. The earliest authentic record is of a John Black, born in the neighbourhood of Ballymena. He was Joseph's great-grandfather and served as a trooper against Cromwell. Joseph's grand-father was "educated a merchant" by Mr. Pottinger in Belfast and served as supercargo in the West Indies and in various ports of Spain, France, and the Low Countries. The supercargo's son, John, was born in Belfast and received a good classical education at Ayr and in his



native town. He was apprenticed to an uncle, Sir John Eccles, in Dublin, and later settled in Bordeaux in the wine trade. He married an Aberdeen lady, Margaret Gordon, whose family were also settled in Bordeaux in the mercantile line. They had thirteen children, of whom Joseph was the ninth.

John Black was a cultured man and a close friend of the philosopher Montesquieu, who derived much of his knowledge of our constitutional government from the British colony in Bordeaux. Later he returned home to Ulster, settling on a model farm at Ballintaggart in County Armagh, and died at his son George's residence at Castle Place, Belfast, in 1767, having attained the ripe age of eighty-six years.

Joseph's brothers appear to have been successful manufacturers and merchants, and two of them, George and Samuel, were each five times Sovereign of Belfast between the years 1775 and 1789. Another brother, Alexander, had a plate-glass factory at Blackfriar's Bridge, London. There are extant in the Belfast Museum and Art Gallery nine letters from Joseph Black to this brother in London. They are written in a graceful and legible hand, and the phraseology and spelling are modern. Some of these

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letters, among others, will be referred to later, as they help in the revelation of his personality.

Joseph received his primary education from his mother, who taught all her children to read English, there being no school for the purpose in Bordeaux. At the age of twelve he was sent to live with relations in Belfast to acquire the rudiments of Latin and Greek. His biographer, John Robison, says that he was educated at the local grammar school, and Black himself says that he attended a private school. It is most probable that he attended the Latin school, a foundation by the first Earl of Donegall shortly after the Restoration. Unfortunately the records of the school are not available. It was situated in the rear of the old parish church in High Street, in the corner of the churchyard facing Catherine Street and School Lane, now known as Ann Street and Church Lane respectively. The school existed for about 125 years and was probably closed after the old parish church was demolished in 1774. The area of ground on which it stood is now an open space as a result of the air raids in 1941.

After four years in Belfast Joseph was sent to the University of Glasgow, where his entry as a matriculated student is recorded on 14th November, 1746. It runs, "Josephus Black filius natu quartus Johannis Black Mercatoris in urbe Bordeaux in Gallia, ex urbe de Belfast in Hibernia."

The advent of the eighteenth century heralded an era of prosperity for the Lowlands of Scotland. Agriculture flourished and new industries were established. The political scene was tranquil, for the Lowlands had held aloof from the rising of '45 and had reaffirmed their loyalty to the House of Hanover as soon as Prince Charles Edward had marched south of the Border. The Jacobite cause had received its death-blow on Culloden Moor six months before Joseph Black entered the University of Glasgow.

At the time of the Union Glasgow had been a country town of 18,500 people, an outpost against the lawlessness of the Highlands. By the end of the century it had attained a population of 80,000 and was a flourishing centre of commerce and trans-Atlantic trade. With increasing material prosperity the narrow outlook and frugal habits of the old Covenanting citizens were discarded for more liberal ways. Nor were the things of the intellect forgotten, and the presence and writings of such men as Adam Smith brought fame to Glasgow's university.

The "old College," as the university was then called, fronted the long and narrow High Street, the central portion of the building being the Senate Hall. At either side of the main building were the

professors' houses, which faced the college green or quadrangle, and had in addition a back entrance from the street. The general architecture of the town was mean and irregular. The upper stories of the houses, with gable-ends towards the street, were entered by outside staircases, and in the triangular space between these and the houses the citizens were accustomed to keep pigs. The condition of the streets and the unsavoury atmosphere must have resembled those of a western Irish town on a fair day.

In a note about his studies Black says:—

"I attended all the lectures on the languages and philosophy in a regular succession. Being then required by my father to choose a profession or employment, I chose that of medicine, the elements of which I began immediately to study by attending the lectures of the Professor of Anatomy and of Dr. Cullen, who was at that time Professor of Medicine at Glasgow. Dr. Cullen began also at this time to give lectures on chemistry, which had never before been taught in the University of Glasgow, and finding that I might be useful to him in that undertaking, he employed me as his assistant in the laboratory, and treated me with the same confidence and friendship and direction in my studies as if I had been one of his own children. In this situation I lived three years."

The Dr. Cullen referred to in this note was William Cullen, who, after the great Boerhaave of Leyden, was the most successful clinical teacher of the time. A native of Lanarkshire, he had practised there for a time in partnership with William Hunter. Later he came to Glasgow and acquired a large practice. He was appointed Professor of Medicine and Chemistry in the University. A fluent speaker, he was the first to deliver lectures in the vernacular instead of in Latin. A close friendship, which was maintained throughout their lives, grew up between Cullen and Black, and later when Cullen had occupied the chair of chemistry in Edinburgh for some time, he resigned it in favour of Black. In Edinburgh Cullen held the posts of Professor of the Practice of Medicine and of the Institutes of Medicine, or, as this would now be called, Physiology. His portrait suggests a serene and kindly disposition, and it is said that his gifts of infinite patience and unruffled temper added to his success.

In 1750 Joseph Black transferred to Edinburgh to complete his medical studies. He took up residence with his cousin, James Russell, Professor of Natural Philosophy, who was also engaged in the practice of surgery. One of his contemporaries in the medical school was Oliver Goldsmith, whose biographer states that he was fond of chemistry and was remembered

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favourably by the celebrated Black.

Some impressions of a medical student's life in Edinburgh in the eighteenth century are recorded by William Drennan, the Belfast physician and United Irishman, in letters to his sister in Belfast. He writes as follows in November, 1777:—

"I have fixed on the classes necessary for me to attend. I rise a little after six in the morning. I strike my flint, blow my tinder, and light my match; and after preparing for my classes, at about 8 o'clock, if it be a good morning, I give stretch to my legs for half an hour in the meadow which lies near my lodging — when I return I take my academical breakfast of bread and milk and then issue out to the labours of the day. From nine till one I am tossed about with the wind of doctrine through the different parts of the university; from 9 till 10 at the practice; from 10 to 11 at chemistry, my second attendance at both; from 11 till 12 at the *Materia Medica*; from 12 till 1 at the infirmary from which I derive much more benefit than when last here. Yet still it is a disagreeable place to me, and I never enter it without thinking of those lines of Milton—

'Despair

Tended the sick, busiest from couch to couch,
And over them triumphant Death his dart
Shook, but delayed to strike.'

From one until three I make it a rule to walk and chew the cud of what I have heard, and either soar to the sublime Calton, where as Johnson expresses it, I can see the dusty world look dim below or pace along with my fellow-mortals in the meadow or the park."

Concerning the status of the medical student he writes:—

"It is greatly the fashion here to despise the students. A student of medicine is a term of contempt, but an *Irish* student of medicine is the very highest complication of disgrace."

The examination for the Doctorate comprised a thesis written in Latin and three viva voce examinations also conducted in that language. There do not appear to have been any clinical or practical tests. Drennan says that "the students generally apply to a fellow in this university, one Brown, who spawns young physicians and surgeons, in order to speak Latin, and get a thesis written by his instructions." Evidently the examiners did not favour this procedure, for Drennan had to repudiate before the Faculty Dr. Gregory's insinuation that his thesis was written by Mr. Brown. Drennan remarks:— "If he (i.e., Dr. Gregory) had known the Irish spirit better he would have known that it was incapable of submitting in such a manner to any Scotchman upon earth."

Black says that he attended the lectures of Dr. Munro, Senior, and the other medical professors in Edinburgh. The Doctor Munro referred to here was Alexander Munro, the first of the so-called Munro Dynasty. For three generations and over a period of 126 years they taught anatomy in Edinburgh. All three had the Christian name Alexander and were distinguished as Primus, Secundus and Tertius. Alexander Munro Primus had studied under Boerhaave and was a distinguished teacher in anatomy and also in surgery, in which he had a large practice. Munro Secundus, in spite of the handicap of a brilliant parent, was even more famous as an anatomist. It was he who described the foramen of Munro. Munro Tertius appears to have been rather indolent and under him the teaching of anatomy languished. It is recorded that he read his grandfather's lectures verbatim, even retaining such phrases as:— "When I was a student at Leyden in 1719."

The years of student life drew to a close and Black presented his thesis, for which, it is needless to say, he did not require the assistance of any "Mr. Brown." On 1st June, 1754, he writes to his father:—

"I am not yet installed into the order of the great wig, but have gone through all the examinations, and nothing is wanting but the ceremony and that has been put off by the Professors to wait for some others that are to be promoted along with me six days hence.

"In my last letter to you I proposed to go immediately to London to spend some time in the Hospitals there. I am now advised to put that off and remain here yet a while longer; and I must own the reasons for it are very strong and quite unanswerable by me unless you disapprove of them. The following are the chief of them. I have now studied the Theory of Medicine and have likewise been taught everything upon the Practice which can be learned in a College. I have also seen some real Practice and have even practised a little myself. But all this is not enough. I should be thoroughly acquainted with the real Practice and this is a thing very different from what can be learned in a College; thus, for instance, we are taught by our Professors that if a sick person breaths with great difficulty, one thing must be done; if his respiration is yet more laborious, another. But how shall we judge of the nice degrees of laborious breathing unless from a dayly and familiar acquaintance with, and study of the appearances and looks of Patients. Most young Physicians neglect this essential part of their art in their education and very often acquire it when they come to Practice at the expense of their Patients' safety. I have not had time

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this last winter to apply to it sufficiently; tho I had the opportunities, my attention was too much taken up with some of the Colleges, preparing my Thesis and recalling to my mind everything I had learned, on account of the examinations. If I go to London to acquire this part of medicine, I may see a good deal of Practice, but I am a stranger there, and have no acquaintance whom I can venture to trust so much or be so familiar with as to trouble him with all my questions and doubts. On the contrary here, medicine is allowed on all hands to be in a very flourishing condition. It is practised in the most rational and simple manner. I have the happiness to be lodged with a Gentleman, who is justly esteemed by all his Brethren, who has extensive Practice both as a Physician and Surgeon and, tho no Doctor himself, yet the oldest of them are not ashamed to consult with him in private. Besides this he is my intimate and familiar friend and is willing upon every occasion to teach me as far as he knows himself.

“When I am well instructed in a method of Practice here, a very short time in London will be sufficient; for then I need only observe the different manner of doing the same thing there, which I shall soon be master of.”

Even in the eighteenth century it would seem that the Edinburgh doctor had a staunch loyalty to his school and did not concede pre-eminence to any other place.

The title of Black's thesis was “*De humore acido a cibis orto et de Magnesia*” (Concerning the origin of the acid liquid from foods and magnesia.) It does not, as the title might suggest, conceal a lost solution of the problem of peptic ulceration, but deals with the subject of renal and vesical calculi.

The surgical operation of lithotomy was an unpleasant ordeal, even though it could be performed by such an expert as William Cheselden in one minute, and a treatment which obviated it would be welcomed by the patient. So a search was in progress for what were called lithonotryptic drugs. Hitherto the substances employed had been the strong alkalis, the lye of the soap-boilers, and it is not to be wondered at that surgeons sought a less necrosing liquid. Robert Whytt, a professor of medicine in Edinburgh, attempted to dissolve bladder stones by injecting into the bladder a mixture of lime water and soap.

Interest in the subject had been stimulated some years previously by the statements of Sir Robert Walpole and his brother, Horace, who suffered from “the stone” and claimed to have received benefit from a medicine invented by a Mrs. Joanna Stephens. For a

consideration of £5,000 Mrs. Stephens revealed her secret, and the details of her treatment were published in the “London Gazette” of 19th June, 1739, as follows :—

“My Medicines are a Powder, a Decoction and Pills. The powder consists of egg shells and snails, both calcined. The decoction is made by boiling some herbs (together with a Ball, which consists of Soap, Swines-cresses, burnt to a blackness, and honey) in water. The Pills consist of Snails calcined, Wild Carrot seeds, Burdock Seeds, Ashen Keys, Hips and Hawes, all burnt to a blackness, Soap and Honey.”

Naturally the profession did not approve of this gross polypharmacy and during Black's student days there was much discussion on the subject.

Black's research began in an attempt to produce a milder alkali from Epsom salts. His classical experiments are well known and will only be described briefly. He commenced by studying the different forms of lime. Limestone, when heated in a fire, became activated, and this quicklime, when placed in water, generated much heat, and was transformed into slaked lime. The limestone was supposed to have absorbed phlogiston from the fire and later to have lost it to the water. Black heated a weighed quantity of marble and found that in the process it lost weight, thus giving the first blow to the phlogiston theory. He next showed that if slaked lime be treated with a mild alkali, such as sodium carbonate, it is changed again to chalk, while the mild alkali becomes caustic alkali.

In modern nomenclature the changes are : —

1. $\text{CaCO}_3 = \text{CaO} + \text{CO}_2$.
2. $\text{CaO} + \text{H}_2\text{O} = \text{Ca}(\text{OH})_2$.
3. $\text{Ca}(\text{OH})_2 + \text{Na}_2\text{CO}_3 = \text{CaCO}_3 + 2 \text{NaOH}$.

Black realized that when chalk or marble was heated, a gas which he called fixed air was released. He was able to collect the gas, which we know as carbon dioxide, and to study its properties. He was also able to show that carbon dioxide was a normal constituent of the air because quicklime was changed into ordinary chalk, albeit tardily, by exposure to air. This was the first atmospheric gas to be isolated and described. The discovery heralded the dawn of a new era in chemical investigation, and so Black is often given the title — Father of Pneumatic Chemistry.

Much of Black's success was due to his accuracy in weighing. The experiments quoted are the first example of a reversible chemical reaction. A certain weight of chalk is taken in experiment 1 and the same weight is recovered at the end of experiment 3. In the words of Sir William Ramsay, “his proof that the change of a complex compound to simpler

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compounds, and the building up of a complex compound from simpler ones, can be followed successfully by the use of the balance, has had for its consequence the whole development of chemistry." On this score he has been called the Father of Quantitative Chemistry.

Truly, Joseph Black's thesis has a strong claim to be the most important ever presented for a doctorate in medicine.

Its contents were made known more widely a year or so later, when it was read in English before the Philosophical Society of Edinburgh under the title:— "Experiments on Magnesia, Quicklime, and other Alkaline Substances." Henry Brougham described this paper as "incontestably the most beautiful example of strict inductive investigation since the 'Optics' of Sir Isaac Newton."

Surely here is a story as romantic as any in the history of science. To alleviate a distressing ailment investigations are undertaken and lead to a discovery in pure science, apparently remote from the original plan. Some would say that this was a gift from medicine to chemistry. Does it not rather illustrate the indivisible unity of all scientific endeavour, and was not the "gift" repaid later with interest in the elucidation of those "nice degrees of laborious breathing" about which the young doctor had written to his father?

As regards his discovery Black was fortunate in another respect. There was none to claim priority. There was, however, a great deal of opposition to his views, especially from the German schools, and Black spent several years in refuting their arguments. The phlogiston theory did not die easily. He considered his experiments a complete expression of his opinions and did not make any others. It was not till 1767 that a Viennese chemist, Jacquin, performed the simple experiment of passing the gas expelled from heated marble into lime water, thus transforming the lime to chalk again. This finally silenced the critics.

After receiving his doctorate in medicine Black appears to have practised his profession in Edinburgh for two years. At the end of this period his old teacher and friend, William Cullen, was invited to take the chair of chemistry in Edinburgh, and Black was offered the chair of anatomy and a lectureship in chemistry at Glasgow. He was diffident about his ability to teach the former subject and soon effected an exchange of the chair for that of the Institutes of Medicine. His biographer, John Robison, who succeeded Black as Professor of Chemistry in the University of Glasgow and who edited his lectures in chemistry, says there are no remains of his medical

lectures to be found among his papers. He followed a celebrated lecturer, who, Robison says, had exhibited "brilliant prospects of systematic knowledge" to his students. Black, however, kept on the firm ground of established principles, declining to travel with the systematists in their attempts to form an all-comprehending doctrine. Robison says that it does not appear that he ever satisfied himself with his method of treating those subjects and he did not encourage conversation on them. He would have been at one with another distinguished Ulsterman and Honorary Fellow of this Society, Sir Almroth Wright, who some thirty years ago in this room impressed on his hearers that medicine must advance by *passus scientificus* and not by *saltus empiricus*.

Apart from his work at the University Black practised as a physician in Glasgow and its environs. He took his practice seriously and was always anxious about his patients' welfare. Robison says, "He was in particular a favourite with the ladies. I could not but remark that they regarded themselves as honoured by the attentions of Dr. Black; for these were not indiscriminately bestowed, but exclusively paid to those who evinced a superiority in mental accomplishments, or propriety of demeanour, and in grace and elegance of manners." However, he remained unmarried all his days, perhaps a mild disappointment to his father, who wrote later on:— "As for our Hippocratic Joseph his affections are about Edinburgh and absorbed in his dear Mistress Philosophical Enquiry as an alchemist."

It was in Glasgow that Joseph Black established a firm friendship with the philosopher Adam Smith, famous for his "Enquiry into the Nature and Causes of the Wealth of Nations." The friendship lasted throughout their lives. Each recognised certain sterling qualities in the other, and an oft-quoted saying of Adam Smith was "that no man had less nonsense in his head than Joseph Black."

During this period Black conducted the other piece of research for which he is famous — the enquiry into the nature of heat. He had been attracted to the problem by an observation of Cullen that ether boiled when the atmospheric pressure was lowered. Cullen had merely recorded the phenomenon and had not offered an explanation. In a series of simple and conclusive experiments Black discovered the property, which he named "latent heat" in solids and liquids. He investigated especially the changes in heat distribution during the transition of ice to water and of water to steam.

In these researches he had the assistance of a rather remarkable young man who was employed as a

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technician at the university. His name was James Watt. A delicate child, Watt had not received an ordinary school education, but from early childhood he had shown evidence of mathematical genius. The story is told that one day a visitor, calling at his father's home, found young James, aged six years, sprawling on the floor on which he had drawn many intersecting chalk lines. The visitor reproached the father for allowing his son so to waste his time, when he should have been at school, but had to recant the hasty judgment on receiving the explanation that the boy was solving an abstruse problem in geometry.

Watt was employed at the university as a maker of instruments of precision and it was part of his duty to set up the apparatus for experiments in the class of Natural Philosophy. The department possessed a model of a primitive form of steam engine, Newcomen's, which was used for demonstration to the class. It went out of order and was given to Watt to repair. He investigated the machine thoroughly and noted its defects. He was aware of Dr. Black's researches into heat, saw the possible applications to his own problem and entered into collaboration with the professor. The association was a very happy one, and in his lectures Black never failed to acknowledge the help he had received from Watt. The latter applied the results of their joint experiments to the design of his condenser, which was his main contribution to the improvement of the steam engine. Black, the most selfless of men, derived as much pleasure from the young technician's subsequent success and prosperity as if they had been his own. Robison says of Watt's engine, "Its immense superiority, in respect of power and economy, offered to the busy part of society a most certain and powerful first mover for all machinery; and thus attracted the attention of all those engaged in the great business of making money. It was this, more than all the love of knowledge, so boldly claimed by the eighteenth century, that spread the knowledge of the doctrine of latent heat and the name of Dr. Black."

In the year 1766 William Cullen transferred from the chair of chemistry in the University of Edinburgh to that of medicine, and Black was appointed to succeed him.

On returning to Edinburgh he found the lines were fallen to him in pleasant places. The old city had recovered from the depression of the early years of the century, when by the Act of Union, she had been deprived of the chief function of a capital, government. Those were dark days, when men said the glory had departed. Grass grew between the cobblestones of the Royal Mile. Yet by the

mid-century all this was changed, for Edinburgh had experienced an intellectual revival which had placed her in the van of European culture. Her philosophers and the great teachers of her medical school were known all over the civilised world. It was said that you could stand at the Mercat Cross of Edinburgh and, within an hour, shake by the hand fifty men of genius.

Black was welcomed into this select company, which included his old friend, Adam Smith. However, his closest friend from henceforth was to be James Hutton, the geologist, whose work, "The Theory of the Earth," revolutionized the study of geology and laid the foundations of modern views on the subject. Two years Black's senior, he had been first of all a law student but changed to medicine, graduating at Leyden in 1749. Seldom did a day pass without these friends meeting. Though alike in their love of scientific accuracy and adherence to fact, Hutton's jovial temperament was a foil for Black's seriousness. Hutton was now the only person near him to whom Black communicated his views on scientific matters, though he carried on a regular correspondence in such with his friend Watt, who at this time was living in Birmingham.

To digress, it seems strange to us now that so many men of science in the eighteenth century were primarily doctors of medicine. In those days medicine was the main gateway to all branches of natural science. In Black's time at Glasgow all the chairs in these subjects, as well as that in mathematics, were held by graduates in medicine.

After his return to Edinburgh Black did not engage in any further serious research work. There were two reasons for this. First, he considered that his primary duty was to instruct the large number of students whom the growing reputation of the Edinburgh medical school now brought to his classes. The general standard of their education was low, and the lecturer had perforce to present his subject in a simple and direct manner. He scorned the tricks of the showman, and, in spite of difficulties, became a favourite lecturer. Robison says of his students, "They were not only instructed but (they knew now how) pleased."

As the years passed he was fond of relating to his classes his early difficulties and how they were overcome. His labour was not in vain, for he trained many who later rose to eminence in the scientific world. One of his pupils, Daniel Rutherford, was the discoverer of nitrogen. It is interesting to note that Rutherford had a nephew who is even better known, Sir Walter Scott.

In the correspondence columns of our medical

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journals we are still treated occasionally to discussions on the relative importance of art and science in medicine. In the eighteenth century many thinkers did not rank chemistry as a science but regarded it as an offspring of the art of pharmacy. In his introductory lecture on the "Definition of Chemistry" Black states his opinion on the subject simply and adduces the practice of medicine as an illustration. He says: "The physician who only practises what he has learned, treats his patients as we say *secundum artem*, and gives himself no further trouble, should be reckoned an artist; but when he bestows uncommon attention and study upon the diseases he has occasion to treat, endeavours to understand them better than ordinary, or to improve the method of curing them, he, in so far, is certainly one of the most useful philosophers – a medical philosopher." Black applied the term "philosopher" to "any man who endeavours to acquire knowledge, or thinks and reasons upon any useful subject." For him a plain farmer, if he studied the construction of his plough and attempted to improve its function, had more title to be called a philosopher than many men of great learning who never proposed a new thought of their own.

The second reason for Black's failure to prosecute his researches was the state of his health. Never robust, the long hours in his laboratory and the mental exertion involved tended to induce febrile illness often accompanied by haemoptysis, and this haemoptysis was severe on more than one occasion.

At this time the university buildings were in a state of decay. Principal Robertson said they resembled almshouses rather than the courts of a seat of learning. Until the year 1780 all classes of society had lived in the dark, many-storied houses in the wynds and closes off the High Street and the Canongate. After that year the New Town with its spacious crescents and stately buildings began to spread forth beyond Princes Street. The foundation stone of New College was laid in 1789 and Black presented a memorial to the trustees on the strong claim of the professor of chemistry to a house contiguous to his laboratory. In the course of his plea he says, "And supposing the Professor of Chemistry should be allowed this advantage over the Professors of Medicine, he need not on this account be an object of envy; his office is much more laborious than theirs who have only an hour of teaching daily; it is also attended by considerable expense for fuel, furnaces, glass and materials. The time he must necessarily bestow on his laboratory prevents him in some measure from courting the world and giving those

attentions which procure favour and employment as a physician." Unfortunately he did not succeed in convincing the trustees and he did not live to occupy the new classrooms and laboratory.

All through his working life Black continued to practise as a physician, and though the extent of his practice had to be limited by his other commitments, his advice in their illnesses was sought by his many friends. His old students also wrote to him for advice on matters medical, and one of the honours conferred on him was that of Physician to His Majesty King George the Third in Scotland. A high tribute described him as "a physician of good repute, in a place where the character of a physician implies no common degree of liberality, propriety and dignity of manners, as well as of learning and skill."

Other honours came to him. He was elected an honorary member of the Imperial Academy of Sciences at St. Petersburg and also of the Royal Academy of Sciences at Paris. This last honour was a graceful recognition of his work by the great French chemist, Lavoisier.

Black disliked publishing papers on his work, and, though invited frequently, he never could be persuaded to address either of these learned societies. He preferred the homely gatherings in the Old Town, the small evening party with his friends rather than the more formal social occasion. A lover of good conversation, he sedulously avoided speaking on subjects in which he was acknowledged an expert, preferring to let others choose the topic and then to contribute his own observations. Being well informed on most subjects he was at ease in the company of all men, whether scholars or men of action.

A shrewd judge of character, though himself without guile, he was not deceived by insincerity or ostentation in others. For example, in a letter to his brother Alexander in London on some problems in the manufacture of plate glass he discusses the work of one Dantic, and says, "He shews that he has had much experience in the manufacturing of glass and he has also some genius but he is too much of a Projector and uses too much declamation."

Black also acted the part of adviser to his brothers on occasion. He writes again to Alexander about brother James, who appears to have been the lame dog of the family, suffering ill-health and receiving regular financial aid from Joseph. James may have been a speculator, for he is advised that "Projects and schemes are dangerous even to men of great fortune; to those who have little they are certain ruin, both by exhausting that little and by debauching the mind from the habits of sober industry and close attention

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to business which when acquired are a sure means of thriving.”

His tastes were simple, verging on frugality, and some said he was parsimonious. The evidence for this imputation is slender and depends on his habit of weighing the guineas which he received from his students in payment of their fees. However, this was probably a necessary precaution in the days of a nobler coinage than ours, when it was worth while for a rogue to indulge in a little coin-clipping. We have his cousin Dr. Ferguson's word that he kept a table equal to, if not above, his position, and that his purse was ever open to his friend.

For thirty years life continued uneventfully in agreeable surroundings until his strength began to fail. The walks with his friends in the meadows were gradually curtailed and finally even conversation fatigued him. He husbanded his reserves and did not suffer any acute illness, though the recurrences of haemoptysis became more frequent. Robison says:—“He thus spun his thread of life to the last fibre; and even this does not seem to have broken but merely ended.” He delivered his last course of lectures in the session of 1796–7.

He dreaded a long illness on account of the trouble and distress this would give to his friends, and his wish was gratified. On a November afternoon in the year 1799, as he sat partaking of his usual simple meal, his servant entered the room to inform him that someone had called. Seeing him perfectly still, the cup steadied on his knee, the servant thought him to be asleep but on looking closer found that he was dead. A friend said it was “as if an experiment had been required to show to his friends the facility with which he departed.”

He rests in the old Greyfriars Churchyard, the burial place of many men famous in Scotland's history.

A physician of good repute, an acceptable teacher, a wise counsellor, a faithful and unselfish friend — for these qualities alone Joseph Black, of Ulster lineage, is worthy of our remembrance; but he has an even higher claim to fame for he fitted the key-piece in a section of that jig-saw puzzle, intricate and still incomplete, the scientist's portrait of Nature.