Frederick Carl Accum

Tucked away in the Society's Historical Collection is a representative selection of the books written in London between 1800 and 1820 by Frederick Accum. The range extends from an academic "System of Theoretical and Practical Chemistry" via " A Description of the Process of Manufacture of Coal Gas" to the best known "Treatise on Adulterations of Food and Culinary Poisons". Although enormously influential during this period, Friedrich Carl Accum is now almost completely forgotten even though his work has many contemporary resonances.

Carl Friedrich Accum was born in Bückeburg , a small German town some 20 miles south-west of Hanover on 29th March 1769. His father was a Jew and his mother a Huguenot, both of whose families had suffered persecution in the 18th century. At the time of their marriage, they were moderately prosperous and Accum senior had set himself up as a merchant and soap-boiler. Of their seven children, only three attained maturity and the father himself died soon after the birth of his last child[1].

The local Gymnasium was a typical institution of the 18th century but it is unlikely that Accum's family circumstances would have allowed him to follow the complete course of the usual syllabus of classical Greek and Latin, Hebrew, metaphysics, logic, history, rhetoric, mathematics and drawing. The young Frederick, as he later called himself, appeared to have show an early interest in chemistry through watching his older brother in the family soap business. Another important influence derived from the regular visits, professional and social, of Dr Bernhard Faust, the highly esteemed Bückeburg physician.

After leaving the gymnasium, Accum became apprenticed as an apothecary and eventually was

associated with the Brande family. Some of these were apothecaries to George III and had chemical establishments in both Hanover and London. At the age of 24, Accum left Germany and moved to London, where William Brande had a laboratory in Arlington Street, just a few hundred yards away from the Royal Institution and St James's Palace. Here he continued to study in his leisure hours and attended lectures in the anatomical lecture theatre in Windmill Street.

William Brande's court connections brought many influential persons to the Arlington Street establishment, amongst whom was William Nicholson. Nicholson was extremely active not only as a chemist of some considerable ability but also as a voracious reader of current journals and text books. From these sources, he began a compilation in 1797 which came to be known as Nicholson's Journal, though its proper title was a Journal of Natural Philosophy and the Arts.

Accum's knowledge of languages was useful in the translation of foreign works and Nicholson, in return, employed his influence to further Accum's career. Almost from the launch of the Journal, Accum contributed articles in his own right and in June 1798 began a series of articles on the adulteration of drugs and medical preparations. Fellow contributors included all the illustrious names of the period, including the reclusive Henry Cavendish, John Dalton, Humphrey Davy, Proust and Count Rumford (Benjamin Thomson).

Early in 1800, Accum moved to premises in Old Compton Street, Soho, where he set up his own laboratory and established a very successful business as a supplier of scientific apparatus and materials. Soho, at this period, was an elegant neighbourhood with Sir Joseph Banks and

William Nicholson amongst its residents and the reclusive Henry Cavendish not far away. In addition to supplying scientific materials, Accum undertook a considerable amount of analytical work into the purity of a wide range of commercial products and came, later, to base his publications on this expertise. In 1801 he was engaged by Sir Humphrey Davy as a "chemical operator" at the Royal Institution and provided demonstrations for his lectures. Within a year, Accum left and started work on the teaching and books by which he is still, if dimly, remembered.

In 1803 he published his "System of Theoretical and Practical Chemistry" in two volumes. This had the distinction of being the first chemistry text book to be published by advance subscription and also by being printed on paper prepared from straw, rather than wood pulp. The straw-based paper has survived the ravages of time far better than the more usual wood-based paper and the Society's copy is in an excellent state of preservation. The long subscription list is headed by various members of the aristocracy, quite a large proportion of clerics (including the Bishop of Llandaff), gentlemen amateurs - and Miss Wilson, the only female subscriber.

In laying out the plan of his book, he declared his intention "to place the student upon an eminence whence he may contemplate the phenomena with advantage and in many cases foretell events with certainty." After discussing the laws of affinity and theories of heat, he proceeded to describe and discuss "the properties of the metals, alkalis, earth etc by direct reference to the facts they afford during chemical examination. I am persuaded that this cannot better be done, than by determining these properties by experiments under different circumstances." Each of the chapters contains a wealth of experiments, described in such

detail as could only arise from first-hand experience.

The procedure to observe the combustion of phosphorus in a bell jar full of “oxigen”, for example, is followed by a description of what is to be seen and the phenomena discussed in what he termed a Rationale. In this case, “..the phosphorus at a certain degree of heat is capable of decomposing this gas: it attracts its ponderable basis, the oxigen, and becomes converted into phosphoric acid: the light and heat which kept the oxigen in a gaseous state, together with those of the phosphorus, are then disengaged in the form of fire.” Although he had earlier mentioned both theories of the nature of heat, Accum showed here that he was definitely in the caloric camp.

His series of “Chemical Demonstrations or Private Lectures” proved highly popular and for a long time, his laboratory was the only institution where instruction in practical chemistry was offered. It thus antedates by two decades the much more famous Liebig school of chemistry. His advertisements for the courses were very persuasive and expounded his fundamental belief that “It is not merely a knowledge of the general laws and leading facts that constitutes the chemist: his skill must be acquired by actual practice and manual dexterity”. Then, rather disingenuously, he added “The latter cannot be obtained from books nor from PUBLIC LECTURES, calculated for a mixt audience.” and advertised that he offered private lectures and took resident pupils.

At the same time as Accum was teaching, performing analytical work and supplying chemical apparatus and materials, he also became involved with the commercial production of coal gas. F A Winsor had taken out a patent in 1804 for a gas-making process and Accum undertook

the experimental work necessary to overcome the objections raised by Winsor's competitor, William Murdoch. His expertise in this field led to his appearing before a House of Commons Committee in 1809, which was considering Winsor's application for a charter, contested by Murdoch.

Accum's expertise was ridiculed by Henry Brougham (later Lord Brougham and also Lord Chancellor). He further created a bad impression when his answers indicated that he was not prepared to divulge further technical information without being paid. His performance before a Committee of the House of Lords, in the following year, was much better prepared and Parliament later passed the Bill which allowed the incorporation of Winsor's company which was eventually established in 1812 as "The Chartered Gas-Light and Coke Company". One result of this was that Westminster Bridge was lit by gas in the following year and by 1815, no less than 15 miles of London streets were lit by this method.

Unsurprisingly, Accum seized the moment and published " A Description of the Process of Manufacturing Coal Gas with Elevations, Sections and Plans.....of the most improved Sorts of Apparatus now employed at the Gas Works in London and the principal Provincial Towns of Great Britain". This richly illustrated book, priced at twelve shillings (£0.60), deals not only with the manufacture of coal gas but also includes sections detailing the cost of a complete installation and the operating costs. Ornamental gas lamp posts and columns, fitted complete, ready for lighting were supplied at six guineas each (£6.30) and a complete plant installation was costed at £7079.75, prices which are put in perspective by the weekly wage of eighteen shillings (£0.90) of the gas works employees, who were shift-working a seven-day week. In a section headed "Costs of laying cast iron Gas Mains in London" it seems that, bad as the state

of roads was in early 19th century London, travellers experienced the same problems as their 21st century successors, for the heading continues "to take up the ground, to fill in but not to re-pave ...".

Accum's "operative chemistry" included mineralogy and his American pupils included James Freeman Dana, the originator of the best-known system of mineral classification, Benjamin Silliman, Sr, who became Yale's first Professor of Chemistry, and Harvard's Professor William Peck. In his memoirs, Silliman revealed that Accum paid little attention to personal safety - "we operated upon white arsenic by nitrate of potassa in a hot crucible.....Mr Accum did not caution me against inhaling the white fumes which were floating about the room." Fortunately, after a few days of "serious inconvenience and prostrated muscular power, together with debility and derangement of the digestive organs" they were back at work, preparing oxalic acid from "half a pound of white sugar with three and a quarter pounds of aqua fortis (nitric acid) at a cost of two shillings (10 pence) per ounce".

Silliman's high opinion of Accum was at least a contributing factor to Accum's success in supplying the first chemistry departments in American colleges with apparatus and consumable materials. He published a descriptive catalogue and was constantly improving or devising new laboratory apparatus. A price list of 1817 offers crucibles of pure silver from three shillings and sixpence to two guineas (£0.175 to £2.10) and the only slightly more expensive platinum at eighteen shillings to five guineas (£0.90 to £5.25). Steam baths "for drying precipitates or explosive compounds" cost seven shillings to ten shillings and sixpence (£0.35 to £0.525) and "flasks, very small" were listed at nine pence to one shilling (£0.04 to £0.05). Copper nitrate was supplied at one shilling per ounce (£0.05 per 28 g) and silver nitrate at two shillings and

sixpence per ounce (£0.125 per 28 g).

Accum's shrewd commercial sense led him to put together portable laboratories, not only for the amateur enthusiast of chemistry but also for mineralogists, an agricultural chest for farmers wishing to examine "soils, manures, marl and limestones, etc" and "Medicine Chests, on an entire new plan for private families, with a book of directions, five guineas to twenty guineas (£5.25 to £21)".

In 1817 he published "Chemical Amusement" - a small book of experiments to be performed at home "with a view to blend chemical science with rational amusement" using the contents of one of the "Chests of Chemical Amusement - ten to eighteen guineas (£10.50 to £18.90)". No-one reading this volume today would go so far as to agree that the experiments "may be performed with ease and safety in the closet". Experiment 24 is headed "To render bodies luminous in the dark, so as to give a sufficient light to shew the hour on the dial of a watch, at night." It involves a solution of yellow phosphorus in almond oil and after describing the glow appearing inside a vial of the solution when it is unstoppered, Accum continues "If rubbed on the face, taking care to shut the eyes, the appearance is most hideously frightful".

In the course of an extremely active career in London, Accum attracted a number of enemies and their number increased sharply after the publication, in 1820, of his best-known work "A Treatise on Adulterations of Food and Culinary Poisons". The tone is set in the Preface where he declares "However invidious the office may appear, and however painful the duty may be, of exposing the names of individuals who have been convicted of adulterating food, yet it was necessary for the verification of my statement.".

After the opening chapter, dealing with water, he devotes separate chapters to consider the adulteration of wine and beer, bread, brandy, cream, lozenges, custards and olive oil, interspersed with shorter sections dealing with counterfeit tea, coffee, pepper and poisonous cheese and pickles. The book was extensively reviewed in Blackwood's Edinburgh Magazine, the Edinburgh Review and the Literary Gazette. The Society's copy has been rebound but the original had light green boards, with white designs of snakes writhing around a rectangle enclosing a spider's web, in which a large spider was engaged in grabbing a fly. At the top was a banner bearing a skull and cross-bones, with "There is Death in the Pot" inscribed underneath.

Each section details the methods of adulteration and how they may be detected. The largest section is devoted to the adulteration of beer, a wide-spread practice in spite of the numerous Parliamentary Acts, from the time of Queen Anne to King George III, which imposed heavy fines on defaulting brewers. In the introduction, Accum states "It has been a matter of frequent complaint, that ALL porter now brewed, is not what porter was formerly." .He reports that the major London brewers, such as Truman, Hanbury & Co. and Henry Meux & Co, were producing a brew containing approximately 7.25% alcohol but by the time the retailers were selling it on to the publicans, this had dropped to an average 4.5%.

Not only was the original brew being diluted with cheaper, weak beer but it was also being treated with green vitriol, (iron(II) sulphate) alum (aluminium potassium sulphate) and salt to give it a good "cauliflower head" when it was poured. An extract of Cocculus indicus, originally prepared for the dyeing and tanning trade, was used to enhance the bitter taste, in

spite of its poisonous and stupefying properties. These additives, being strictly illegal, were usually stored off-site and it was a frequent practice for the retailer on “brewing days” to turn up at work, in a specially large coat, with specially large pockets, filled with these additional ingredients.

Accum had no compunction in “naming and shaming” brewers who had been convicted of adulterating beer and druggists convicted of supplying them with the harmful materials. He supported his statements by quoting the official court reports. The fines imposed were very substantial, amounting to around £400 in the bad cases and similar fines were imposed on grocers who similarly adulterated their produce. Cayenne pepper was frequently laced with red lead to cover up the fact that it was old and had faded considerably, ground pepper was “extended” by mixing it with PD (pepper dust, being nothing more than warehouse sweepings). Used tea leaves were dried on copper plates to acquire a green patina and then resold, pickles were boiled in copper vessels or half-pence were added to the recipe ingredients to produce “a lively green colour”. The same copper pigments occurred in green confectionery, jellies and blancmange, together with vermillion (adulterated with red lead) in the red items.

The first edition of a thousand copies was sold out within a month of publication and the second edition appeared later in the same year, in spite of a number of threatening anonymous letters which he had received. The book attracted widespread interest abroad, with an American reprint appearing in Philadelphia (1820) and a German translation printed in Leipzig in 1822. The consequences were, for Accum, nothing less than a disaster. A few months after the appearance of the second edition, a complaint was made to the managers of the Royal

Institution, alleging that Accum had been mutilating books in the Institution's library, to which he had been a subscribing Member.

It was claimed that, though this practice had been going on over a period of years, only recently had evidence appeared linking Accum to the missing pages. At first, the managers were inclined to ignore the charge, especially as Accum had at one time served as their librarian, but further complaints led to Accum being visited in December 1820 by the librarian and two officers, armed with a search warrant. The librarian identified some thirty pages as being the property of the Royal Institution and Accum was arrested and charged with robbery.

He was discharged when the magistrate took the view that though the books might have been valuable, the separate leaves found in Accum's premises were only waste paper. The Royal Institution managers then brought an indictment on the grounds of mutilation of books in their library and a further trial was set for April 1821. Public opinion turned against Accum and public appeals on his behalf by his friends and supporters were in vain. Accum became severely depressed, failed to appear at his trial and forfeited his bail.

He remained only a few months longer in London to wind up his affairs and returned at the age of 52 to his native Germany. He soon established himself in Berlin where he became Professor of Technical Chemistry at the Gewerbe Institut and simultaneously Professor of Physics, Chemistry and Mineralogy at the Bau Akademie. His final book, and the only one he had written in German, appeared in 1826 and dealt, uncontroversially, with the physical and chemical properties of building materials and their evaluation.

He remained in Berlin until his death on 28th June 1838, so deeply affected by the scandal of 1820 that articles which he contributed to the Berlin Royal Academy of Sciences were published either anonymously or under the pseudonym Mucca. Even his London publishers producing new editions of his works omitted his name from their title pages. Adulteration of food and drink continued virtually unchecked in Britain for a further forty years after Accum's departure, but eventually the Adulteration Act of 1860 brought in the much needed pure food regulation and stands as a belated recognition of but one of Carl Friedrich Accum's activities during his time in London.

References and further reading:-

Biographical information has been compiled mainly from the following two sources. Although Browne made use of much original material, the report is sadly lacking in references.

1 Charles Albert Browne, Life and Chemical Services of Frederick Accum, J Chem Ed, **2**, 829 - 851, 1008 - 1035, 1925

2 Prof Koch, Ein vergessener Bückeburger, der Chemiker Friedrich Accum, Schaumberg-Lippische Heimat-Blätter, **1932,** Nr 10

Quotations from Accum's books are taken from the originals in the Society's Historical Collection.

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