Physiological and Pathological Research at the General Military Hospital of Valletta, Malta, in the early Nineteenth Century*

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The theoretical and practical progress achieved by the biological sciences in our time contrasts very markedly with the tentative experimental studies in these fields in the early decades of the nineteenth century. Those distant years are of special interest to the historian of medicine as they formed the matrix in which the seeds of our present knowledge were sown and cultured.

Malta may take some pride in the fact that it has had a share - albeit a small one - in the series of steps leading towards the elucidation of the chemical, physiological and pathological perplexities of those formative years. This was possible thanks to the investigations and observations of Dr. John Davy carried out at the British General Military Hospital of Valletta- formerly the Holy Infirmary of the Order of St. John - between 1828 and 1835.

Biographical Note

Dr. John Davy (1790-1868) was the younger brother of Sir Humphrey Davy who invented the safety lamp for miners and was the first to record in 1800 the intoxicating effects of nitrous oxide and discover its anaesthetic properties[1].

John studied medicine at Edinburgh qualifying M.D. in 1814 at a time when London medical schools were still in embryo[2]. He joined the Medical Department of the British Army, serving for a period of almost twenty-five years and finally rising to the rank of Inspector General of Army Hospitals. In 1834 he was elected Fellow of the Royal Society of London.

He was in the Mediterranean for a span of eleven years (1824-35), seven years of which (1828-35) he spent in Malta. He again visited the island towards the end of November 1840 while he was on his way to Constantinople to advise on the organisation of the medical corps of the Turkish Army[3]. Two months previously, on the 28th September 1840, he was elected Honorary member of the *Societa Medica d'Incoraggiamento di Malta* (The Maltese Medical Society of Encouragement). This society was the only medical and scientific association in Malta at the time[4].

Apart from his professional commitments in the army, Davy was President of the Medical Committee which superintended the civilian medical services of the islands. He also had a busy private practice among residents in Malta and numbered several distinguished visitors to the island among his patients.

When Sir Walter Scott reached Malta on the 21st November 1831, he was an invalid as a result of an apoplectic attack which he had at Abbotsford in April of the same year. While he was in Malta, it was feared that another stroke was impending. Dr. Davy was called instantly. He found Scott with a flushed face, heavy eyes and great difficulty in speaking. He ordered the application of leeches to the patient's head -then the standard treatment - and Scott felt so much relieved the following morning that he was allowed to be driven into the countryside in the company of Mrs. Davy. The latter enjoyed an old family relationship with Sir Walter Scott as her parents resided near Scott's home in North Castle Street in Edinburgh; while Scott himself knew Dr. John Davy through his friendship with Sir Humphrey Davy[6].

Two years later Dr. Davy had occasion to treat another famous visitor in Malta. This was the Rev. J.H. Newman (later Cardinal) who had caught a very bad cold while undergoing quarantine at the Lazzaretto in January 1833. Dr. Davy recommended fifty drops of antimonial wine three times daily - a remedy which Newman found to be *wonderfully efficacious*[7].

Davy was an intimate friend of the Rt. Hon. John Hookham Frere who had settled in Malta and who endeavoured to arouse the interest of naturalists in

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the fauna, plant life and fossils of the Maltese Islands. Davy kept up a correspondence with Frere on the natural history and geology of Malta even after his departure from the islands. He also wrote extensively on the agriculture and climate of Malta in his *Notes and Observations on the Ionian Islands and Malta* published in London in 1842. In this work he produced excerpts from a publication by the Professor of Botany at our university, the Rev. Fr. Carlo Giacinto (1805-24), issued in Italian in 1811 under the title of *Saggio di Agricoltura per le Isole di Malta*[8].

Davy conducted a number of experiments to find out whether the bright moonlight of Malta had any heating, chemical or magnetising powers. The belief was then current, in some Mediterranean countries, that moonlight had a harmful effect on health but Davy's inquiries failed to support this concept. Indeed he ascribed - and rightly so - the ill-effects on health to malaria which he found to be more frequent in those who slept exposed to the night air though he admitted that the agent causing malarial fever was *enveloped in profound mystery.* In fact the malaria-cycle and the role of the mosquito (that bites at night) in the spread of the disease was only elucidated in 1897.

The provisions of measures to counteract the effects of the summer heat and to ensure a restful sleep at night engaged his attention in August 1830. A series of thermometric experiments led him to suggest the construction of an apartment *made as much as possible of glass* and provided with thick wooden shutters lined on the inside with cotton wool and painted white on the outside. These shutters were to be kept closed during the day and opened only after sunset[9].

From a study of the smallpox epidemic that raged in Malta in 1830-31, Davy became convinced that vaccination gave adequate protection against smallpox. The beneficial results of vaccination were amply demonstrated by the comparative exemption from the disease of the vaccinated British troops then in Malta. Thus Davy was able to show that, while among civilians one in every twelve was attacked, the proportion among the military was one in one hundred eighty-eight.

He endeavoured to promote the treatment of needy civilian sick on an out-patient basis so that the individual could receive the necessary medical attention without going to hospital. For this purpose he suggested the setting up of a dispensary in Valletta which was eventually opened on the 14th April 1832. He made over to the new dispensary sundry surplus utensils from the General Pharmacy of the British Army. This is how the Government Dispensaries in our towns and villages - known as *il-berġa* - originated.

There were two government institutions which called forth Davy's criticism - the Foundling Hospital and the Quarantine System. He disapproved of the Foundling Hospital because, in his view, it afforded a cloak *to licentiousness and the deadening of moral principle and natural affection* and because of the high mortality among its infants due, most probably, to dietetic errors. He favoured the mitigation of the quarantine laws but did not advocate any alteration in the regulations in force in his time before a searching inquiry into the whole subject had been carried out. What he wished to see established was a restrictive system which, while protecting the public health, caused as little vexation to individuals and to commercial intercourse as possible[10].

John Davy died on the 24th January 1868.

Davy's Research Work before coming to Malta

By the time he came to Malta in 1828, Davy had already shown great interest and gained fruitful experience in chemical and anatomical research. In 1811, three years before graduating, he tried to determine the proportional quantities of organic and of calcareous matter in bones of different animals and of human beings of various ages. In the same year he joined the Royal Medical Society of Edinburgh to which he read a dissertation *On the Diseases Peculiar to Different Climates* - a suitable exercise for his future overseas service on the medical staff of the army. He later became President of the Society (1812-13) together with Richard Bright - of Bright's Disease fame - of whom he was an intimate friend.

He was the first to prepare phosgene gas ($COCl_2$) in 1812 by exposing a mixture of equal parts of carbon monoxide and chlorine to sunlight. Phosgene found its chief use in the manufacture of aniline dyes and of pharmaceutical products, such as creosotol, but ironically enough what should have contributed to the welfare of humanity was turned into a lethal weapon of destruction by Germans one hundred years later when they made use of the toxic properties of phosgene to spread death by asphyxiation on the Western Front in December 1915.

During a voyage from England to Ceylon in 1816 he took the opportunity to observe the temperatures of men and animals in different latitudes and relating them to variations in the temperature of the atmosphere, diet, exercise and state of health. While stationed in Ceylon (1816-20), he studied the anatomy of the urinary organs of various amphibians and experimented with the effect of poisons from twenty different species of snakes[11]. When he was transferred to the Ionian Islands (1825-27), he investigated the effects on the human skin of the sun's rays and of the fluid exuded from he cuticle of the toad (Rana bufo, L).

He commenced the practice of keeping notes of every autopsy he performed from May 1821 to 1838. These post mortem examinations were carried out mostly on soldiers dying in British military hospitals but, in some foreign stations, also on the native population especially in Malta where he discovered that the Civil Hospital offered *an ample field of research.* Thus in a period of seventeen years he did no less than seven hundred and eighty six autopsies of which three hundred and seventeen were held in Malta[12].

Observations on the Temperature of the Human Body after Death (1828-29)

A topic which engaged Davy's attention in Malta in 1828-29 was the rise in temperature which is noticed in the deep seated parts of the cadaver at autopsy - a phenomenon about which ,to his knowledge , no precise observations had hitherto been made.

His series consisted of ten cases of death occurring at the General Military Hospital or Station Hospital at Valletta. His study extended over a period of six months from July 1828 to the following January. The bodies were all of British soldiers serving in Malta. Immediately after death the bodies were removed "to a large, airy and comparatively cool room, the old laboratory of the hospital of the Knights, where they were to be examined and where they were generally covered merely with a sheet and placed on a table of wood". As the onset of putrefaction was hastened by the hot weather of the Mediterranean, in fact the autopsies were carried out sooner than usual and *almost immediately after death,* the time varying from three to seventeen hours after the decease. One obstacle to this haste was the question - then very much on men's minds - as to whether the individual was really dead or only apparently so. To exclude the possibility of vitality in the cadaver or of suspended animation, Davy took the very prudent precaution of excluding such an eventuality by ensuring that the body did not react when a small incision was made in the cutis, when the eyes were exposed to light and when the platysma myoides was punctured.

He found that the difference in temperature between that of the air in the room and the internal parts of the cadaver varied from twelve to as much as thirty-three degrees F. As these observations were recorded in a *comparatively warm climate* (Malta), later on in the same year, he compared them with an additional series of observations made at the General Hospital at Fort Pitt, Chatham, on ten bodies of soldiers and found the same range of increase in the internal temperatures of the cadaver relative to that of the room in which the examination took place.

As no putrefaction had taken place in the cadavers examined, Davy concluded that the high internal temperatures were generated before death, as happens in febrile diseases and in those persons living in the tropics where Davy ascertained that the temperature could rise to 101^{0}F in the living *without damaging health*.

He realised that thermal phenomena could be of practical use in medical jurisprudence in arriving at *a tolerably positive conclusion, in doubtful cases of death, as to the time which may have elapsed between the fatal event and the post mortem examination* after taking into account the *circumstances likely to modify temperature*. He did not, however, follow this line of research any further and left *other openings for curious and perhaps useful inquiry* to others[13].

Experiments on the Tissues of the Human Body (1828-30)

Desiccation

The question of the proportional quantities of solid to fluid matter in the body was still unresolved in Davy's time. According to some research workers the proportion of solids to fluids was as one to six; and according to others as one to nine. He tried to throw some light on this question by desiccating eighty-two samples of human tissues (cartilage, bones, internal organs, etc) taken from the bodies of British soldiers dying at the General Military Hospital of Valletta but he found it extremely difficult to come to a definite conclusion as the number of samples examined was not large enough to furnish him with accurate data[14].

Action of Corrosive Sublimate

Davy felt on surer ground in his experiments with corrosive sublimate on human body tissues. The property which corrosive sublimate possesses of preserving animal tissues has been known for many years and anatomists had taken advantage of this feature both in the dissecting room and in pathological museums. However, Davy felt that not enough dependable research had been carried out. He applied himself to this inquiry in the summer of 1828 with the following positive results:-

(a) Confirmation of *the general antiseptic power* of corrosive sublimate for the purpose of making dried preparations and for its employment in the dissecting room;
(b) corrosive sublimate arrests the fermentation of juice of grapes;
(c) corrosive sublimate prevents putrefecation of animaland human tissues and arrests it when it has already started.[15].

Action of Lime

In Davy's days, it was a commonly held belief that lime had a corroding and destructive action on animal matter and that, therefore, animal tissues exposed to it decomposed and disappeared rapidly. Accordingly it was recommended to add lime to burials where a quick decay of corpses was desirable as during the prevalence of pestilence.

From many experiments which Davy conducted in Malta in 1829-30 he concluded that this belief was erroneous and that far from destroying animal tissues, lime preserved them through its *antiseptic* property and enabled them to resist putrefaction whether they were placed *in air or plunged and kept in common water*. Lime, however, softened skin, nails and hair and finally destroyed them and it was perhaps this destruction of these particular tissues that led to the idea that lime exercised a destructive action on animal substances generally.

In the course of trials with other chemicals he found that ammonia, magnesia and potash had a similar preservative effect as that of lime[16].

Boiling of Body after Death

Davy found that the boiling of the human body after death aided its preservation if the boiled parts were immediately placed in receptacles containing spirit of wine (proof spirit)[17].

Action of Air on the Putrefaction of Various Tissues

These experiments were carried out during the summer season. The rapidity of putrefaction varied from one type of tissue to another, being most rapid in the brain and slowest in bone. The process was attended by an elevation in temperature. A circumstance that accelerated the putrefactive process and the evolution of heat was the presence of maggots of various kinds of the genus Musca. Davy gives a very vivid account of the activity of these creatures. *It is curious*, he wrote, *to watch the progress of these animals in their growth and still more so in their operations. When their food is very nutritious, the almost microscopic ova, in forty-six hours, are converted into large maggots. When they have nearly attained their full size they feed with extraordinary voracity as if aware that their lives depended upon their activity. The whole of a numerous brood might be observed, side by side erect, with one extremity in the ammoniacal poultacious mass, pumping up nourisment, and with the other narrower extremity in the atmosphere, the orifice of its canal dilated, seeming to pump down air*[18].

Maceration in Water

Anatomists had been hampered in their investigations on the maceration of the human body because of difficulty in procuring corpses, the time required for maceration to take place, the disgusting nature of the operation and the risks to the health of the investigator. These hurdles, however did not deter the inquiring mind of Davy from engaging in research on this topic while in Malta in July 1828. *The experiments,* he wrote, *were all made in the laboratory of the General Hospital - formerly the hospital of the Knights - a room by its equable temperature well adapted for the purpose.* The investigations extended over a period of twelve months. The water used was the potable water conveyed to Valletta by the Wignacourt Aqueduct. The parts were macerated in glass jars varying in capacity from one to two gallons and were kept in the water for eight to twelve months. The specimens were removed from the bodies of twelve British soldiers, varying in age from eighteen to fifty-six years, who died in hospital from such varied conditions as fever, tuberculosis, dysentery, etc[19]. The organs used included the heart and pericardium, lungs, the brain and its membranes, spleen, pancreas, kidneys, alimentary canal from mouth to rectum, sexual organs, muscles, cartilage and bones. Davy found that the rate of maceration varied from one type of tissue to another being *most rapid* in some but less so in others. He refrained from giving a *minute account* of his findings as otherwise *a volume would be required to contain them* but he wrote in sufficiently great details on the more important results obtained.

He attributed the changes produced by maceration to:

(a) chemcial reactions,
(b) the activity of the unicellular *infusoria of Linnaeus,* today known as protozoa, feeding on the specimens,[20]
(c) the larvae of the *common gnat of Malta* which were very abundant and active as destroying agents performing a role in water similar to that of the larvae of flies on dead animal matter in air, and,
(d) the operation of *those obscure plants belonging principally to the confervae* or *algae aquaticae* of Linnaeus, i.e. fine velvety-like mosses[21].

Observations on the Blood (1828-35)

John Davy graduated from Edinburgh with an inaugural dissertation on the composition of the blood based mainly on the views current in Edinburgh and on the research work of the eighteenth century physiologist William Hewson who established the essential features of the coagulation of the blood.

In later years Davy returned to the same subject with special regard to the specific gravity and the coagulation of the blood. His experiments were conducted on lambs, turtles, sharks and human beings and took place at intervals and in various places where he happened to be staying at the time i.e. 1811 (Edinburgh), 1818-19 (Ceylon) and 1824-35 (Mediterranean, chiefly Corfu and Malta).

While in our island, he was led to inquire into the effects of various physical and chemical agents on blood coagulation. He studied this phenomenon in two hundred and forty-nine cadavers of soldiers of British regiments serving in Malta. He found that in only one hundred and five cadavers was the blood coagulated. He tried to establish a correlation between this feature and the type of disease from which the patient died but in his time, knowledge about the composition and functions of the blood was still elementary. Yet the question was of practical importance because of the use of bloodletting, by leech and by the lancet, as a remedy for the abatement of pain and the relief from the feeling of oppression in the chest accompanying certain illnesses. Physiologists differed considerably in their interpretation of the few facts then known while they were still trying to unravel the effect of oxygen and of carbon dioxide on the blood; and they were not yet sure whether blood was a *living* or a *dead* fluid. It is no wonder, therefore, that Davy, in spite of his investigations, had to confess that *the subject of the blood in all its bearings* was for him *one of great obscurity* and that *all speculation concerning it required to be received with much caution and examined with all possible rigor (sic)*[22].

The Preservative Action of Vinegar and Spirit of Wine (1818-39)

Davy's attention was initially directed to devise methods for preserving anatomical preparations in 1825 when the Director General of the British Army Medical Department called on Medical Officers in overseas stations to contribute specimens to the Pathological Museum at Fort Pitt which was then in its formative phases.

In response to this request, Davy, who was then serving in the Ionian Islands (1825-27), made trials with a solution of sulphurous acid gas in water which he found to be effective for at least three years. It was besides, cheap and allowed a clear view of the minute structures of the prepared specimens.

When he came to Malta in January 1828 he carried out experiments over a period of six months with vinegar as a preservative for specimens. He used a solution of distilled vinegar diluted with water, the solution being almost colourless and with a specific gravity of 1006. The specimens were suspended in this solution which was poured in jars covered with bladder at their mouths to exclude air. All the specimens thus treated were found to be *in perfect preservation* when they were inspected three years later.

Davy ascribed the preservative properties of vinegar to its *antiseptic quality* and for this reason he suggested the use of distilled vinegar in surgery for clearing foul ulcers and washing out deeply seated abscesses. He also recommended it for the preservation of table food thus preventing wastage of food.

In the hottest weather, states Davy, *during the summer in the Mediterranean, when cold meat became tainted and unfit for use in twenty-four hours, or even in a shorter time during the prevalency of the damp scirocco wind, I have had slices of roast and boiled meat, of fish, poultry, etc put into vinegar... and they were preserved perfectly good and fit for the table for weeks. It is well known how long vegetables may be thus kept.* He was not so convinced, however, about the efficacy of the pungent fumes of vinegar as a means of fumigating rooms and hospital wards for which purpose the fumes of vinegar were still commonly employed in his time.

By 1839 his experience in the field of preservation had been enriched by further trials during a stay of eleven years in the Ionian Islands and in Malta when he experimented with *spirit of wine* (Alcohol) as a preservative. He found that a mixture of seventy parts of proof spirit and thirty parts of rain or distilled water answered the purpose quite well. He stressed the need of using rain or distilled water because water containing carbonate and sulphate of lime produced a precipitate that prevented a distinct view of the specimen in the jar. Following these experiments he seems to have dropped the idea of using vinegar as a preservative for he declared that *spirit of wine* had proved to be *better adapted for the preservation of moist preparations than any other liquid yet tried*[23]. One wonders whether Davy was aware that spiritus vini (alcohol) was first tried experimentally as a preservative of animal tissues as early as 1662 - although it was not until 1740 that it came into use as a museum preservative in England[24].

Animal Electricity (1831)

In 1831 Davy was engaged in experiments *on the extraordinary property which the Torpedo (fish) possesses of imparting shocks similar, as far as sensation is concerned, to those of* the *Leyden vial.*

Since the seventeenth century the Torpedo had become of special interest to anatomists because of its *electrical functions.* Stefano Lorenzini had written a monograph on the Torpedo in 1678 while an account of its electrical organ was published by R.A. Ferchault de Reaumur (1686-1757) in later years[25].

Davy, who was familiar with the literature on the subject, embarked on his enquiry at the request of his late brother Humphrey Davy who had shown great interest on this topic about which he had published a paper in 1829. Humphrey had used an apparatus, apparently of his own devising, which he suggested John should use in further researches but which John later found that it *did not answer so well.*

John commenced the anatomical studies of the Torpedo in Rome while his brother Humphrey was still alive, the kinds of fish which he dissected being the *tremula* and *occhiatella;* but his electrical experiments on the living fish were entirely made in Malta, the first one being carried out on the 3rd of September 1831 at eleven o'clock at night. It was not made earlier because on his return to Malta from Rome in June 1829, John was informed that the Torpedo was not known in the sea around Malta; but in the summer of 1831 he found out that he had been misinformed and that *with a little trouble* the fish could be procured alive at all seasons of the year.

As a result of his investigations he determined that the discharge from the electrical organ of the Torpedo could magnetise a needle and that a needle poised on a pivot in a multiplier *made half a revolution.* With regard to those investigations meant to ascertain whether the electricity of the Torpedo could produce light or had the power of igniting or passing through air, his experiments were *attended by less satisfactory results*. However he succeeded in confirming Michael Faraday's idea that heat was evolved during the passage of electricity as indicated by a very sensitive spirit thermometer.

In a number of electro-chemical experiments he found that the electricity of the Torpedo affected such chemical substances as common salt, silver nitrate and sulphuric acid with the evolution of gas and the precipitation of the metal. From these observations he deduced that the undersurface of the Torpedo corresponded to the copper or negative extremity of a voltaic battery and the upper surface to the zinc or positive end. He called the sensation imparted by the shock of the Torpedo to the human body the *physiological effect.*

John Hunter had dissected the electrical organ of the Torpedo but Davy considered that this organ deserved a more minute investigation than Hunter had devoted to it and he proceeded to record his own observations in the course of dissection *conducted with considerable care*. In fact he traced the course of the cerebral, cervical and spinal nerves to their terminations in the various organs of the fish. He established the fact that when the brain of the Torpedo was removed entirely, the fish lost its power to give shocks. With regard to the *electric organ, an examination with a simple lens magnifying more than two hundred times,* suggested that it was formed of nervous tissue - an observation which Davy confirmed by microscopical examination. Concerning the mode of production of the electrical discharge, he admitted that it was *unavoidably enveloped in great mystery.*

Apart from the electrical phenomena of the Torpedo, Davy tried to investigate the breeding habits of this fish. While in Malta he examined more than two hundred Torpedos with this aim in view but only in five of them he found foetal Torpedos at full term. He therefore, inferred that the gravid fish was rarely met with in Maltese waters; in fact it was only after the lapse of twelve months that he could procure a fish with its young though he had offered to pay the fishermen *above fifteen times the market price* of the fish. Even the non-pregnant ones were difficult to procure as they came into shallow water quite irregularly and sometimes he had to wait for as long as two to three weeks to obtain a specimen. The species which he met with in Maltese waters were the T. ocellata (oculata D) or Cramp Ray and the T. marmorata (diversicolor D) or Marbled Torpedo. They were known in Maltese as Haddayla (sic) (Ħaddiela) from the verb signifying to paralyse or benumb[26]. To preserve the fish alive he recommended that it should be kept in an earthenware vessel, that the *purest* sea water should be used and changed daily; and that the vessel should be maintained in the coolest place available *where the sun never shines*[27].

Davy published the results of his experiments in the *Philosophical Transactions (Part 11 for 1834)* under the title *Observations on the Torpedo with an Account of Some Additional Experiments on its Electricity,* dated from Malta, March 4, 1834.

The conclusions he drew from his experiments were:-

(a) the electricity of the Torpedo acted *electro-chemically in separating the elements of compound bodies.*
(b) it affected the needle in the multiplier and imparted magnetism to iron; and
(c) it generated heat[28]

It must be borne in mind that it was only during the first half of the nineteenth century that scientists began to gain a clear understanding of electrical phenomena and that up to Davy's time the investigation of electricity was still limited mostly to static electricity produced by a manually operated generating machine and that, though the Leyden jar had been in use since 1746, the Voltaic pile and battery were developed in 1800.

Aqua Binelli for the Arrest of Bleeding (1831)

The year 1831 found Davy occupied with less academic pursuits than the electrical phenomena of the Torpedo - none other in fact than the arrest of bleeding from the large arteries. The occasion arose in 1831 when he embarked on a number of experiments to test the styptic properties claimed for a proprietary medicine - *Aqua Balsamica Arteriale* -produced by an Italian Doctor Fedele Binelli from Piedmont. A case of several bottles of this preparation, imported from Naples, was sent to Davy by the British Governor of Malta, for the purpose of having its *qualities fairly investigated* at the Military Hospital, Valletta.

Davy tried it on superficial cuts in the skin but found that it did not stop the bleeding at all. He decided that the preparation was *an imposition on the public* and deserved no further investigation. Two years later his attention was recalled to the subject by a medical practitioner in Malta who had studied in Naples. This practitioner invited Davy to witness the effect of a preparation, which was reputed to be identical with *Aqua Binelli* in composition and effect, on the severed carotid artery of a goat. The experiment was unsuccessful. Davy, however, tried to check the alleged styptic properties of the preparation himself by experiments on dogs. In every instance, however, he found that moderate compression of the cut artery with several folds of linen dipped in water succeeded in arresting bleeding and resulted in the healing of the artery after some weeks; these effects being due not to the water but to the moderate pressure exercised on the severed blood vessel. Would the same means of moderate compression operate as effectively in the case of wounds of the large arteries in human subjects? Davy did not know as he had not ascertained this possibility experimentally but he thought that the result would be the same. It was a point worth determining, in his view, especially for military surgery particularly on the field of battle where the number of wounded men required attention always exceeded the means of surgical intervention for the suppression of bleeding by ligating the cut blood vessel[28].

Chemical Studies (1833-34)

During these years Davy was busily occupied with chemical, physiological and pathological studies. His earliest paper, dated May 8, 1833, dealt with *Some Experiments and Observations on the Combination of Carbonic Acid and Ammonia.* His experiments confirmed the correctness of the results obtained by Louis Joseph Gay-Lussac (1778-1850) and other contemporary workers and showed where his brother Humphrey had been deceived in some of his experiments on the salts of ammonia[30].

In *Some Observations on Phosphorus* he examined the varying gradations in the intensity of luminosity of phosphorus when placed in oxygen gas at different temperatures[31].

His third paper is made up of two unrelated studies both of which are dated March, 1834. Part I entitled *Some Observations on a Note of M.A. Van Beek Purporting to Point out an Error in the Bakerian Lecture of the late Sir Humphrey Davy on the Relations of Electrical and Chemical Changes* is a defence of his brother's theory concerning the protective action of zinc on copper when this latter metal is exposed to sea water. The question was of great practical interest for marine engineers becuase the rapid decay of the copper sheeting on the bottoms of British ships constituted a serious problem before zinc was found to be a satisfactory preservative to the copper sheeting.

Part II deals with *Some Observations on Euchlorine Relative to the Question of its Decomposition.* Following a series of experiments Davy concluded that euchlorine was a mixture of chlorine and deutoxide of chlorine (a combination of oxygen and chlorine) and not a pure or true chemical compound[32]. Off prints of the three papers were presented to the University Library by Davy, each title page being inscribed in ink *For the University Library from the author.* The texts contain a few corrections of misprints in the author's hand[33].

Experiments on Animal Heat (1833-34)

The problem of the source and maintenance of animal heat had been the subject of a prolonged controversy in the early decades of the nineteenth century[34]. It first engaged Davy's attention in 1814. He returned to investigations on this subject in 1833[35].

While dissecting a tunny fish (*Thynnus vulgaris*, Cuv. & Valen) he was struck by the fact that its temperature in the deep seated muscles was higher than that of the surface of the sea, from which it had just been taken, by no less than 18 degrees and a half (99^0 and 80.50^0 F). A careful inquiry among Maltese fishermen with a wide experience in the tunny fishery convinced him that the tunny was a warm-blooded creature. He tried to extend his investigations to other fish of the same family but he was unable to repeat his temperature experiments as he could not procure any of these fish alive. He was, however, able to carry out a dissection of the nervous system of various species of tunny caught in Maltese waters, but he could not suggest what accounted for the great difference in temperature between the tunny and its surrounding medium so that nineteen years after his initial attempts to understand the phenomenon of animal heat he humbly confessed that until physiologists learned more about *all the sources of animal heat* and the *circumstances for its preservation* no explanation was possible[36]. In fact this understanding of the factors involved in the temperature regulation of the body came much later.

Observations on the Vascular System of the Human Body.

John Davy had shown interest in the pathology of the cardiovascular system as early as 1823 when he carried out experiments on the power of resistance of the heart muscle and the large vessels when he came across a fatal case of rupture of the heart and aorta in a man due to a fall of 50 to 60 feet deep in a chalk pit in Chatham. He again directed his attention to the cariodvascular system when he read about Sir Astley Cooper's experiments on the dog and the rabbit by which Cooper demonstrated that the carotid and vertebral arteries can be occluded by tying with survival of the animal. This was due to the continuation of the blood circulation to the brain by the process of anastomosis. Davy had met with many instances, at autopsy, of atheromatous occlusion of the larger arteries in men where it had never been suspected during their lives. These fatalities had occured in soldiers of active habits who died of acute diseases of short duration but which were unconnected with the morbid condition of the artery as found at post mortem; in fact the circulation had not been impeded in these cases owing to the expansion of the arteries involved or of adjoining ones. This, however, was not always what happened and in 1834 he came across an instance where the train of events was of a quite different and contrasting kind. A soldier of 36 years first experienced some difficulty in breathing at the beginning of 1833 but he remained on duty until he was admitted to the Military Hospital at Valletta on the 18th February 1834 when he came under the observation of John Davy. The main signs were paroxysms of *tumultuous action of the heart,* breathlessness, temporary loss of vision and occasional syncope. The pulse could not be felt in either wrist and brachial arteries but was strong in the femoral. He gradually became worse with continuous and severe dyspnoea, a livid hue of the face and *great agony of suffering.* He died suddenly on the 2nd June. At autopsy, Davy found hypertrophy of the heart and an enlarged arch of the aorta with *thin plates of bone* under the inner coat and complete obstruction of the left carotid and subclavian arteries *by dense white matter.*

His interest in the arteries of the human head did not flag in subsequent years. He was well aware of the existence of the anatomical peculiarities in the structure of the basilar artery in man but in June 1837, while at Fort Pitt, he came across a peculiarity that to the best of his knowledge had not yet been noticed by any anatomist. It consisted of a congenital band of fibres in the interior of the vessel, attached to its sides and intersecting it near the junction of the vertebral arteries[37]. During a period of seventeen months he met it in ninety-eight autopsies held at the General Hospital of Fort Pitt. In two instances he also observed another hitherto unnoticed anatomical anomaly i.e. the presence of a narrow opening between the two vertebral arteries in the septum formed by their juxtaposition posterior to the basilar artery[38].

His concern with these anatomical variations stemmed from the fact that in his time structural rarities had continued, as in previous epochs, to hold the interest of the dissector over what was common in anatomical investigations.

Davy's Laboratory

Among the problems that beset the experimental investigator in Davy's time was the dearth of laboratory equipment because the range of instruments and technical aids then available was very limited apart from being of a rudimentary kind and not very efficient. Davy, therefore, had to work with the simplest of tools. One must bear in mind, for instance, that tissues were still examined unstained under the microscope while the microtome and the embedding of tissues had not yet become diffused. Indeed a microtome capable of sectioning soft animal tissues was developed in 1856 and a method of staining bacteria in tissues was first described in 1875 - seven years after Davy's death.

Davy had the advantage of being familiar with the laboratory equipment of his time for he was a member of the Apparatus Committee, set up in 1796, of the Royal Medical Society of Edinburgh. Several rooms of the premises of this society were reserved for the performance of physiological and chemical experiments by its members; and dogs, calves and rabbits were made available for the investigation of the effects of temperature on the body, for transfusion experiments and for the study of the respiratory system[39].

Davy must have assembled many of laboratory tools himself as none of the apparatus which he mentions in his publications is known to have been held by the Holy Infirmary or by the Military Hospital before his time.

His instruments comprised a galvanometer, Coulomb's electroscope, Harris's electrometer, a Leyden jar, a Voltaic cell and an *electrical machine* - probably a generating machine i.e. a contrivance worked by hand for the production of static electricity, the charge thus produced being then stored in a Leyden jar. He also had his brother's apparatus in a *little box* for studying the electrical phenomena of the Torpedo but which *did not answer so well* in John's experiments. Of great help was a *powerful lens* and a microscope constructed by the *excellent maker Mr. Ross* with an object lens of one-eight inch focal distance. Mr. Andrew Ross (d. 1859) was *one of the foremost microscope makers* at the time of Davy's researches in Malta. Ross was engaged in the construction of achromatic lenses and succeeded in obtaining a good quality image and a fine focusing mechanism in his instruments, so that it is likely that Davy's microscope incorporated these advanced refinements[40]. Other items in Davy's laboratory were glass retorts and tubing, spirit lamp, air pump with receiver, steam baths, mercurial baths (for raising the temperature to 170°F), a balance which was *distinctly affected by 1/100 of a grain,* bottles with glass stoppers, wires of gold, silver, platinum and copper, pieces of steel obtained from *pianoforte wires,* litmus paper, fine absorbent paper for wrapping salts and *fine cambric (white linen) for drying glass tubes.*

His range of chemicals was modest and included alcohol, ammonia, Black Manganese Oxide (for producing chlorine), camphor, Carrara Marble (pieces) for the production of carbonic acid by the action of dilute muriatic acid, chlorate of potash, distilled vinegar, iron filings *from the blacksmith's shop* (for the production of hydrogen by the action of sulphuric acid), hydrocyanic acid, mercury, muriatic acid (hydrochloric acid or spirit of salt), nitrous oxide gas, oil of turpentine (solvent of phosphorous), silver nitrate, sulphuric acid, sulphuric ether and water solutions of chlorine, iodine and bromine[41].

Clinical Instruments

In Davy's days the clinical instruments available for the physician were very few. In 1823 the stethoscope had not yet been introduced in the General Hospital at Fort Pitt, Chatham. Davy saw *this excellent instrument* in the autumn of the same year in Edinburgh and began to use it. He was enthusiastic about it. *Whoever employs the stethoscope,* he wrote, *though he may not appreciate its merits in the same high degree as the ingenious inventor of the instrument did, yet he cannot fail to derive instruction from its use, and to become better, more minutely, more discriminatively acquainted with the diseases of the chest.*

Davy was no less appreciative of the value of Leopold Auenbrugger's method of diagnosis by percussion of the chest. Indeed he was in favour of every method of clinical investigation *which directs and fixes the attention - drawing it away from vague and unmeaning generalities, the bane of knowledge, to precise and significant particulars -which are its essence -and which are equally important whether we have in view, during life, the symptoms of disease by the bedside of the patient, or, after death, on the dissecting table,the organic changes, the effect of diseased action.*
Davy had been using an oral thermometer since 1816[42]

Davy leaves Malta

Davy left Malta in 1835 but was here again for short periods after the 15th April 1838, in 1839 and, in transit, in November 1840. In the intervening years he was at Corfu and Chatham, occupying himself with the microscopical study of human pus cells, anatomical research work on the male generative organs of the Torpedo, common ray, and other fish. It may be of interest to learn that Davy had already (1838) examined microscopically the human spermatic fluid after death while at Chatham from twenty cadavers. The *spermatic animalcules* were first discovered in man by John Ham in 1677 and confirmed by A. Leuwenhoeck in the same year; yet Sir Everard Home maintained that *spermatic animalcules* had no real existence. Davy not only opposed Home's view but confirmed their presence in the spermatic fluid and also realised their medico-legal importance in *certain* doubtful criminal cases *where the microscopical examination of the fluid may reveal their presence and thus lead to decisive evidence. He found that though the spermatic fluid soon become putrid* when exposed to air, the *animalcules* resisted change *in a remarkable manner.* In fact he claimed to have detected them microscopically in *putrid* fluid wich had been kept for ten weeks and, in another specimen, which had been kept for a year and a half.

In January 1838 he carried out observations on the body temperature of mental patients under care in the Lunatic Asylum at Fort Clarence, Chatham, to check the notion - then current - that the temperature of mental patients was below the average of normal people. He found that this belief was erroneous. His studies confirmed the *well established fact* that *the insane bear degrees of heat and cold - which would be disagreeable to sane persons - without complaining.* He also noted that certain organic disease in mental patients, such as pulmonary tuberculosis, may be unaccompanied by the usual symptoms of cough and breathlessness but will show a raised temperature and a rapid pulse -two points of importance for the early detection of phthisis[43].

Discussion

John Davy commands our attention and respect because he endeavoured to discover truth and lay it before his colleagues in an objective and meaningful manner in over one hundred and fifty memoirs and papers; and because, thanks to his experimental work, he consolidated various innovative findings in the field of biological research of his time. In fact his merits lie mainly in his questioning the findings and deductions of previous investigators, in testing the accuracy of the results obtained by his contemporaries and checking the soundness of their speculations and clearing up uncertain ties in the areas of physiology and morbid anatomy; and finally, in the fact that the researches he undertook were not a mere quest for knowledge but were directed to practical ends.

Davy was a blend of physician, chemist and pathologist at a time when none of these practitioners had as yet emerged as distinct from one another and attained the status of specialists in their own rights. As such he was a representative of a new generation of doctor-scientists that appeared on the medical horizon at a time when pathology was still groping its way to gain an insight into the causes of disease and to explain clinical findings in terms of the underlying tissue changes revealed by post mortem examination; for although Gio. Batta Morgagni (1682-1771) and other workers had laid their knowledge and experience of pathological anatomy for the medical world of the eighteenth century, the study of gross and minute pathology had much farther still to go[44]. In fact pathology came into its own in the final years of Davy's professional life. It happend after Robert Virchow (1821-1902) applied the cellular concept (1839) of Theodor Schwann (1810-82) to his *cellular pathology* (1858); and after the rise of the new science of bacteriology, the staining of bacteria in tissues by carmine in 1871 and methyl violet in 1875 and the artificial reproduction of lesions in experimental animals[45] had become established procedures.

To appreciate Davy's efforts we must bear in mind that the state of medical knowledge was so poor in the mid-nineteenth century that medicine was being criticised for being rudimentary and involving *much guesswork*; and the President of the college of Physicians of England was regarded as being *so nearly on a level with the meanest herbalist*

With regard to physiology, it must be borne in mind that Davy was engaged in such research, years before the founder of modern physiology - Claude Bernard (1813-78) - came on the scene. In fact the year when Davy qualified as a doctor and started his experimental work (1814) was almost the same year in which Claude Bernard was born so that by the time that the French scientist had become renowned and was doing the best part of his work between 1840 and 1870[46], Davy was coming to the close of his medical career.

Davy prepared himself with a wide and varied reading of the literature then available. This comprised, apart from such contemporaries as Astley Cooper, Charles Bell, Lorenzo Spallanzani and R.F.H. Laennec, the naturalist and medical pioneers of the seventeenth and eighteenth centuries as Gio Batta Morgagni, John Hunter, William Harvey and A. Van Leuwenhoeck. His journals included the *Edinburgh Philosophical Journal* and the *Annales des Sciences Naturelles*[47].

The medico-legal experts of his time were in his debt for elucidating some of the problems in forensic medicine such as the action of insect larvae in determining the rate of putrefaction of bodies exposed to the air or immersed in water; the detection of *spermatic animalcules* in cases of alleged sexual assaults; and observing the temperature in the cadaver to determine the time elapsing between death and the necropsy.

His idea of *antisepsis,* to which he alludes when *discussing the preservative action of corrosive* sublimate and of lime on pathological specimens, is also worth noting in view of the fact that it shows that he had already grasped the significance of that concept before the age of bacteriology. This is not to say that he was among the first scientists to employ the word *antisepsis* because it had already come into use by 1712 (if not earlier) but his reference to the notion of antisepsis amply shows that he was receptive to the new concepts that heralded the germ theory of disease of Antonio Bassi (1773-1856), Louis Pasteur (1822-95) and its practical application by *Joseph Lister (1827-1912) in 1865*[48].

To what extent did Davy's work influence the study of chemistry, physiology and pathology in Malta? He certainl knew Dr. G. Aquilina, Professor of Chemistry at our university (1834-59), who had set up a *regular chemical laboratory* in that institution and whom Davy had judged to be a competent candidate for the professorship in 1834; Davy even honoured him, when he was in Malta in 1840, with his presence at one of Aquilina's lectures on chemistry *with which he expressed himself very satisfied*[49].

Physiology and pathology were taught by Dr. Stefano Grillet (1815-31) and, after a gap of two years, by Stefano Zerafa (1833-56). It is very likely that these two teachers were acquainted with Davy and his work. However that may be, there is no doubt of the influence exercised by British physiology on medical teaching in Malta in the late sixties. Indeed Dr. W.B. Carpenter's *Principles of General and Comparative Physiology*, then acclaimed as the *first English book which contained adequate conceptions of a science of biology*, was the textbook of physiology in the course of Medicine at the University of Malta[50].

Davy was well known for his active interest in the medical school of the island which was *always his favourite object* and to which he donated some books on chemistry and surgery (Appendix III). He had been appointed member of the University Council on the 1st November 1828 and in 1834 was invited to participate in a discussion on the planning of the medical curriculum and to examine the students in medicine. Even after leaving Malta in 1835 his interest in the medical school did not wane; so much so that when he passed through Malta for a few days in November 1840 on his way to Turkey, he made it a point to visit the university[51]. On that occasion he mixed freely with the students and declared himself so very satisfied with the *improvements that had been introduced* that it was thought likely that he would suggest the training of medical students from Turkey at the Malta medical school[52]. I have, however, found no indications so far that any young men came to Malta from Turkey to study medicine[53]. We have not been told what the *improvements* were; they certainly did not include a collection of pathological specimens at the Civil Hospital of Valletta - the teaching hospital of the medical school - because the *Societa' Medica d'Incoraggiamento di Malta* was requesting the setting up of a Pathological Museum (*gabinetto patologico*) and an *ad hoc* Dissection Room in the hospital in July 1848[54]. The absence of these features, however, does not mean that no pathological dissections were being performed at the Civil Hospital for teaching purposes for Davy himself has recorded that his *talented friend* Dr.Charles Galland, professor of Anatomy at the university (1839-58), had examined no less than six hundred and fifteen bodies of civilian patients dying from various diseases during the period December 1840 - December 1841[55]. Unfortunately none of Galland's work was published and it is not known whether their manuscript records have survived and still await discovery.

Davy's Relevance To-day.

Apart from enriching the historical tie of the magnificent edifice of the Holy Infirmary, now the Mediterranean Conference Centre, with its medical past, Davy provides us with scientific principles that remain of fundamental value in the pursuit of the study of pathology in spite of the passage of almost one hundred and fifty years. In view of their soundness and their emphasis on thoroughness of examination and on attention to tidyness, they bear recalling for the benefit of our present generation of medical men.

(a) The main objects of pathological dissection are:-
(i) the detection of the effects of disease on the human body and of the cause of death;
(ii) the removal of diseased parts from the cadaver for preservation in a museum; and
(iii) the acquisition of general anatomical knowledge.

(b) Every dissection should be carried out methodically with neatness and cleanliness. Thus conducted it promotes the dexterity of the hand for surgical operations on the living and trains the eye to distinguish between what is sound in structure and what is diseased.

(c) Parts of the body meant for preservation should be dissected out so as to be seen to the best advantage when mounted and in order to appear by themselves as intelligible as possible and to require very little explanation.

(d) Specimens should be freed from extraneous tissues at once; washed in running water and immersed immediately in *strong spirit* and mounted as they are intended to remain for display. The spirit should be changed after a month for fresh spirit and the mouth of the jar or vessel should be firmly secured.

(e) We must cultivate a cautious attitude of mind regarding the speculations and opinions of research workers who preceeded us in the field lest we are misled by the uncritical acceptance of their views and conclusions[56].

As has already been mentioned, Davy's experiments were performed at the erthswhile Holy Infirmary of the Knights of St John at Valletta, which had already become memorable in the time of that hospitaller Order as a house of healing (1575-1798) and as the cradle of the Medical School of Malta (1676). In 1800 the Holy Infirmary was turned into the general hospital of the British Military garrison stationed in Malta (1800-1920).

Very likely Davy's *laboratory*, where he also performed some of his dissections, was none other than the pharmacy laboratory of the Knights which still existed in his own time. It occupied one side of the so-called Upper Quadrangle of the hospital abutting on Merchants Street. The building suffered extensive destruction by air bombing by the Axis powers during the Second World War and all traces of John Davy's laboratory were erased. The site is now occupied by a block of flats.

By recording his investigations and experiments from this hospital in his two volumes of *Researches Physiological and Anatomical*[57], John Davy adds a novel role to the historical record of the ancient Holy Infirmary as a pioneering source of physiological, pathological and chemical research in the early decades of the nineteenth century.

Appendix I

Medical and other Literature quoted by Dr. John Davy

J. Abernethy. *Surgical and Physiological Essays, London, 1793.*

Aristotle. *De Historia Animalium,* (Latin translation by Theodore Gaza). Venice, 1476.

M. Baillie. *The Morbid Anatomy of Some of the Most Important Parts of the Human Body,* London, 1807.

C. Bell. *The Nervous System of the Human Body,* London, 1830.

M.F.X. Bichat *Anatomia Generale,* Paris, 1818.

J. Bostock. *An Elementary System of Physiology,* London, 1824-7.

A. Cooper. *The Principles and Practice of Surgery,* London, 1836-7.

G. Cuvier. *Histoire Naturelle des Poissons,* Paris, 1828 *Le Regne Animal,* Paris, 1817. *Lecons d'Anatomie Comparée,* Paris, 1800-5.

M. Faraday. *Experimental Researches on Electricity,* London, 1839.

S. Hales. *Statistical Essays,* London, 1738-40.

A. Haller. *Elementa Physiologicae Corporis Humani,* Lausanne, 1757. *Opuscula Anatomica de Respiratione,* Gottingen, 1751.

W. Harvey. *Exercitatio Anatomica de Cordis et Sanguinis Motu,* Rotterdam, 1648.

E. Home. *Lectures on Comparative Anatomy* London, 1814.

J. Hunter. *Observations on Certain Parts of the Animal Economy,* London, 1786.

R.F.H. Laennec. *A Treatise on the Diseases of the Chest* (Translated by John Forbes), London, 1821.

A. Leuwenhoeck *Letter to Lord Brouncker dated 1677. Philosophical Transactions,* Vol. 12.

S. Lorenzini. *Osservazioni intorno alle Torpedini,* Firenze, 1678.

F. Magendie. *Traitè des membranes,* Paris, 1827.

J.F. Meckel. *Manuel d'Anatomie Generale, Descriptive et Pathologique,* Paris, 1825.

A. Monro. *The Structure and Physiology of Fishes,* Edinburgh, 1785.

G.B. Morgagni. *De Sedibus et Causis Morborum,* Venice, 1761.

J. Muller. *Diss. inaug. Physiologica Sistens Commentarios de Phenomena Animalium,* Bonnae, 1822. *Plinius Secundus. Naturalis Historiae,* Leiden, 1669.

J. Pringle. *Observations on the Diseases of the Army,* London, 1752.

G. Proschaska. *Disquisitio Anat. Phys. Organismi Corp. Human ejusque Procesus vit.,* Vien, 1812.

G. Rondolet. *Libri de Piscibus,* Lugduni, 1554.

L. Spallanzani. *Memoires sur la Respiration,* Geneva, 1803.

G. Winthringham. *An Experimental Inquiry on Some Parts of the Animal Structure,* London, 1740.

Journals. *Annales de Chimie et de Physique; Annales des Sciences Naturelles;* Edinburgh Philosophical Journal; Philosophical Transac tions of the Royal Society (London).

Appendix II

RESEARCHES
PHYSIOLOGICAL AND ANATOMICAL
By
JOHN DAVY MD FRS
Assistant Inspector of Army Hospitals
In Two Volumes
London.
SMITH, ELDER AND CO. 65, Cornhill,
MDCCCXXXIX

The work is dedicated

TO
THE DIRECTOR GENERAL
OF
THE ARMY MEDICAL DEPARTMENT
AND TO THE
MEDICAL OFFICERS OF THE ARMY
THESE VOLUMES
ARE RESPECTFULLY INSCRIBED.

Illustrations.

Volume I. There are thirteen plates drawn on stone by Mr. Ford from specimens preserved in spirit or from drawings of specimens in the fresh state. Twelve of these plates illustrate parts of the anatomy of the Torpedo fish. The thirteenth plate shows the anatomical variations of the basilar and vertebral arteries described in the text; the carotid artery of the dog in three stages of healing after being partially divided; and the microscopical appearance of the fluid of the human seminal vescicles.

Volume II. It contains three plates showing peculiarities of structure of the common biliary duct; the male genital organs of the Torpedo and of the thornback; and the microscopical appearance of pus globules.

Appendix III

Papers and books donated by Dr. John Davy to the University Library.

1. **Davy, John.** Some Observations on Phosphorus.
2. **Davy, John.** Some Experiments and Observations on the Combination of Carbonic Acid and Ammonia. Dated Malta, May 8th, 1833. *Edinburgh New Philosophical Journal* for April 1834.
3. **Davy, John.** I. Some Observations on a Note of M.A. Van Beek Purporting to Point Out an Error in the Bakerian Lecture of the late Sir Humphrey Davy 'On the Relations of Electrical and Chemical Changes'.

II. Some Observations on Euchlorine relative to the Question of its Decomposition. Dated Malta 1st March 1834. *Edinburgh New Philosophical Journal* for July 1834.

4. **Davy, John.** Observations on the Torpedo with an Account of Some Additional Experiments on its Electricity. *Philosophical Transactions.* Part II for 1834 (London).
5. **Fourcroy, A.F.** Chemical Philosophy on the Established Basis of Modern Chemistry, 3rd Edition, London, 1807.

A.F. Fourcroy (1755-1809), besides being a medical man, was also a chemist. His *Chemical Philosophy* describes the instruments used and the operations performed by chemists at the beginning of the 19th century. In fact this book was considered to be *the best elementary work* on chemistry. It deals, among other items, with the action of light on chemicals, the oxidation of metals and the investigation of animal and vegetable compounds. The book had a wide diffusion on the continent so much so that it was translated in German, Swedish, Danish, Italian, Spanish and Greek.

6. **Lavoisier, Anton.** Elements of Chemistry in a New Systematic Order. Translated by Robert Kerr, 3rd Edition, Edinburgh, 1796. Anton Lavoisier (1743-94) was a French chemist who stressed the importance of accurate observation and of testing theory by experiments in search for scientific truth. The *Elements of Chemistry* contains a number of plates showing equipment and instruments used in chemical investigations.
7. **Robertson, Archibald.** *Colloquia Anatomica, Physiologica atque Chemica Quaestionibus et Responsis ad usum ingenuae Juventutis Accommodatam,* Edinburgh, 1810.

This is a pocket book intended as an aid to refresh the memory of the student regarding the main topics in anatomy, physiology and chemistry of body fluids; in fact it consists of a series of questions and answers - a sort of catechism - on osteology, musculature, special senses, nervous system, internal organs etc; on the chemical composition of mucus, milk, urine, inspired and expired air, etc.

The author wrote in Latin because books on medicine were still being written in that language in his time and because he wished to encourage students to cultivate Latin because of its "elegance" of expression.

8. **Velpeau, Alfred Armand Louis Marie.** *Nuovi Elementi di Medicina Operatoria,* Milano, 1833.

This Italian translation of Velpeau's work on operative surgery, besides 941 pages of text, contains twenty copper engravings showing various surgical instruments and operative procedures. Velpeau (1795-1867) was a surgeon of great experience and Professor of Clinical Surgery in Paris Faculty. He was also an obstetrician with special interest in the causes of mortality of women in childbirth.

All these books and papers are inscribed in Davy's handwriting *For the use of the Medical School, Malta, from J. Davy* or *Presented to the University Library by Dr. Davy*; or *For the University Library from the author* in the case of his four papers, the first three of which contain corrections of a few misprints in the text in the author's hand. They all bear a rubber stamp with the words *Public Library Malta* or *Malta Government Library* or *Royal Malta Library*.

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1. **P. Pringle.** *The Romance of Medicine,* London, 1948, p.118.
2. **C.R. Long.** *A History of Pathology,* New York, 1965, p. 93.
3. *Dictionary of National Biography,* Vol. XIV, London, 1888, p. 196.
4. *Storia della Societa Medica d'Incoraggiamento di Malta,* Malta, 1845, pp. 12 & 29.
5. **J. Davy.** *Notes and Observations on the Ionian Islands and Malta,* London, 1842, Vol. 2, p. 295. Malta Government Gazette 5th November 1828, p. 337.
6. **J.G. Lockhart.** *Memoirs of the Life of Sir Walter Scott,* Paris, 1842, Vol. IV, p. 293.
   J. Gray. *History of the Royal Medical Society,* Edinburgh, 1952, p. 115.
7. **A. Mozley.** *Letters and Correspondence of John Henry Newman,* London, 1891, Vol. I, p. 341.
8. **J. Davy.** *Notes etc.,* Vol. I, p. 400.
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    J. Gray, op. cit. pp. 114-5.
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12. **J. Davy.** *Researches etc.* Vol. I, pp. 106-9, 293 & 307-8.
13. **J. Davy, op., cit.,** Vol. I, pp. 228-36, 240-48 & 444.
14. **J. Davy, op., cit.,** Vol. I, p. 227.
15. **J. Davy, op., cit.,** Vol. II, p. 280.
16. **J. Davy, op., cit.,** Vol. II, pp. 290-4, 296 & 298.
17. **J. Davy, op., cit.,** Vol. II, p. 329.
18. **J. Davy, op., cit.,** Vol. II, p. 331, 337, 339-40 & 352.
19. **J. Davy, op., cit.,** Vol. II, pp. 373, 377 & 410.
20. **T.S. Hall.** *History of General Physiology,* Chicaco & London, 1969, Vol. II, pp. 175-77.
21. **C.A. Linne.** *Systema Vegetabilium,* Lugduni, 1796, Vol. II, pp. 1285 and 1392-5.
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22. **J. Davy.** *Researches etc,* Vol. II, pp. 1-79, 86, 113, 133 & 193.
    W.M. Dawson. *Medicine and Science Bibliographical Catalogue,* London, 1956, p. 271.
23. **J. Davy.** *Researches etc., Vol. I. pp. 355-76, 382, 417 & 425.*
24. **F.J. Cole.** *A History of Comparative Anatomy,* London, 1949, pp. 445 & 450.
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26. **G. Gulia.** *Prontuario di Storia Naturale,* Malta, 1889-90, pp. 39-40. calls it Ħaddiela imtabbgħa (sic) jew tal-għajnejn.
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27. **J. Davy** *Researches etc.,* Vol. I, p. 127.
28. **J. Davy.** *Researches etc.,* Vol. I, pp.1-7, 12, 21, 23, 27-8, 35, 38-9, 46, 52, 69, 75 & 79.
29. **J. Davy** *Researches etc.,* Vol. I, pp. 340, 346, 3512 & 354.
30. *Edinburgh New Philosophical Journal,* April, 1834.
31. *Ibidem,* July 1833.
32. *Ibidem,* July 1834.
33. Misc. 236, National Malta Library, Valletta.
34. **G.J. Goodfield.** *The Growth of Scientific Physiology,* London, 1960, p. 76.
35. **J. Davy.** *An Account of Some Experiments on Animal Heat.* Philosophical Transactions of the Royal Society, London, 1814, p. 390.
36. **J. Davy.** *Researches etc.,* Vol, I, pp. 218-23.
37. Fort Pitt was built between 1805 and 1819. It was adapted as/a hospital in 1824. It was closed down in 1860 but was again used as a hospital during the 1914-18 war. Col. (Retd) A Tennucci, RAMC Historical Museum, Aldershot. Personal communication 1983.
    J. Davy. *Researches etc.,* Vol. I, Plate XIII. fig. 2.
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43. **J. Davy.** *Researches etc.,* Vol. I, pp. 206-7 & 338; Vol. II, pp. 439, 453, 472 & 480.
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54. Storia della Societa Medica ecc, pp. 200-1.
55. **J. Davy** *Notes etc.,* Vol. II, p. 301.
56. **J. Davy** *Researches etc.,* Vol. I, pp. 343, 417 & 425.
57. Appendix II.