Introductory lecture on organic chemistry, delivered at the Royal School of Medicine and Surgery, Birmingham / [John Percy].

INTRODUCTORY LECTURE

ON

ORGANIC CHEMISTRY,

DELIVERED AT THE

ROYAL SCHOOL OF MEDICINE AND SURGERY,

BIRMINGHAM.

SESSION, 1842—1843.

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1843.

TO

JOHN EDWARDS PIERCY, ESQUIRE,

HIGH SHERIFF OF THE COUNTY OF STAFFORD,

This Lecture is Dedicated,

WITH EVERY SENTIMENT OF RESPECT,

BY HIS SON-IN-LAW,

THE AUTHOR.

LECTURE.

GENTLEMEN.

IT appears to me expedient to preface my Lectures with observations of a general character concerning Organic Chemistry, to consider its relations to medical science, and then briefly to explain the system of acquiring correct and practical chemical knowledge.

Chemistry, you know, is the science which has for its object the study of the ultimate or undecomposable elements of matter, and the action of these elements upon each other. I must presume that under the teaching of my colleague, Mr. WOOLRICH, you have acquired precise information concerning the atomic theory, which is the very foundation of chemical science. It is more amusing than profitable, to review the varied and fanciful notions which have been entertained by the philosophers of antiquity, in respect to the term atom. Matter was believed to be susceptible of infinite divisibility, and in proof of this belief, arguments of a mathematical character were advanced. Now, although we can conceive of no particle of matter so minute as to be incapable of further division at the will of the Omnipotent Creator, yet, as it appears to me, we can readily conceive of particles of definite size and form, which the Creator has ordained to be incapable of further division under the present system of laws which regulate the material universe. Lay hold, Gentlemen, clearly of this simple conception, and you have at once the key to the atomic theory, in accordance with which, all matter is supposed to consist of indivisible atoms of determinate *weight*

and *form*. It does not, however, become me to transgress further upon the limits of that department which is assigned to Mr. WOOLRICH.

You have already examined the relations which the elementary bodies bear to, and the actions which they exert upon, each other; and your attention has been directed to a great variety of compounds, which are either presented in the inorganic kingdom of nature, or may be produced in the laboratory of the chemist. It now devolves upon me to unfold to you a wonderful and most extensive series of compounds, which are formed in the economy of plants and animals, the study of which compounds, and of others derived from them, is the object of Organic Chemistry. In this division of chemical science, of which, at no very distant period, scarcely any thing satisfactory was known, extraordinary progress has of late been made. Before proceeding, permit me to caution you against the error of supposing that there exist two distinct kinds of chemistry, of which one is confined to the inanimate, and the other to the animate kingdom of nature. The forces engaged in chemical phænomena are universal and constant, and are as active in animate as in inanimate matter;—they are as active in the laboratory of living nature as in that of the Chemist; in the one case they are modified or controlled by other forces, which are known only to exist in association with life; while, in the other case, they are influenced only by forces of a purely physical character. When I speak of chemical forces being controlled or modified by vital forces, I may, in order to explain more clearly my meaning, have recourse to a familiar, though not a perfect illustration. Conceive of two springs, identical in all respects, so placed as that they shall oppose each other. Now, although the two springs are at rest, yet the elastic force of each is in constant activity; for the moment one spring is removed, the other instantly expands or contracts, as the case may be.

It may not, Gentlemen, be useless to offer a few obser-

vations on the terms, *law* and *force*, as employed in scientific phraseology, for there cannot be precision of language without great precision and clearness of thought. By the term *law* is implied simply the *expression* of a *fact*, of a greater or less degree of *generality*. Thus, when any given body A, combines chemically with any other given body B, in several proportions, it is a fact that the weight of B, in that particular compound in which A is combined with the smallest proportion of B, is contained in every other compound of A and B, in a perfectly definite ratio, as 2 B, 3 B, 4 B, et cæt. Now this fact is one of the greatest degree of generality,—extending to every known chemical combination; it is, then, a general law, known to you as the law of definite multiples. Now every single and isolated fact is in truth a law, so far as concerns the particular body to which the fact applies: the term law, however, is conventionally restricted to a fact of great generality, or what is the same thing, to a classification of facts. For when we speak of the generality of a fact, we mean necessarily, a collection of particular and identical facts:—thus, when we say, it is a law that chlorine combines with all metals, we state a collection of facts; that chlorine combines with iron, which is a particular fact; that it combines with copper, which is another particular fact, and so forth.

Let us next proceed briefly to consider the true import of the term *force*. When a little yeast is added to a solution of sugar, at a suitable temperature, a remarkable action is soon excited, termed fermentation; by virtue of which the sugar is resolved into two distinct compounds, carbonic acid, on the one hand, and alcohol, on the other. This resolution is complete; the composition of the sugar being precisely represented by that of the carbonic acid and alcohol produced. Here then we have presented to our attention the singular fact of one body exciting a transposition of elements another body, without the former participating in any degree, in this transposition. Now the yeast has *exerted an influence*, which must imply the existence of

some particular *power* or *force*. Revolve this illustration, derived from the process of fermentation carefully in your minds, and you will arrive at a clear idea of what is meant by the term *force*.

This idea of force appears to be an essential element of every sound human understanding; but further than the idea itself, we know scarcely any thing, except that ultimately every force may be traced to the will of the Creator. All that we are enabled to explore in reference to forces is simply the condition under which any particular force may be developed. Upon this subject I might expatiate at great length, but the preceding observations will, I trust, be found sufficient for the object of the present introductory lecture. Let me impress upon you deeply the absolute necessity of correct mental discipline, if you would successfully prosecute the study of any science; for without such discipline it will be difficult for you to make a practical and satisfactory application of the facts with which you are at present occupied in storing your minds.

The division of chemistry into inorganic and organic, however convenient and practical, is conventional and arbitrary, not in reality being founded in nature: for, as I have before remarked, the forces concerned in the chemistry of inanimate nature, are as active and constant in animate nature, although in the last case these forces concur with others which are known only to exist in the living economy, whether of plants or animals. The laws which apply to the combinations of inorganic, apply also to those of organic, chemistry. Of the truth of this statement we shall discover ample evidence as we proceed; and for the elimination of this truth, so interesting and so important, we are, I conceive, mainly indebted to Gay Lussac and Liebig. The term organic, then, applied to chemistry, refers simply to the origin of the substances, of which this department of chemical science takes cognizance.

Let us now direct our attention to the principal features of

difference by which inorganic substances are distinguished from those of organic origin, and in the first place, the general difference of elementary constitution.

In inorganic chemistry, you have observed, that the differences between the various combinations which have been presented to your notice are referrible chiefly to a variety of elements, or to a very limited variation in the definite proportion of one element in any given series of compounds. Even in examples of greatest variation in this respect, we find that the proportion is rarely increased to five multiples. Now in Organic Chemistry, on the contrary, notwithstanding the extraordinary variety of compounds, we find that four elements only, oxygen, hydrogen, carbon, and nitrogen, are generally met with. In many organic substances, as the majority of the essential oils, carbon and hydrogen alone are present; and what is still more remarkable in many of these oils, which physically differ in so marked a degree from each other, the carbon and hydrogen exist in the same proportions. In illustration, I may mention oil of sabine, oil of juniper, oil of citron, and oil of turpentine. In many other organic compounds, nitrogen is present. We have, then, in respect to elementary constitution, four principal classes.

1st. That in which two elements only are present. Carbon and oxygen, as in oxalic acid. Carbon and hydrogen, as in most of the essential oils. Carbon and nitrogen, as in cyanogen. Hydrogen and nitrogen as in ammonia, which, however, together with cyanogen, may not improperly be regarded as belonging both to organic and inorganic chemistry.

2nd. That in which three of the preceding elements are present. Generally, oxygen, hydrogen and carbon, as in sugar. Hydrogen, nitrogen and carbon as in prussic acid.

3rd. That in which the four elements, oxygen, hydrogen, carbon and nitrogen, are present. As in urea, albumen, et cæt.

4th. That in which an additional element exists, as in cystic oxide, which contains sulphur in addition to oxygen, hydrogen,

carbon and nitrogen. In sulphocyanogen, we have carbon, nitrogen and sulphur, and in hydrosulphocyanic acid, we have also hydrogen. In hydroferrocyanic acid we have carbon, hydrogen, nitrogen and iron,—and so forth.

When, Gentlemen, we survey the kingdom of living nature, and behold the all but infinite diversity of product which that kingdom presents; and when we reflect upon the fact that this diversity generally arises from the combination of the three or four elements which I have just mentioned, we cannot but be filled with admiration. Who could have imagined that the delicious fragrance of the rose and the offensive odour of our coal gas, should be produced by the same two elements, carbon and hydrogen, combined in different proportions? Who could have imagined that whilst the four elements, hydrogen, carbon, oxygen and nitrogen, constitute in one proportion of combination the pabulum of animal life as flesh, they should in another, produce a most deadly poison, as morphia or conia?—or in a different proportion still, should form one of the most valuable tonics which we possess, as quina? I know not of any department of science more calculated than Organic Chemistry when properly explored to inspire the human intellect with the knowledge of its own littleness, and to replenish it with vast conceptions of the wisdom and omnipotence of our God. Gentlemen, this is no digression. On occasions appropriate like the present, I regard it not only a paramount duty, but a most exalting privilege to make science subservient, as it ever must be, to the manifestation of the glory of the Most High.

We now pass on in the second place, to the consideration of other general points of difference between organic and inorganic substances. In respect to purely physical characters, there is no line of demarcation between the two classes. Organic substances occur in the form of gas, of liquid, and of solid, when they are either amorphous or crystallised; or possess, and this is a point at which I wish to arrest your attention, a certain peculiarity of

structure essentially removed from crystallisation. It appears to me that a wide distinction should be made between organic substances purely crystalline and amorphous, and those which present the peculiarity of structure just mentioned; and after careful reflection, I am convinced, that owing to the neglect of this distinction, much confusion has arisen; chemists having hitherto in vain attempted to apply satisfactorily the laws which regulate amorphous and crystalline combinations, to those which contain a substance, the particles of which have a definite, organic form. This, however, is a subject requiring much further investigation. Fibrin, albumen, pus, et cæt., are not improbably substances of the kind to which I refer.

When organic substances are subjected to heat in a retort, four circumstances may occur.

1st. Sublimation, or volatilization without decomposition. Examples, benzoic acid, and alcohol.

2nd. Complete sublimation may occur with the formation of new products. This has been termed the white distillation because there is no carbonaceous residuum. Example, gallic acid.

3rd. Partial sublimation or volatilization, and partial decomposition, with the production of a carbonaceous residuum; and other empyreumatic products. Example, margaric acid.

4th. Total decomposition, when it is called destructive distillation.

a. In the case of organic matters not containing nitrogen with the formation of water, acetic acid, empyreumatic oils and tar; and under certain conditions a liquid having a remarkable analogy with alcohol, known as pyroxylic spirit or wood naptha, and lastly, gaseous matter, consisting generally of carbonic acid, carbonic oxide and carburetted hydrogen.

b. In the case of organic substances containing nitrogen, carbonate of ammonia is also formed, in addition to the preceding matters.

When sufficiently heated in contact with oxygen, or certain materials containing oxygen, as chlorate of potass, oxide of copper, and chromate of lead, organic substances are resolved completely into carbonic acid and water; and in the case of those in which nitrogen exists, this element is also liberated at the same time, in a free state. This statement, it will be understood, applies only to organic compounds in which no element besides oxygen, hydrogen, carbon, and nitrogen is present. Upon these principles is conducted the present refined method of organic analysis, to the perfection of which is to be ascribed the advanced and progressing condition of Organic Chemistry.

When azotized organic matters are heated, with certain precautions, with potass, soda, or lime, all the nitrogen is evolved, in the form of ammonia, which may be readily collected in an acid solution. The ammonia may then be completely abstracted in the insoluble form of ammonio-chloride of platinum, from the weight of which may be estimated the quantity of ammonia, and consequently that of the nitrogen contained originally in the organic matter employed.

An extensive series of organic substances, when exposed to certain conditions, undergo what is termed the process of putrefaction or spontaneous decay.* This process may be properly defined to be a molecular change, by virtue of which the putrefying matter is resolved into binary compounds of various kinds, of which the principal are, carbonic acid, carburetted hydrogen, and in the instance of those containing nitrogen, ammonia. It appears to be a general law, that organic particles in an active state of change or decomposition, tend to excite a similar change in

* Vide "Organic Chemistry with its application to Agriculture and Physiology," by LIEBIG, p. 217, et seq. A distinction is made between *putrefaction* and *decay*; the latter being a process of slow oxidation, and not simply a molecular change. I have here employed both terms in their general acceptation. The distinction, however, of LIEBIG, is in a strictly chemical point of view correct and philosophical.

contiguous particles, whether of the same or of a different nature. Thus yeast, or putrid flesh, of which the particles are undergoing the process of decomposition, excites fermentation in saccharine liquors; and fermentation, as I have already remarked, is simply the resolution of sugar into two other compounds, alcohol and carbonic acid. Decay, then, may be said to propagate decay. Digestion itself, may not improbably be classed amongst a similar series of phænomena; and in the sequel I shall have occasion to adduce other apposite illustrations. During the progress of putrefaction of organic substances, minute fungi and animalcules are frequently observed; and in this respect, there is a wide difference between substances of organic, and those of inorganic origin. Towards the termination of the course, I shall enter into detail concerning putrefaction, which, when clearly understood, is calculated to excite considerable surprise, especially in the popular mind. It is a curious reflection, that our bodies, when committed to the tomb, rapidly become the subjects of decomposition, and are resolved into compounds, principally gaseous, which escape through the ground, and may serve as nutriment to vegetation; and vegetable matter, in its turn, may again become the food of man or other animals. The gastronomic portion of our race would be not a little startled, could they but trace the atoms, which in various states of combination are eaten with relish and avidity, through the long and changing course of their past history. What Hamlet uttered in respect to Alexander and Cæsar, although not literally, is yet, as you will at once understand, virtually correct.

"Alexander died, Alexander was buried, Alexander returneth into dust; the dust is earth; of earth we make loam: and why of that loam, whereto he was converted, might they not stop a beer-barrel?"

"Imperial Cæsar, dead, and turn'd to clay,
Might stop a hole to keep the wind away.
O, that that earth, which kept the world in awe,
Should patch a wall to expel the winter's flaw."

The definite combinations of Organic Chemistry, which exist ready formed in nature, have received the name of *proximate* or *immediate principles;* but these principles may themselves be binary, ternary, et cæt. compounds. Thus crystallized cane sugar is a proximate or immediate vegetable principle, a definite combination, which, from whatever source obtained, or however extracted and prepared, uniformly has the same ultimate composition, that is, contains the same proportions of oxygen, hydrogen, and carbon. There is, however, reason to believe that these elements are not directly combined in sugar, but that the sugar itself is the result of the union of secondary and more simple principles. Oxalic acid, for example, is composed of two atoms of carbon, three of oxygen, and one or three of water. Now you will find that one atom of carbonic acid, and one atom of carbonic oxide, represent precisely the constitution of oxalic acid, without the water. And accordingly, by the action of a body which has a powerful affinity for water, as strong sulphuric acid, oxalic acid is resolved into equal volumes of carbonic acid and carbonic oxide. I merely avail myself of oxalic acid for the purpose of practical illustration, and I am not prepared to maintain, that, in the case of this acid, the oxygen and carbon are primarily united in the two forms of carbonic acid and carbonic oxide. Cane sugar, grape sugar, quina, morphia, et cæt. are familiar examples of vegetable proximate principles; and urea, cholesterine, stearine, sugar of milk, et cæt. afford illustrations of similar principles in the animal kingdom. In nature these principles generally exist in association with a variety of other matters, from which sometimes it is extremely difficult satisfactorily to separate them; and it is only in modern times that progress has been made in this department of practical chemistry.

Permit me, now, Gentlemen, to offer some observations in respect to the apparatus which nature employs in the formation of her wonderful variety of organic products. The term organic implies, as you are aware, a relation to living organs; and these organs, presenting an almost infinite variety of forms in the vegetable and animal kingdoms, constitute the apparatus to which I allude, and upon the elaborate character of which let us reflect for a few moments. We are quite sure that there is no superfluity in the works of nature. Hence, we must conclude that every delicate membrane, every vesicle, every minute tube, every perforation, is adapted to some important end; and must, doubtless, exert an influence, however inappreciable by us at present, in the production of chemical combinations; for it may be laid down as a general, if not a universal principle, that variation in structure corresponds to variation in chemical product. Can it be imagined that in the bark tree there is not a structural peculiarity, or what is the same thing, a special organisation not only adapted but essential to the formation of quina? Can it be imagined that in the poppy there exists not a special organisation for the formation of morphia? It would be needless to repeat the question in reference to other immediate principles. It might, perhaps, be objected that the microscope reveals not this supposed difference of organisation; but in reply, it may be urged that notwithstanding the advanced state of optical science, there yet remains a world, the limits of which no one can circumscribe, and which the microscope has never explored. What the extent, indeed, may be between the minutest particle capable of being observed by the aid of the most powerful microscope, and an organic particle, who can tell? There are many delicate membranes which liquids freely permeate; and which, therefore, must abound in perforations, although such perforations have never been demonstrated by the aid of the microscope. Now we know that even in inorganic chemistry, structure does exert a very remarkable influence in determining the combination of

elements. Platina, for instance, in the form of sponge instantly occasions the ignition and combination of a mixture of hydrogen and oxygen in proper proportions. Is it not then reasonable, in the highest degree, to conclude that the intricate and elaborate apparatus of the animal and vegetable kingdoms is of essential importance in the laboratory of nature? Doubtless the various tubes and vesicles are adjusted and proportioned to each other with *atomic* accuracy, if I may be allowed the expression. How far the apparatus of nature may be instrumental in the chemistry of nature, we are at present, and not improbably shall ever remain, unable satisfactorily to determine. The labour of future chemists will throw light upon this delightful and interesting subject of enquiry, by shewing what may, and what may not, be effected without the aid of the apparatus of nature. Gentlemen, I would not expose myself to the imputation of being too chemical, when I broadly assert my conviction that chemistry is far more predominant in the economy of living beings, than physicians and many physiologists are willing to admit. It is easy to talk about a vital principle, and of the immediate influence of this principle in effecting chemical combinations; but where I would ask, do we discern its operation except through complicated organisation? Here, Gentlemen, let me be clearly understood. No organisation can be formed without life, and life is essential to the due performance of those functions, such as circulation, respiration, et cæt. by virtue of which the nutrient liquids of the system are elaborated and circulated through the respective organs. The formation of organic substances requires organisation or apparatus, and the distribution in a particular manner of the matter (the blood in animals and the sap in plants) from which these substances are produced, to the various parts of the organisation; and this distribution can only be effected, the necessary conditions of circulation and respiration can only be complied with, in the living economy. Hence, although life is essential in the operations of vital chemistry, yet it does not appear to

exert so immediate an effect, as is generally supposed, in the chemical actions which are perpetually occurring in plants and animals.

One important result of modern discoveries in chemical science has been the overthrowing of the high wall of separation which was generally believed to exist between the chemistry of animate and that of inanimate nature. It was imagined that the atoms of the various definite combinations with which we meet in the animal and vegetable kingdoms, received from the vital principle some new and peculiar properties by virtue of which they were enabled to enter into new and peculiar states of arrangement; and which properties they retained until they were reduced either to the form of isolated elements or binary combinations, such as carbonic acid. It has, however, of late been discovered that some very remarkable substances, which were supposed to be generated exclusively under the immediate influence of the vital principle, may now be artificially produced; and the probability is that the number of such substances will be greatly augmented. Let us ever be cautious to guard ourselves from the extremes of assigning either too little to the operation of forces purely chemical, or too much to that of forces purely vital; and vice versa; a position which in the present state of science it is difficult to maintain. Many of the processes of nature are too recondite for our limited and feeble powers of penetration. Here we may adopt with propriety the language of the illustrious BERZELIUS, who writes "Our researches daily teach us more of the admirable construction of organic bodies, and it will always be more honourable to admire the wisdom which we cannot follow, than to wish to elevate ourselves, with a philosophical arrogance, and by worthless reasoning to an imaginary knowledge of things, which will probably for ever elude the grasp of our understanding."

The opinions, Gentlemen, which I have attempted to advocate in the foregoing observations are similar in great measure to those

advanced by DUMAS and BERZELIUS, the former of whom writes, "In my opinion there exist no organic matters. That is to say, that in organised beings I behold only a collection of apparatus of slow operation, acting upon nascent matters, and thus producing inorganic combinations very diversified, out of a small number of elements." BERZELIUS expresses himself as follows "A living body considered in a chemical point of view, is a laboratory where chemical operations are carried on by means of instruments adapted to the production of the organic substance, which is intended to be generated: these instruments receive the name of *organs,* and from this is derived the name of *organic nature,* which is applied to living nature, and which we extend to the results and products of living bodies, until their elements are again combined in precisely the same manner as in inorganic nature." Yes, let us ever keep in remembrance these instruments, of the nature and influence of which we are yet profoundly ignorant; for until we know more of them, it is vain to speculate, to any great extent, upon many of the obscure operations of the chemistry of living beings. Let us reflect upon the mysterious effects which are attributed in inorganic nature to what is termed catalysis; effects which appear to be determined by the presence of a body which does not in the smallest degree participate in the chemical action; and then let us extend our reflection to the apparatus contained in the laboratory of living nature. Dr. DAUBENY, it seems to me, remarks with propriety, that "there is little doubt, that the progress of research will bring to our knowledge many similar cases, (referring to the artificial production of *urea* and *formic* acid,) and that it will eventually appear that all the other secretions or excretions of animals and vegetables, are only so far dependent upon life, inasmuch as, in consequence of the favourable temperature which it sustains, the constant circulation of the fluids it occasions, and their exposure to external agents in vessels of different shapes and dimensions, a mechanical separation of the ingre-

dients of the blood is effected in some instances, and a chemical change produced in its constitution by *catalytic* action in others."

We now proceed succinctly to consider the relation of Organic Chemistry to the science of medicine.

Physicians of all ages have been prone to commit the error of maintaining *opinions too exclusive* in respect to the nature and treatment of disease. While some have attempted to refer the seat of almost all diseases to the *solids* of the body, others have referred this seat to the *liquids*. This wide difference of opinion is to be explained on the ground of ignorance, and cannot excite surprise when we consider the extremely intricate character of the living organism both as relates to structure, and to function. All correct knowledge of disease must be based upon correct views of physiology, and the very foundation of physiology consists of anatomy and Organic Chemistry. To the physiologist, the truth of this assertion will at once be palpable. We shall not, I think, be liable to the charge of being too sanguine, when we express our confident anticipation that at no distant period, when microscopic anatomy and Organic Chemistry, twin sciences in respect to medicine, shall have attained a higher degree of perfection, more rational views of the nature of disease will be entertained, and consequently more rational methods of treatment adopted.

The intimate nature of the relation of Organic Chemistry to medical science will appear when we examine an extensive series of diseases which are prominently characterised by a deviation in the chemical constitution of the secretions from the condition of health. As examples I may enumerate the following. In rheumatism and gout we have an increase in the quantity of uric acid; in Bright's disease, as well as in some other states of the constitution, we have a new principle, albumen in the urine; in gravel and stone a practical knowledge of Organic Chemistry is indispensable to enable us to discover the nature of the calcu-

lous matter, in order that we may administer suitable medicinal agents; in diabetes mellitus, we have also a new principle, grape sugar, in the urine: the composition of the urine varies remarkably in numerous other affections, and is frequently of practical importance to the practitioner: and lastly, the chemical characters of the blood, of the saliva, and of the contents of the stomach may also occasionally prove valuable aids in diagnosis and treatment. And then the importance of Organic Chemistry will further appear when we reflect upon the variety of organic substances which are continually employed as remedial agents in medicine and surgery. I do not, however, deem it expedient to dwell longer on this head, as the mere narration of the preceding facts will be sufficient clearly to illustrate both the intimacy and importance of the connection between Organic Chemistry and the science of medicine.

Suffer me, then, Gentlemen, to urge upon you the value of extensive professional information. Let the physician ever be eminently practical, as he ever must be, if he would be eminently successful, but let him at the same time have a mind correctly disciplined and well stored with scientific knowledge. Listen not to the men who speak disparagingly of every accessary branch of medical science with which they themselves are not conversant, and who enquire of what avail is the knowledge of the true character of disease, if without this knowledge drugs can be empirically administered and patients cured? Every fact, however isolated and useless it may at first sight appear, may at some time or other be found important, and to admit of valuable practical application.

We now arrive at the last head of our Lecture, and proceed to offer a few brief remarks in respect to the most successful mode of prosecuting the study of chemistry. Chemistry is preeminently the science of illustration and experiment; and therefore cannot be profitably pursued by the mere perusal and study of chemical works. And especially in all that relates to the

application of chemistry to medical science, are experimental knowledge and tact absolutely indispensable. Accordingly we find that experiments always constitute a most important and prominent part of a system of Chemical Lectures. Lectures have the advantage of enabling the student properly to apportion his time to the respective branches of study, and of inducing a progressive and systematic method of reading and meditation. It is essential, Gentlemen, if you would improve the opportunity afforded by lectures, to observe with attention the practical illustrations which may be presented to your notice; and so far as your circumstances will permit, you will do well to acquire the habit of manipulation, not only at the practical course of Mr. WOOLRICH, but also at your own abodes. Extensive and costly apparatus is not needed in performing any chemical processes in connection with the urine or other secretions, which are of importance to the physician. In the sequel I shall endeavour as much as possible to make you acquainted with those various and simple manipulations which have a directly useful and practical bearing. I shall dwell at considerable length upon the examination of urine in its morbid states, and analyze qualitatively before you, the various kinds of urinary calculi and deposites. In fine, my object will be to communicate that knowledge of Organic Chemistry which you may afterwards apply to the best practical account.

By way of conclusion, Gentlemen, to this Introductory Lecture, permit me to urge upon your serious attention, the solemn and sacred responsibility which is imposed upon you, to improve every opportunity of acquiring professional knowledge. We are not bound with the fetters of a blind fatalism, and we must, therefore, believe that the life of a patient not unfrequently depends, under Providence, upon the skill of his medical attendant. And impressed with this belief, can we fail to admit and to feel the responsibility to which I allude? It is a responsibility which at times is sufficient to make a man

tremble; and yet how many do we observe who seem scarcely to entertain one anxious thought! What multitudes of our fellow creatures have fallen victims to the ignorance, rashness, indecision, or timidity of the professor of the healing art! And hence how great the necessity of sound and extensive medical education! Our illustrious Patron, Dr. WARNEFORD, has indeed manifested his philanthropy, by promoting, to so liberal an extent, this good object. The munificence of Dr. WARNEFORD must not be regarded as circumscribed within the limits of Birmingham and its vicinity, but as extending to the Country at large. It is to be hoped that our too credulous countrymen, will one day or other be defended more effectually against the artifices of deceitful and advertising quacks, as well as against the ignorance and inexperience of legitimate practitioners. It is a lamentable fact, that impositions of the most unblushing and palpable character are so extensively practised. "How many," as Sir JOHN FLOYER observes, "(even in the agony of death) have been cram'd with *bark* and *bolus,* and sent hence with the last repeated *dose* undigested on their stomachs? How many thousands has Dr. *Morpheus* locked up in his leaden coffin, by needless, intempestive, and wrong applied *paragoricks,* et cæt.; hung their *herse* with garlands of *nightshade,* and sung requiems to their souls in wreaths of *poppy!* when their drowsie prescriptions have proved their credentials, or a warrant to knap on, 'till the day of *judgment.*"

Never, Gentlemen, I pray you lose sight of your responsibility, in the character of students at present, and subsequently in that of practitioners. And in addition, allow me to urge you to cultivate habits of gentlemanly feeling. The members of our profession are not unfrequently, and not altogether unjustly, it must, alas, be confessed, stigmatised as querulous and deficient of courteous and honourable deportment amongst themselves. Let us, however, be anxious, so far as our influence may extend, to efface this stigma, by acting, with uniform consistency,

the part of Gentlemen. The profession itself is too high and ennobling, to be in any degree disgraced by the inconsistency of some of its professors, however much that inconsistency may induce the world to asperse the profession itself. It will always be gratifying to me to be informed of your success in future years. May prosperity attend you all! The emolument which I anticipate from my Lectures is the advancement of your knowledge. And hitherto, on this ground, I have had no reason to complain, for in many of my pupils I have witnessed earnestness and delight in the prosecution of chemical science. With these remarks, Gentlemen, I conclude, wishing you again, in all sincerity, success as students now, and as practitioners hereafter.

B. Hudson, Printer, 18, Bull Street, Birmingham.

BY THE SAME AUTHOR.

"Experimental Inquiry concerning the Presence of Alcohol in the Ventricles of the Brain, after Poisoning by that Liquid; together with Experiments illustrative of the Physiological Action of Alcohol." For which a Gold Medal was awarded by the Medical Faculty of the University of Edinburgh. 1839.

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