

A letter to the presidents and fellows of the Royal Colleges of Physicians and Surgeons, on the present state of practical chemistry and pharmacy / by D.B. Reid.

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A
LETTER

TO

PRESIDENTS AND FELLOWS OF THE ROYAL
COLLEGES OF PHYSICIANS AND SURGEONS,

ON

THE PRESENT STATE OF PRACTICAL CHEMISTRY
AND PHARMACY.

By D. B. REID, M. D.

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OF THE ROYAL SOCIETY OF EDINBURGH, AND OF THE ROYAL COLLEGE OF PHYSICIANS,
VICE-PRESIDENT OF THE SOCIETY OF ARTS FOR SCOTLAND, AND LECTURER ON
CHEMISTRY TO THE EDINBURGH SCHOOL OF ARTS, FORMERLY
SENIOR PRESIDENT OF THE ROYAL MEDICAL SOCIETY.

EDINBURGH:

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1838.

Dr D. B. Reid begs to state to the Members of the Royal College of Physicians, that he has taken the earliest opportunity of writing this letter after the suggestions made in the College on Friday last (Feb. 16.), and has forwarded accordingly a proof in the mean time, till it shall be submitted to the consideration of the College.

A LETTER, &c.

EDINBURGH, 17th February 1838.

GENTLEMEN,

The rapid progress of the Arts and Sciences of late years, and the great attention now paid to the principles of Education, have affected so much the whole frame of society, that it is impossible to turn in any direction without observing their influence, both on the various relations of individual life, and in all those great institutions which are so warmly cherished in every civilized community. New sources of information have been developed—new powers of action have been brought into play—a more friendly intercourse has taken place throughout a greater portion of the globe than ever existed in any former period of history; and, while the individualities of one's own country must ever be the warmest objects of attachment, still every day brings more and more convincing proof of the benefits which all nations derive from a friendly intercourse with others. In no country, perhaps, are the effects that spring from these sources more deeply traced than in our own. None has commercial relations so widely established over the whole globe—none sends forth a greater number of individuals into distant regions in the military or naval service, or as missionaries, engineers, manufacturers, or qualified in other capacities to undertake some arduous office in a foreign land. Even her mechanics and artizans may be seen, in every quarter of the globe, disseminating a practical knowledge of the arts they may have cultivated at home, or superintending that great monument of modern times, the steam engine, in all its mighty operations for abridging human la-

bour, and for facilitating communication between man and man.

It would be surprising then, if, in their reflex operation, the institutions of this country were not affected by the causes we have so briefly adverted to, and still more especially, those establishments in which the higher branches of education are taught, where men are trained for all the more responsible situations in society. Here, however, the genius and disposition of its laws, the temperament and feeling of its inhabitants, and the force and influence of its customs, have not led to that direct connection between its educational establishments and the Government, which exists in many other places. The people, in a more especial manner than the Government, have been called upon, in the first instance, to move forward in matters of science and education. They are not under the immediate protection and control of any Minister of Instruction; and accordingly, it is their duty to examine minutely into the causes of any defect that may be connected with such public institutions, or to point out any extension that may be required to enable them to keep pace with the progress of the age.

In the few observations contained in this letter, it is not my object to inquire how expedient it would be, were the Crown to appoint Ministers, or a Board, whose sole attention should be devoted to the interests of Science and Education—though, as an individual, I would be led to join with those who advocate such a system, and, more especially, from the effects which it is producing in other nations, where we may be enabled to judge of its operation by its fruits,—but simply to request your attention earnestly to some points connected with the state of education in a particular branch of science, which has been the subject of much discussion of late years; and which, I have been led to believe, may easily be put in a position much more advantageous to the student and the public than it has hitherto occupied, while, at the same time, the teacher may be relieved from a restriction which is most injurious to all his efforts, which bears heavily upon his time and resources, and to which there is no parallel in any other branch of practical science taught at present either within or without the walls of

the University. It is, indeed, to this restriction that I attribute much of the comparative inefficiency that is at present inseparably associated with the Practice of Chemistry; and though I know that it was introduced with the very best views, and has been considered necessary by gentlemen whose opinions and motives I most warmly respect, still, in this particular, if I am so unfortunate as to differ with them, I can only say, that I do so for the reasons I shall here explain, trusting that any inquiry into the merits of the case may be made which the facts I have to adduce may appear to demand. And in a science, such as Chemistry, so intimately connected with so many objects of investigation in the medical profession, that no branch of it can be studied without a constant reference, directly or indirectly, to the facts and doctrines which it embraces,—a science, also, which is one of the first that engages the attention of the medical student,—too much attention cannot be paid to the system of education adopted: for it is then that the student forms those habits of activity and steadiness, or of supineness and inattention, which usually accompany his future career; laying a good foundation, which supports him in all his subsequent studies, or passing over in a careless manner those principles, a want of the knowledge of which clogs and embarrasses his progress in every succeeding science upon which he enters. I may be permitted to add, that I have not ventured to bring forward the propositions I have taken the liberty of submitting to your notice, without a very careful and elaborate inquiry, which has now been continued for many years. Before I entered upon the study of medicine, I had been engaged as assistant and superintendant of the chemical manufactories of the late Joseph Astley, Esq., with whom I received my first instructions in Chemistry; and in examining the state of Practical Chemistry, while a student of medicine, it occurred to me that much might be done to put it upon a more extended footing; and I accordingly commenced, with this view, as a teacher of Practical Chemistry, in my first class-room, in the High School Yards. Some years afterwards (about five years ago), I ventured to direct attention to the state of Practical Che-

mistry as a branch of education, and its daily increasing importance to the members of the Medical profession, as well as to other classes of society. The views I then proposed were not agreed to, and, accordingly, since that period, I have endeavoured to ascertain in what other mode arrangements might be made to put the practice of Chemistry and Pharmacy upon that efficient footing which the present state of medical science so imperiously demands. In prosecuting these objects, I have explained my views to different individuals in town, and particularly to some members of both Colleges, who have been in the habit of visiting my class-room. Before bringing them under your notice, however, I resolved to make an inquiry as to the state of education in this department on the Continent, during which I was fortunate enough to meet with Baron Berzelius, and his successor Professor Mozander, Baron Humboldt, and Professor Mitscherlich of Berlin, Sir James Wylie, who was kind enough to shew me all the arrangements connected with the Medical Department at St Petersburg, and MM. Gay Lussac, Becquerel, Pelouze, D'Arceet, Chevreul, Brongniart, and many other scientific gentlemen, who were so obliging as to assist me in all my inquiries. Nor ought I to forget M. Robiquet, who conducted me personally through all the departments of the College of Pharmacy at Paris, where the Museum, the arrangements for Practical Pharmacy, &c., gave the most convincing evidence of some of the causes that had contributed so much to distinguish the Apothecaries of that city. But it is unnecessary for me to enter into farther particulars on this point. I shall only add, that the general disposition of the museums, laboratories, and hospital arrangements, and the mode of proceeding in the Schools of Mines, the Colleges of Pharmacy, and the Laboratory of the Polytechnic School, and in other institutions both in Paris and elsewhere, where Practical Chemistry and Pharmacy were introduced, were special objects of inquiry. The result of these having confirmed me in my views, I have now more confidence in bringing them before your notice, and in doing so, I am assured that no one will consider me as reflecting upon the present order and arrangement adopted in

any school of medicine, but, on the contrary, only advocating such improvements as are equally called for by the state of science and the progress of society.

EXTENT OF THE COURSE OF PRACTICAL CHEMISTRY AND PHARMACY.—A three months' course, during which the student attends an hour a-day, is the usual period allotted to the Practical Course. If the student were to confine his attention solely to manipulation in this course, taking one illustration of each operation that presented any peculiarities, he might, indeed, be able to go over considerable ground in a three months' course, but he would have no time to study the science practically in a systematic manner. A kind of mechanical expertness in experimenting would be the only fruit of such a course. But this never has been the nature of the Practical Course; the students attend it as the most efficient mode of becoming acquainted with Chemistry; they would be much disappointed if any experiment of importance were omitted, nor are there above one or two out of fifty who can proceed with any satisfaction in the experiments they perform, without having a frequent explanation of the theory brought before them, at the moment they are engaged in experimenting.

Such being the case with respect to the nature of the course, we must, in the next place, consider how far the time allotted to it is sufficient to enable a student of average abilities to become practically acquainted with those departments of the science which he may be expected to know. I presume that, in the following list, no one will be inclined to think that I have inserted any subject which a student of Practical Chemistry and Pharmacy could, with any justice to the subject, pass over. On the contrary, I am assured that it presents the barest outline which it is possible to submit as a part of professional education.

Table shewing the principal subjects requiring the attention of the student in the Elementary Course of Practical Chemistry and Pharmacy.

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| 1. Use of the balance in chemical operations. | 35. Potassium and its preparations. |
| 2. Specific gravity of chemicals. | 36. Soda, &c. |
| 3. Production of Heat. Furnace operations. | 37. Ammonia. |
| 4. Management of coke, coal and charcoal. | 38. Lime, &c. |
| 5. Gas and other kinds of fuel. | 39. Baryta, Strontia, Magnesia, &c. |
| 6. Production of cold. Freezing mixtures. | 40. Alumina. Silica. |
| 7. Examination of air, ventilation. | 41. Iron. |
| 8. Use of the Blowpipe. | 42. Lead. |
| 9. Tube apparatus. | 43. Copper. |
| 10. Flat-glass apparatus. | 44. Zinc. |
| 11. Water. | 45. Antimony. |
| 12. Steam. | 46. Chrome, manganese, cobalt, and nickel. |
| 13. Mineral waters. | 47. Arsenic. |
| 14. Acidimetry. | 48. Mercury. |
| 15. Alkalimetry. | 49. Silver. Gold. |
| 16. Crystallization. | 50. Platinum. Use of instruments of platinum. |
| 17. Electrical machine. | 51. Oxalic and Tartaric acid. |
| 18. Galvanic trough. | 52. Acetic acid. |
| 19. Electro-magnetic machine. | 53. Citric, Benzoic, Gallic, and meconic acids, &c. |
| 20. Experiments in vacuo and with the air-pump. | 54. Prussic acid. |
| 21. Experiments under increased pressure. | 55. Morphia. |
| 22. Filtration. Funnels. Displacement. Pressure. | 56. Quina. |
| 23. Crucible operations. | 57. Strychnia. |
| 24. Pneumatic apparatus. | 58. Fixed oils. |
| 25. Glass apparatus. | 59. Volatile oils. |
| 26. Porcelain apparatus. | 60. Sugar, starch, gum, gluten. Examination of flour and bread. Colouring matter. |
| 27. Miscellaneous apparatus. | 61. Fermented liquids. |
| 28. Nitric acid. | 62. Ethers. |
| 29. Sulphuric acid. Sulphur. | 63. Fibrine, albumen, gelatine. |
| 30. Sulphureted hydrogen. | 64. Bone, animal charcoal. |
| 31. Compounds of phosphorus. | 65. Examination of blood. |
| 32. Carbon. Carbonic acid. | 66. Milk. |
| 33. Chlorine. | 67. Bile and biliary calculi. |
| 34. Iodine (bromine. Fluorine). | 68. Animal oils and fats. |
| | 69. Urinary calculi, &c. |
| | 70, 71, 72. Miscellaneous operations. |

But a three months' course, in general, includes, at the utmost, about seventy-two working days, and deducting twelve of these for lessons in analysis and practical exercises, so essentially necessary in a course of Practical Chemistry, it is, indeed, impossible to include the foregoing subjects without extra lessons, which it is often very difficult to arrange from the different engagements of the pupils.

I need scarcely mention, that, to go over some of these sub-

jects in a proper and deliberate manner, several successive practical lessons, each continuing at least for two or three hours, would be necessary, as in studying the compounds of chlorine, and the preparations of potassa, antimony, mercury, &c. and the DETECTION OF ARSENIC. In operating with the BLOWPIPE alone, I have never seen the student acquire any thing approaching to a proper command and knowledge of this invaluable instrument in less than ten lessons, and have always accordingly given extra opportunities to enable him to become familiar with it.

Farther, let it be recollected, that the Practical Chemistry and Pharmacy class, is the only class in which the student has the opportunity of acquiring a practical knowledge of the method of experimenting; the only place where he is expected to become practically familiar with those processes and reagents he must have recourse to in future life, where he may be called upon to detect a poison—to tell the nature of a mineral water—to analyse a calculus—to look for adulterations—to measure accurately the strength and energy of his medicines, the tools with which he works—to prepare them for himself when thrown at a distance upon his own resources—to examine the state of the atmosphere in any hospital—or, in short, to conduct any of those numerous chemical investigations, which a medical man, who has had the opportunity of attending such a class, may be expected to know how to bring to a successful termination.

But the Practical Chemistry class labours under another disadvantage, which it is equally important to remove, though this is far from being peculiar to it. Being only a three months' course, the Student who attends it very frequently does not make sufficient allowance for the time that is absolutely necessary to do it justice. It is too often considered as a subordinate branch, which he may hurry over at any time that may best suit his convenience; and hence it is not at all uncommon, to see him enter for this class while he is engaged with no less than five or six other subjects. Cases of this kind have so frequently been forced upon my attention, that I was led to make numerous inquiries on this point; and I am satisfied that the practice exists to an extent quite incompa-

tible with a fair attention to this class. The pupils who are in the situation I have just adverted to, very frequently give themselves much more trouble with their Chemistry before they have done with it, and make much less progress, than others who devote much less time to this class. They are unable to give a fair attention to it; what they learn accordingly is learned hurriedly. They are thus forced to content themselves with a glimpse, instead of becoming familiar with the subject; and as this soon fades away, they are in a perpetual state of anxiety, and always vainly endeavouring to renew their knowledge; whereas, the Student who avoids the frequent error of overcrowding his classes, becomes so thoroughly acquainted with principles as well as facts, that, afterwards, he has comparatively little or no trouble with what he has once thoroughly investigated.

It will be obvious, from the preceding statements, that, whatever progress may be made by the private pupils of the teacher, the great majority who follow merely the prescribed course, cannot be so well acquainted with the Practice of Chemistry and Pharmacy as is required in the exercise of their professions. And as a considerable number attend this class principally, if not entirely, with the view of devoting themselves afterwards to the pharmaceutical department, the manner in which it supplies their wants demands the most careful consideration.

If we look to the impurities found in medicines, the adulterations to which they are subject, and the importance of a thorough knowledge of experimental Chemistry in the preparation of numerous valuable medicinal agents, we shall see, in a still more glaring form, the defects of the present system of teaching Practical Chemistry. Eleven or twelve years ago, in searching for Peruvian bark for the preparation of sulphate of quina, I was offered, among a variety of other specimens, a portion at a price so far below that usually demanded, as to lead me to make the most minute inquiries on the subject, and obtained afterwards the most decisive proof that it consisted merely of the refuse of Peruvian bark, from which the essence had been previously extracted, and had been mixed in powder with a little fresh bark to give it a flavour. Since

that period, the subject of adulterations, the extent to which they are carried, and the impurities generally in pharmaceutical preparations, have continually engaged my attention; and while I cannot but concur with those who consider that the pharmaceutical preparations are too frequently in such a condition, as in no small degree to frustrate the intentions of medical and surgical practice, and entail a protracted suffering in the patient, I am also prepared to affirm, that the zeal and activity of the principal apothecaries in procuring their supplies from the purest sources, has done much to put this department on a very superior footing to what it has ever previously enjoyed; and that the same cause, a desire to forward the state of Pharmacy in this country, has even led several of them to prepare a variety of articles, which they could not have attempted to have manufactured without very considerable skill; and so complete has their success been, that I may be allowed to quote the fact of Mr Duncan, the distinguished apothecary in this city, having not only introduced the manufacture of the muriate of morphia, to which the researches of Dr Gregory and Dr Robertson contributed so much, but even so great was his success that he sent it also to the London market. Nor ought I to omit mentioning, that Mr Macfarlane has entered upon the same field, and that his acetate of morphia is perhaps the most beautiful and perfect specimen of this salt which has been made either here or abroad. I am indeed assured that there is now a greater desire among the apothecaries, as a body, than ever prevailed at any former period, to provide their drugs from the purest sources, and to make their pharmaceutical arrangements in accordance with every thing that the medical profession could expect or desire. The impurities that are observed by the professional chemist arise, I am persuaded, in many cases, from ignorance of their nature and extent: nor do they appear to me to exceed what may be observed in other matters, where materials ultimately disposed of by retail pass previously through many successive hands. An investigation into the nature and qualities of different kinds of pigments, metals, flour, wine, brandy, ale, many groceries, and various other matters constantly referred to the practical chemist, will, I believe, prove what I have now stated. Occasional adulterations we must always expect to see, unless

the occupations of Pharmacy be exempt from what all others are subject to. It would be difficult to trace in all their details the sources of such impurities as may at times be added with a fraudulent intention. Numerous facts indeed lead us to the conclusion, that the investigation of this question is one of great complexity, and that adulterations are not practised so generally as the impurities detected might at first lead us to suppose. The respectability of the wholesale establishments, as well as of the retail practice, preclude us from believing that it is carried on systematically; and, indeed, the retailer has less temptation, from the great per-centage he receives, than the larger establishments. May the great extent to which it has been observed of late not depend principally upon the increased facilities of detection now accessible to the public from the progress of science?

The evil, however, arising from the impurities in medicines, where the agents employed are so frequently of great activity in reference to the animal economy, is too serious not to require the most careful consideration; and the medical profession cannot fail to be keenly alive to its importance. It is indeed calculated to excite and alarm the fears even of the most indifferent. The case demands peculiar attention also from the circumstances under which they act, and the dangerous consequences which might ensue from an amount of adulteration too trivial to be noticed in other matters.

The great root of the evil appears to me to lie, not so much in any intention to impose a spurious article, however gross such attempts at times may be easily proved to have been by the most unequivocal evidence, but in the defective means at present afforded to apothecaries and others, who ought to be acquainted with Practical Chemistry, for acquiring the knowledge necessary for estimating the strength of the materials in which they deal, and for detecting the adulterations to which they are liable. If we look to the medical profession, the number at present who can conduct the analysis of any medicinal preparation, bears but a small proportion to the number engaged in actual practice; and I believe also that the number of individuals engaged in apothecaries' shops who cannot tell precisely the strength of acids and alkalis, though this is one of the most simple and indispensable of the processes

the occupations of Pharmacy except from what all others are subject to. It would be difficult to trace in all their use in analytical Chemistry, is very considerable, unless we confine ourselves to those who began their studies after the Practical Chemistry and Pharmacy class was established; and if impurities have of late been more frequently noticed than formerly, it is gratifying to consider that the same science which enables us to detect them, has also afforded us increased power of remedying the dangerous consequences to which they might lead.

The Professor of Materia Medica in this city has also publicly proposed a step, which cannot fail to be highly important in reference to the progress of Pharmacy in this town,—the institution of an Association of Apothecaries. Two years have elapsed since I proposed this to one of the apothecaries of Edinburgh as a plan that must sooner or later come into operation (and with the view of forwarding this object, I examined particularly last summer the constitution of a similar institution abroad). But it is obvious that some time must elapse before such an association could be brought into effective action; and after the particulars I have now detailed, I have been led to the conclusion that the only effectual remedy for the evils above alluded to are,—the extension of the practical course of Chemistry and Pharmacy.

But in what manner is this to be effected? and will this not necessarily involve a great additional burden on the Student? Where also is the time to be found for it, without imposing another year's attendance upon the pupil?

The Practical Chemistry class labours at present under the oppressive restriction of being confined to twenty-five students, whatever may be the expenditure of the teacher, the labour which he bestows on his arrangements, or the facilities which he may endeavour to introduce. Why this class should labour under so severe a restriction, while the classes for

Practical Anatomy,

Practical Surgery,

Practical Medicine, and

Practical Surgery as taught at the Hospital,

Practical Mechanical Philosophy,

Practical Mathematics, and

Practical Drawing,

are all free and unrestricted in this respect, it is indeed difficult for me to see. There is scarcely a single argument that applies to Practical Chemistry, that does not equally apply to the other branches; and while I freely state my opinion on this subject, I trust I do so without being wanting in that respect that is due to the opinions of others, where I may be reluctantly compelled to differ from them. I believe I may safely assert, that there is no science more eminently practical than Chemistry, and none more broadly connected with all the relations of the material world, or with the various departments of that profession to which the members of both Colleges are attached. They all desire that it should be studied, as far as may be compatible with the time the student has to devote to other pursuits; and I am sanguine enough to hope, that they will agree with me in considering, that it requires a more minute attention than has hitherto been bestowed upon it. What, then, would be the effect of removing the restriction to which I have adverted? Teachers of Practical Chemistry would then be able to give a course four or six times the extent of their present course, without imposing upon the student any additional burthen beyond a guinea or twenty-five shillings for the expense of the additional materials consumed in his experiments. They would no longer be confined to a three months' course, in which the teacher is placed in the very disagreeable dilemma of either passing more quickly than he ought to do with the subject of the course, or of confining his attention to that which the student considers only a part of what he might reasonably expect to have been included in his course. In short, the student, instead of being limited to the laboratory for an hour a day, for half the winter session, would have it thrown open to him every day for several hours during a six months' course. He would study the Practice of Chemistry as a professional student, instead of sacrificing no small part of the great advantages it offers, principally to the purpose of making it more subservient as a means of enabling him to answer questions at the examinations which he has to undergo in taking his degree; or he would be as competent, with this extended course, to go practically through many analyses, as he is at present able to explain them.

I may also take this opportunity of stating, that when the late Dr. Turpin (Professor of Surgery in the University), and other members of the College of Surgeons, proposed to me that the classes of Practical Chemistry should be restricted to seven, I then stated that a restriction to this extent would probably put a stop to the teaching of Practical Chemistry, except at such a price as would permit only a few individuals to take advantage of it.

Again, this arrangement would enable the teacher to study individually the capabilities and progress of each of his pupils; and I believe it will be admitted by all who have examined most minutely into the subject of education, that this ought to be the great object of every teacher. The leading facts and principles of science are to be seen in numerous elementary works; the experience of the teacher, therefore, is most valuable in assisting the student in any difficulties that may be peculiar to each, in teaching him that practice which actual experience can alone communicate, and in exciting and sustaining a proper spirit of scientific inquiry. And while engineers, artists, agriculturists, architects, manufacturers, and all who study any peculiar art or profession, are assisted each in their own department, surely it is now high time to inquire into the changes that may be necessary to put the study of Practical Chemistry in such a form, as may fulfil the intentions of those who have advocated the importance of adding it to the curriculum of medical education. In short, I humbly submit, that there can be no real objection to the placing of the Practical Chemistry class upon the same footing on which Practical Anatomy has so long stood.

But, it may again be asked, when is the student to find time for this extended course? If we look to the Regulations of the Royal College of Surgeons, we shall see that the student is recommended to study Practical Chemistry during the **THIRD SESSION**. This is the year, however, when he commences his attendance at the Hospital; it would thus be difficult for him to devote the time required for such a course. During the **SECOND YEAR**, his attention is too much occupied with Practical Anatomy; and during the **FOURTH** or last year of his studies, he is equally engaged with the Hospital, Clini-

cal Medicine, Surgery, and other classes, which certainly include as many subjects as he can reasonably be expected to attend. But, during the first year, CHEMISTRY and ANATOMY alone engage his attention, if he shall have previously studied Natural Philosophy. He has, therefore, abundance of time this session to conjoin the study of the Practice of Chemistry with his attendance at lectures; and thus, each successive session, he would be engaged practically with the various branches of his profession.

It may be said by some, that there is an advantage in studying Practical Chemistry the third year, as it serves as a recapitulation previous to the final examination on the fourth session. I admit the full force of this objection; but humbly contend, that it is perhaps counterbalanced by the circumstance, that the more thoroughly the student is acquainted with Chemistry, the more easy is it for him to advance with more and more success in all the varied studies to which he must afterwards attend. The well-informed Chemical student, in his attendance at lectures on Anatomy, Physiology, Botany, Dietetics, Materia Medica, Pathology, Toxicology, and Medical Jurisprudence in general, Surgery, Practice of Physic, &c., continually, indeed almost daily at times, has to draw upon his knowledge of Chemistry; and without this, how imperfectly could any one prosecute these sciences. And in his first attempts at practice by himself, how often does the beginner add to the sufferings of his patient, from ignorance of pharmaceutical details. Cases of this kind have come under my own observation, and may probably be familiar to many who have looked particularly to this point.

But there is another view of great practical importance, which I would here wish to advert to. If the student shall be thoroughly informed on Chemistry by attendance at the extended practical course I have proposed, he will be so intimately acquainted with the science, and acquire such a power and command in experimenting, that he will not fail to experiment from time to time by himself, in conducting his future studies. And by adopting, as a means of instruction, the mode of analysis so ably followed by Dr Wollaston, in operating with minute quantities of materials, he may, indeed, at

the most trifling expense, renew again and again, and go over deliberately at home, all the principal tests and illustrative experiments he may have seen conducted on the large scale in the class-room. The experience of several years has shewn me,

1. That, for an expense so small as six or seven shillings, the student of Chemistry may provide himself with about sixty specimens of the most useful chemicals, including all the most important elements, or some of their principal compounds, with five phials containing sulphuric, nitric, and muriatic acids, potassa, and ammonia.

2. That with the use of the simplest means, namely, the slips of glass which glaziers throw away, and of cartridge-paper, test-paper, and filtering paper, thousands of experiments may be performed with the above materials. For on these slips, he can not only hold solids and fluids, but also dissolve, boil, evaporate, filter, mix, fuse, and even distil, after a very little practice, besides conducting numerous other chemical operations. And thus, he has also the power of renewing a course of Chemistry to himself in his leisure hours during the autumn, and even of extending a knowledge of chemical science among his friends, or in a distant region where the usual facilities for chemical operations are not to be obtained.

3. The extent to which these have been used has assured me that the students are not indisposed to make use of the very simple means I have recommended for enabling them to acquire practice in the examination of chemicals, and in the detection of adulterations; while the frequency with which they are thus enabled to experiment leads them to acquire a familiarity with the facts and resources of the science which it would be difficult for them to obtain in any other way. With the FLAT-GLASS APPARATUS, a FEW TUBES, and a BLOW-PIPE, there are few test experiments which cannot be performed.

To assist in the introduction of this mode of testing, so accessible to every student, introductory lessons on chemical analysis are given every Saturday morning in my class-room, from ten to eleven o'clock, where every student endeavours individually to find out experimentally the nature of the ma-

materials placed before him, according to the lessons inculcated at the same time, and as these may be visited on any occasion when any of the members of either College may desire to see this mode of testing, it will be unnecessary to mention more minutely here, what five minutes' inspection would more thoroughly explain than the most lengthened discussion.

There are also other means which will naturally suggest themselves to every teacher as powerful methods of stimulating the student to a better knowledge of his subject, particularly, for instance, giving him small quantities of materials home with him to study at his leisure, and by correcting the conclusions he draws from the experiments he makes. By giving an opportunity also to the pupil to execute some difficult experiment, and to prepare some compound that requires much skill and attention, he is led to enter upon the more elaborate series of chemical investigations.

The symbols introduced by Berzelius assist greatly in all these arrangements. They, indeed, constitute the greatest boon that has been conferred upon the science since the introduction of the atomic theory. Without them, indeed, the teacher and the student would be equally at a loss in following the progress of modern Chemistry. To those whose professional engagements may not have led them to attend to them minutely, I would simply remark, that, without them, Chemistry would at the present day be in the same position as arithmetic or algebra, were every operation in these branches expressed at length by words, without the use of signs and figures.

DISCIPLINE, ANNUAL EXAMINATION, &c.—Whatever may be the conclusion to which the preceding observations may assist in leading, I trust that another question will be taken up at the same time,—I mean the introduction of some system of discipline to which all professional students should be subjected. At present, there being no appointed tutors to watch over the progress of the student, all who have no particular friends or guardians in this city, are too frequently left entirely to their own superintendence. The consequence is, that among the great number of students who frequent this city, there are always several falling into mistakes as to their course of study,

productive of the greatest injury to their future progress. Nor is this all, for when the arrangement of the time is in a great measure optional each successive season, however fixed the rules may be as to the classes that must ultimately have been attended, and where the student looks forward merely to a single examination at the distant period of four years, he is frequently careless of immediate consequences, consoling himself with the idea that this is only his first session, and that he will make up for it by working harder at a future opportunity. Thus he proceeds, from year to year, always involving himself deeper, until at last he finds out the reality of his situation, and now it is necessary to abandon all ambition of passing his examination in the manner he would desire. To get through, on any terms, is his great object; and to enable him to have any chance of this, he hurries on from subject to subject in a manner incompatible with that sure and regulated progress which the steady and systematic student alone can ensure, while he subjects himself to a species of torture in the mean time which leaves occasionally an impression upon his future life.

I willingly and gladly acknowledge, that I know no place where, as a body, the students are more honourable in their conduct, more devoted to their profession, or more anxious to seize hold of every opportunity which they may have of improving themselves in the course of study they may follow. This conduct in after life—the eminence to which they have risen,—their independence and enterprize in every quarter of the globe,—and the principles which they have imbibed,—have given them a character which, I trust, they will ever continue to enjoy. I only maintain at present, that, among so many, cases too frequently occur such as I have described, not to render them an object deserving the most serious consideration of those who may be expected to look into these matters. And if we turn to those alone whose conduct and attention gives their teacher the best proof that they are advancing as steadily as he could expect or desire, how much more pleasing would their progress be were it certified from time to time by some public board? How much would this stimulate them in their future progress? How cheerfully would they enter

upon a new branch of study, when assured that they had done their duty and succeeded in what they had already studied? A light and a glad heart would accompany them in their future academical career, recollecting that they had merely to keep up for their final examination what they already knew in the branches they had studied. But, at present, in a number of sciences, where the student has not that precise and definite series of problems presented to him, such as he goes over in studying Mathematics, he is never certain how far he may have advanced in the right tract, — a constant, and in some cases a distressing, anxiety as to the result, embarrasses his progress. And if we consider the case of a student having these feelings, and going up for an examination after a few years' course of study, when he is to be questioned upon Anatomy, Chemistry, Practical Chemistry, Pharmacy, Materia Medica, Physiology, Surgery, Practice of Physic, Midwifery, Medical Jurisprudence, &c., he certainly requires to summon no small degree of moral energy in entering upon such a trial. It would therefore be important to ascertain the possibility of enabling the same end to be accomplished by means which may not be so distressing in individual cases, and equally effectual, if not much more so, in raising the general standard of professional excellence.

It will also be obvious, that the public have a better security for the thorough education of graduates, by annual examinations, than by the present system; for cases certainly must occur where the examiner may be considered as called upon to insist less on high attainments in each science, than he would do if the student appeared before him annually after he had concluded his studies for that session.

View also the case of a rejection where the student is first told of his inefficient study, or, it may be, incapacity for the profession, after two or four years have been devoted to it, without a single official warning, and perhaps even where he might have, however erroneously, looked forward to a very different result. Surely the views now so generally entertained as to education are almost unanimously in favour of those periodical examinations, which are enjoined in so many other circumstances where it is an object to check the possibility of

mistake, and avoid by every possible means a termination equally unpleasant to all parties.

Again, while the new Regulations of the Royal College of Surgeons, and the opening of their invaluable Museum, have done so much to forward the cause of Medical Education, I cannot permit myself to doubt, that, if an Education Committee were appointed, composed of Fellows of both the Royal Colleges, much might still be done to advance the interests of the medical profession, of the public, and particularly of the students. Great as the fame of this School of Medicine has been, and proud as its pre-eminence is, in having been open without restriction to every individual, without distinction, who wished to avail himself of the advantages it holds out, still it is impossible, and it would be equally useless, to attempt to conceal the fact, that, with the views of education now so widely gaining ground, the parents, friends, and guardians of the younger pupils, now anxiously look forward to some guarantee, that they shall not be without some special protection and assistance from some board or public office, which shall inquire at least from time to time as to their progress, and that the practice of a student going up for his final examination, without having previously been made aware, more than once, of his success or his failure in his studies, will give way to a more precise system, as soon as the fluctuating state of medical education, and the variety of opinions entertained upon this subject, shall have fixed into a more settled form.*

In concluding these observations, I trust I shall be excused for trespassing upon your attention by the importance of the subject, however imperfectly this may have been done in the few remarks which my limited time has permitted me to lay before you. My great desire has been to bring forward such facts as may induce you to institute an inquiry into the consequences that ensue from the defective state of the present arrangements for the study of Practical Chemistry. I have noticed every successive season the students display more zeal,

* The introduction of calisthenic exercises, or such games, as would promote the health of the student, appears to me also an object well deserving of public attention.

more intelligence, and come forward better prepared for taking higher and higher ground in their scientific studies, but the circumstances I have stated have proved an insuperable barrier to every effort that has been made to give it the practical efficiency it requires. The student who attempts to perform what he desires to undertake within the limited period allotted by the ordinary course, is continually in danger of falling into a rough and hurried mode of operating, which would speedily give way, by new arrangements, to that calm and deliberate precision and accuracy, so much and so justly the boast of many continental institutions. Nor can I permit myself to doubt, that this would soon be followed by the appearance at this school of young men as distinguished in the ranks of Chemistry and Pharmacy, as they are to be met with in foreign countries. And as to the adulteration of drugs, the same means would be equally effectual in training the young apothecary to those methods by which alone he can judge of the purity of the articles he dispenses, and in enabling the physician and the surgeon to ascertain if his prescriptions are carefully and accurately made up. And, lastly, in respect to any new arrangements which it may be desirable to make for forwarding the cause of Pharmacy, and checking such adulterations as may from time to time appear either from accident or otherwise, I beg to state that I know I only express the feelings of both the wholesale and the retail dealer, when I say that, so far as I am acquainted with them, they will cordially co-operate with the medical practitioner, and, indeed, it is not to be supposed that, when such a knowledge of Practical Chemistry as may be required both by him and by the apothecary, shall be more generally diffused, that the medicines used will be inferior to those which it will be the desire of the profession to employ.

I have the honour to be, Gentlemen,

Your most obedient Servant,

D. B. REID.











