as a remedy in dyspepsia, digestive ferments have been largely employed to assist the stomach and intestine in the performance of their functions, but very little has been done until lately in the way of modifying tissue changes in the body by the introduction of ferments derived from solid organs. For ages back savages have eaten the raw hearts and other organs of the animals which they have killed, or the enemies they have conquered, under the belief that they would thereby obtain increased vigour or courage; but the first definite attempt to cure a disease by supplying a ferment from a solid non-glandular organ of the body was, I believe, made in Harvey's own hospital by the use of raw meat in diabetes.[1] It was not, however, until Brown-Séquard recommended the use of testicular extract, that the attention of the profession became attracted to the use of extracts of solid organs. Since then extract of thyroid, extract of kidney, extract of supra renal capsule have been employed; but even yet they are only upon their trial, and the limits of their utility have not yet been definitely ascertained.

But yet another therapeutic method has been recently introduced which bids fair to be of the utmost importance, the treatment of disease by antitoxins. The discovery by Pasteur of the dependence of many diseases upon the presence of minute organisms may be ranked with that of Harvey, both in regard to the far-reaching benefits which it has conferred upon mankind, and for the simplicity of its origin. The germ of all his discoveries was the attempt to answer the apparently useless question: "Why does a crystal of tartaric acid sometimes crystallise in one form and sometimes in another?" From this germ sprung his discovery of the nature of yeast and of those microbes which originate fermentation, putrefaction, and disease. These minute organisms, far removed from man as they are in their structure and place in nature, appear in some respects to resemble him in the processes of their growth and nutrition. They seem, indeed, to have the power of splitting up inactive bodies into substances having a great physiological or chemical activity. From grape sugar, which is comparatively inert, they produce carbonic acid and alcohol, both of which have a powerful physiological action. From inert albumen they produce albumoses having a most powerful toxic action, and to the poisonous properties of these substances attention was for a while alone directed. But it would appear that at the same time they produce poisons they also form antidotes, and when cultivated without the body, and introduced into the living organism, they give rise to the production of these antidotes in still greater quantity.

The plan of protection from infective diseases, which was first employed by Jenner in small-pox, is now being extended to many other diseases, and the protective substances which are formed in the body, and their mode of action, are being carefully investigated. The introduction either of pathogenic microbes or of toxic products appears to excite in the body a process of tissue change by which antitoxins are produced, and these may be employed either for the purpose of protection or cure. By the use of antitoxins tetanus and diphtheria appear to be deprived of much of their terrible power. But it seems probable that a similar result may be obtained by the introduction of certain tissue juices into the general circulation. It was shown by Wooldridge that thyroid juice has a power of destroying anthrax poison, and it seems probable that increase of the circulation of certain organs will increase their tissue activity, will throw their juices or the products of their functional activity into the general circulation, and thus influence the invasion or progress of disease. As I have already mentioned, we are able to influence the circulation in muscles both by voluntary exertion and by passive massage, and we should expect that both of these measures would influence the constituents of the blood generally; and such, indeed, appears to be the case, for J. K. Mitchell[2] has found that after massage the number of blood corpuscles in the circulation is very considerably increased.

Had time allowed it, I had intended to discuss the modifications of the heart and vessels by the introduction of remedies into the circulation, the power of drugs to slow or strengthen, to quicken or weaken the power of the heart, to contract or relax the arterioles, to raise or lower the blood pressure, to relieve pain or to remove dropsy; but to do this would require time far exceeding that of a single lecture. Moreover, the methods and results were admirably expounded to the College by Dr. Leech in his Croonian lecture, and I have therefore thought I should be better fulfilling the wish of Harvey that the orator of the year should exhort the Fellows and Members of the College to search out the secrets of nature by way of experiment by directing their attention to fields of research which have received at present little attention, but promise results of great practical value. Lastly, I have to exhort you to continue in mutual love and affection among yourselves; and it seems to me that the best way of doing this is to direct your attention to the examples of Harvey and of our late President, whose death we deplore to-day. They were beloved by their fellows while they lived, their loss was lamented when they died, and they have left behind them an example not only of goodness, but of courage. Harvey, seated speechless in his chair, distributing rings and parting gifts to his friends while awaiting the approach of death; or Andrew Clark, steadfastly determining to continue at work and die in harness, in spite of the hæmoptysis which seemed to threaten a speedy death, afford us noble examples which ought to encourage us to follow the directions of the venerable Longfellow, who, taking the organ Harvey studied to symbolise such courage as Harvey and Clark showed, says—

"Let us then be up and doing
With a heart for any fate,
Still achieving, still pursuing,
Learn to labour and to wait."

[1] *Brit. Med. Journ.*, February 21, 1874, p. 221 *et seq.*
[2] *American Journal of Medical Science*, May 1894.

SCIENTIFIC METHOD IN BOARD SCHOOLS.[1]

AT the request of my friend and former pupil, Mr. W. M. Heller, I have undertaken to say a few words by way of introduction to the course which he is about to give here to assist a number of you who are teachers in schools in the Tower Hamlets and Hackney district under the School Board for London—a course of lessons expressly intended to direct your attention to the educational value of instruction given solely with the object of inculcating *scientific* habits of mind and *scientific* ways of working; and expressly and primarily intended to assist you in giving such teaching in your schools.

Nothing could afford me greater pleasure, as I regard the introduction of such teaching into schools generally—not Board Schools merely, but all schools—as of the utmost importance; indeed, I may say, as of national importance: and I now confidently look forward to the time, at no distant date, when this will be everywhere acknowledged and acted on. Personally I regard the work that I have been able to do in this direction as of far greater value than any purely scientific work that I have accomplished. At the very outset of my career as a teacher, I was led to see how illogical, unsatisfactory and artificial were the prevailing methods of teaching, and became interested in their improvement. My appointment as one of the first professors at the Finsbury Technical College forced me to pay particular attention to the subject and gave me abundant opportunity of practically working out a scheme of my own. I was the more anxious to do this, as I soon became convinced that if any real progress were to be made in our system of technical education, it was essential in the first place to introduce improved methods of teaching into schools generally, so that students of technical subjects might commence their studies properly prepared; and subsequent experience has only confirmed this view. Indeed it is beyond question, in the opinion of many, that what we at present most want in this country are proper systems of primary and secondary education: the latter especially. Now, most students at our technical colleges, in consequence of their defective school training, not only waste much of their time in learning elementary principles with which they should have been made familiar at school, and much of our time by obliging us to give elementary lessons, but what is far worse, they have acquired bad habits and convictions which are very difficult to eradicate; and their mental attitude towards their studies is usually a false one.

The first fruits of my experience were made public in 1884, at one of the Educational Conferences held at the Health Exhibition. On that occasion, and again at the British Association meeting at Aberdeen in 1885, in the course of my address as president of the Chemical Section, after somewhat sharply criticising the methods of teaching in vogue, I pointed out what I conceived to be the directions in which improvements should be effected. Others meanwhile were working in the

[1] A revised address delivered at the Berners Street Board School, Commercial Road, London, E., on October 9, 1894, by Prof. H. E. Armstrong, F.R.S.

same spirit, and consequently, in 1887, a number of us willingly consented to act as a committee "for the purpose of inquiring into and reporting upon the present methods of teaching chemistry." This committee was appointed at the meeting of the British Association in York, and consisted of Prof. W. R. Dunstan (secretary), Dr. J. H. Gladstone, Mr. A. G. Vernon Harcourt, Prof. H. McLeod, Prof. Meldola, Mr. Pattison Muir, Sir Henry E. Roscoe, Dr. W. J. Russell (chairman), Mr. W. A. Shenstone, Prof. Smithells, Mr. Stallard and myself. A report was presented at the Bath meeting in 1888, giving an account of replies received to a letter addressed to the head masters of schools in which elementary chemistry was taught. In 1889 and 1890 reports were presented in which were included suggestions drawn up by myself for a course of elementary instruction in physical science.

Let me at once emphasise the fact that these schemes were for a course of instruction in physical science—not in chemistry alone. The objects to be accomplished by the introduction of such lessons into schools have since been more fully dwelt on in a paper which I read at the College of Preceptors early in 1891, printed in the *Educational Times* in May of that year. After pointing out that literary and mathematical studies are not a sufficient preparation in the great majority of cases for the work of the world, as they develop introspective habits too exclusively, I then said, in future boys and girls generally must not be confined to desk studies; they must not only learn a good deal *about* things; they must also be taught how to *do* things, and to this end must learn how others before them have done things by actually repeating—not by merely reading about—what others have done. We ask, in fact, that the use of eyes and hands in unravelling the meaning of the wondrous changes which are going on around us in the world of nature shall be taught systematically in schools generally—that is to say, that the endeavour shall be made to inculcate the habits of observing accurately, of experimenting exactly, of observing and experimenting with a clearly defined and logical purpose, and of logical reasoning from observation and the results of experimental inquiry. Scientific habits and method must be universally taught. We ask to be at once admitted to equal rights with the *three R's*—it is no question of an alternative subject. This cannot be too clearly stated, and the battle must be fought out on this issue within the next few years.

Well, gentlemen and ladies, you have the honour of forming part of the advanced guard in the army which is fighting this battle—for the fight is begun in real earnest, although as yet on a small scale: nevertheless, in this case, the small beginning *must* have a great ending.

I had long sought for an opportunity of carrying the war into the camp of elementary education, and this came about four years ago when my friend Mr. Hugh Gordon was appointed one of the Science Demonstrators of the London School Board. During at least three years prior to his appointment, Mr. Gordon had been doing research work in the laboratory of which I have charge at the City and Guilds of London Institute Central Technical College, where he had also taken part in our elementary teaching, and he was already an ardent advocate of the educational policy of which I am so strong a supporter. Under the London School Board, he achieved a marvellous success, and the work that he has done as a pioneer cannot be too highly appreciated. He secured your confidence and sympathy, and interested his pupils; and working in a most unpromising field, under conditions of a most unsatisfactory and often depressing character, he has proved that to be possible, even easy (to the competent and willing teacher!), which my friends in higher grade schools have often scoffed at and declared to be impossible. In future, no public school will be able to excuse itself, except on the ground of want of will to give such teaching. I have often been told that our scheme was too costly, that much special provision must be made to carry it into effect, and that it requires so much time and such an increase in the teaching staff: my friend Gordon, with your assistance alone and no other addition to the staff, by successfully teaching, I believe, in seventeen of your schools, has given all these statements the lie. But I confess that as yet there are few who could accomplish so much; few equally well fitted and prepared for the work, so imbued with the right spirit, so convinced that the cause is a great and holy one, gifted with sufficient energy and enthusiasm to overcome the difficulties. The little book he has written, in which the first part of the course of teaching he adopted is broadly outlined,[1] although containing a few slight blemishes which mar its otherwise logical character—blemishes which will be very easily removed in a second edition—appears to me to be a most important contribution to educational literature, and will render great service to our cause. But I count as his greatest achievement the introduction of a proper balance—calculated to inspire confidence and respect—into the schools, for I believe the discipline of learning to weigh carefully and exactly to be of the very highest value to a child, and one of the most effective means of leading children to be careful and exact in their work generally. I envy my friend his success, as I have in vain tried to get proper balances introduced into schools of far higher grade in place of wretched contrivances costing but three or four shillings, *which can be of no service in forming character*, although I have no wish to deny that such may be made use of in illustrating principles.

Mr. Gordon, I believe, was appointed to teach mechanics under what I will venture to call an antiquated and wooden syllabus, but he had the courage to burst the bonds imposed upon him, and from the outset determined to teach what was likely to be of real service to his pupils. I have said that he gained the confidence and sympathy of the teachers with whom he was associated and whose work he was appointed to supervise and direct; but I believe that he did more, and achieved success in a task of greater difficulty—that he actually made converts of some of her Majesty's Inspectors whose sympathies had previously lain with literary studies.

I have thought it desirable thus to sketch the history of the introduction of our British Association scheme into School Board circles. Let me now further emphasise the importance of teaching *scientific method*, which after all is recognised by very few as yet. Let me endeavour to make it clear what I mean by scientific method.: that when I speak of scientific method, I do not mean a branch of science, but something much broader and more generally useful. We may teach scientific method without teaching any branch of science; and there are many ways in which we may teach it with materials always close to hand.

I have very little belief in the efficacy of lecturing, and it is always difficult to persuade those who are not already persuaded—I would therefore refer those of you who are not yet with me to a book from which they may derive much information and inspiration. I mean Herbert Spencer's "Essay on Education," the cheap edition of which, published by Williams and Norgate, costs only one shilling and elevenpence! It is a book which every parent of intelligence desiring to educate his children properly should read; certainly every teacher should have studied it thoroughly; and no one should be allowed to become a member of a School Board who on examination was found not to have mastered its contents. But as Herbert Spencer says—and the times are not greatly changed since he wrote—although a great majority of the adult males throughout the kingdom are found to show some interest in the breeding, rearing, or training of animals of one kind or other, it rarely happens that one hears anything said about the rearing of children. I believe the subject is seldom mentioned in School Board debates. Hence it happens that Herbert Spencer's book has had a smaller circulation than many novels, and that the 1893 edition is but the 34th instead of being the 340th thousand. After very fully discussing the question "What knowledge is of most worth?" he arrives at the conclusion that science is, and eloquently advocates the claims of the order of knowledge termed scientific. The following are eminently instructive passages in his essay:—"While every one is ready to endorse the abstract proposition that instruction fitting youths for the business of life is of high importance, or even to consider it of supreme importance; yet scarcely any inquire what instruction will so fit them. It is true that reading, writing, and arithmetic are taught with an intelligent appreciation of their uses. But when we have said this we have said nearly all. While the great bulk of what else is acquired has no bearing on the industrial activities, an immensity of information that has a direct bearing on the industrial activities is entirely passed over. For, leaving out only some very small classes, what are all men employed in? They are employed in the production, preparation and distribution of commodities. And on what does efficiency in the production, preparation, and distribution of commodities depend? It depends on the use of methods fitted to the respective natures of these commodities; it depends

[1] *Cf.* NATURE, 1893, xlix. 121.

on an adequate acquaintance with their physical, chemical, and vital properties, as the case may be: that is, it depends on science. This order of knowledge, which is in great part ignored in our school courses, is the order of knowledge underlying the right performance of those processes by which civilised life is made possible. Undeniable as is this truth, there seems to be no living consciousness of it: its very familiarity makes it unregarded. . . . That which our school courses leave almost entirely out, we thus find to be that which most nearly concerns the business of life. Our industries would cease, were it not for the information which men begin to acquire, as they best may, after their education is said to be finished. And were it not for the information, from age to age accumulated and spread by unofficial means, these industries would never have existed. Had there been no teaching but such as goes on in our public schools, England would now be what it was in feudal times. That increasing acquaintance with the laws of phenomena, which has through successive ages enabled us to subjugate nature to our needs, and in these days gives the common labourer comforts which a few centuries ago kings could not purchase, is scarcely in any degree owed to the appointed means of instructing our youth. The vital knowledge—that by which we have grown as a nation to what we are, and which now underlies our whole existence, is a knowledge that has got itself taught in nooks and corners; while the ordained agencies for teaching have been mumbling little else but dead formulas."

Some improvement there has been since Herbert Spencer wrote, but chiefly in technical teaching; and there is yet no national appreciation of what constitutes true education: fashion and vested interests still largely dominate educational policy.

Another advocate of the teaching of scientific method to whom I would refer you is Charles Kingsley, the celebrated divine, but also a born naturalist possessed of the keenest powers of observation, a novelist of the first rank, and a poet. Read his life, and you will find it full of inspiration and comfort. Study his scientific lectures and essays (vol. xix. of his "Collected Works," Macmillan and Co.), and you will not only learn why "science" is of use, but will have before you a valuable model of method and style. A friend—a member of the London County Council—to whom I happened to send some of my papers, noting my frequent references to Kingsley, remarked, "How very fond you are of his writings!" Indeed I am, for they seem to me to display a truer grasp of the importance of scientific method and of its essential character than do any other works with which I am acquainted. I recommend them because they are pleasant as well as profitable reading, and because our text-books generally are worthless for the purpose I have in view. Any ordinary person of intelligence can read Herbert Spencer's and Kingsley's essays and can appreciate them, especially Kingsley's insistent application of the scientific principle of always proceeding from the known to the unknown; but few can read a text-book of science—moreover, the probable effect of most of these would be to dissuade rather than persuade.

Kingsley's great point—and Herbert Spencer's also—is that what people want to learn is not so much what is, still less what has been, but how to *do*. And the object you must set before yourselves will be to turn out boys and girls who, in proportion to their natural gifts—for, as every one knows, you cannot make a silken purse from a sow's ear—have become inquiring, observant, reasoning beings, ever thoughtful and exact and painstaking and therefore trustworthy workers. To turn out such is the whole object of our scheme, which chiefly aims at the development of intelligence and the formation of character. In your schools information must be *gained*, not imparted. After describing how the intelligent mother trains her young child, Herbert Spencer remarks:—"To *tell* a child this and to *show* it the other, is not to teach it how to observe, but to make it a mere recipient of another's observations: a proceeding which weakens rather than strengthens its powers of self-instruction—which deprives it of the pleasures resulting from successful activity—which presents this all attractive knowledge under the aspect of formal tuition. . . " You must train the children under your care to help themselves in every possible way, and give up always feeding them with a spoon. Abolish learning lessons by rote as far as possible. Devote every moment you possibly can to practical work, and having stated a problem leave it to the children if possible to find a solution. Encourage inquisitiveness, but suggest methods by which they may answer their own questions by experiment or trial or by appeal to dictionaries or simple works of reference, part of the furniture of the schoolroom, and lead them to make use of the public library even: in after life you will not be at their elbows, but books will always be available, and if they once grow accustomed to treat these as friends to whom they can appeal for help, you will have done them infinite service and will undoubtedly infuse many with the desire to continue their studies after leaving school. Under our present system school books are cast aside with infinite relief at the earliest possible moment, and the desire for amusement alone remains. Teach history, geography and much besides from the daily papers, and so prepare them to read the papers with intelligence and interest, and to prefer them to penny dreadfuls and the miserable, often indecent, illustrated rubbish with which we are nowadays so terribly afflicted. At the same time, make it clear to them that the editorial "we" is but an "I," and that assertion does not constitute proof. If such be your teaching, and it have constant reference to things natural, you will also—as Herbert Spencer points out in a very remarkable passage—without fail be giving much *religious* culture, using the word in its highest acceptation, for, as he says, "it is the refusal to study the surrounding creation that is irreligious." As I have already said, one great—indeed the great—object of our teaching is the formation of character: and if you teach your pupils to be careful, exact and observant, and they become trustworthy workers, you are giving much training of the highest excellence; and if they have enjoyed such training, what does it matter what facts they know when they leave school?

But I hear you say that the inspectors will not allow all this. Gentlemen, do not fear the inspectors—they also are advancing; they also are learning that literary methods are insufficient, that desk studies must not absorb the entire attention of the scholars; that greater latitude must be permitted to the teachers, and especially in the direction of devising more suitable methods. And a new race of inspectors is coming into existence. Mr. Gordon, I know, had difficulties with the inspectors; but when they realised that he understood his business and learnt to appreciate his work, they soon became his supporters.

And with appreciative ministers like Mr. Acland at the head of affairs, we shall move far more quickly than heretofore, and shall be able soon to entirely throw off the cast-iron bonds of control by examination and payment on results—a refined method of torture affecting both teachers and taught most disastrously. We know that a holiday spent under healthy conditions at the seaside or in the country is of the greatest service. We are becoming accustomed to take care that our houses are properly ventilated and drained, and to rest satisfied that when this is the case their inhabitants may safely be left to themselves. In like manner, in future, we shall take care that our schools are fully provided with all necessary proper appliances—in which I include teachers—and we shall see that the teachers are working in accordance with a proper system; but we shall trouble ourselves little about the taught, feeling that if they have been placed under healthy conditions they cannot fail to have benefited, however little this may be apparent on the surface. In the days to come the work of the teachers will be directly criticised; they, not their pupils, will be examined: but always by competent and sympathetic inspectors who have become acquainted with the work and its difficulties practically, and are not mere theorists, whose main function will be that of guide, philosopher and friend—not that of inquisitor.

In the course that you are about to attend under Mr. Heller—the demonstrator upon whom has fallen the mantle previously worn by Mr. Gordon, and who is equally desirous of promoting and devising rational methods of teaching—you will in the first place devote your attention to exercises in measurement, including much that is ordinarily taught under mechanics and physics, the prime object of which is to teach accuracy of observation. You will then study a series of problems, mainly chemical, which have been arranged chiefly in order to cultivate reasoning powers and to teach the research method. In fact, what we want to do is, as far as possible, to put every scholar in the position of the discoverer. The world always has and ever will advance through discovery; discoveries, however, are rarely made accidentally—indeed we all pass from ignorance to knowledge by discovery, and by discovering how to do things that we have not done before we ever increase our powers of usefulness: we all require therefore to be taught how to discover, although

we may never be called on to make original discoveries or have the opportunity. But as you proceed I trust that you will realise that the method which you are learning to apply is one which can be made use of in all your work—that the course has a broad educational value far transcending its special value as an introduction to physical science.

Lastly, I should like to take this opportunity of calling attention to the very great value to girls, as well as to boys, of teaching such as you are about to give. I fear that much that girls are being taught under the guise of domestic ecônomy is of slight value educationally or otherwise, and that they are but having imparted to them little tit-bits of information which they are as likely as not to misapply. Nothing is done by way of increasing their intelligence and forming their characters. Lessons which would lead them to be observant, thoughtful and, above all, exact—lessons in method—would be of far higher and abiding value. They would then carry out their household functions with greater ease; there would be far less waste; less unhealthiness; far more comfort. I believe the need for such training to be indeed far greater in the case of girls than in that of boys. Boys are naturally apt in many ways, and even if neglected at school, perforce develop when they go out into the world; but girls are of a different disposition, and rarely seem to spontaneously acquire the mental habits which a training in scientific method can confer, the possession of which would be of inestimable value to them. Extraordinarily little has been done as yet on their behalf, and they have been cruelly sacrificed at examinations—for which, unfortunately, they appear themselves to have an insatiable natural appetite. It is to be hoped that the new Board will give the most serious attention to this matter, and that it will take steps to secure the teaching of scientific method in all the schools under its charge, whether boys' schools or girls' schools. Unhealthy buildings have attracted much attention; but the existence of a far more serious evil—the absence of healthy teaching suited to the times—has not even been noticed.

In these remarks, I have been able but briefly to bring before you a number of questions of importance—it must rest with you to seriously study the subject. It is a subject worth hard study, which will afford infinite opportunity and infinite satisfaction to the earnest worker.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The following examiners for the Natural Sciences Tripos were appointed on October 25. Physics: L. R. Wilberforce and Prof. G. F. Fitzgerald, F.R.S. Chemistry: W. J. Sell and Prof. W. Ramsay, F.R.S. Mineralogy: Prof. Lewis and H. A. Miers. Geology: P. Lake and Prof. G. A. J. Cole. Botany: Prof. F. W. Oliver, F.R.S., and W. Gardiner, F.R.S. Zoology: W. Bateson, F.R.S., and Prof. S. J. Hickson. Human Anatomy: Prof. A. Macalister, F.R.S., and Dr. H. D. Rolleston. Physiology: W. B. Hardy and Prof. E. A. Schäfer, F.R.S.

Prof. Bradbury delivered his inaugural lecture, as Downing Professor, on Wednesday, October 24, before a large audience. The subject was "Pharmacology and Therapeutics."

The University Lecturer in Geography, Mr. Yule Oldham, delivered a public lecture on the evening of October 24, on "A New Discovery of America." He will give during the present and the Lent terms a course on the "History of Geographical Discovery," on Thursdays at noon in the Chemical Theatre.

An election to the Royal Geographical Society's Studentship of £100 will be held in the Lent Term. The studentship is open to members of the University who have attended the lectures on Geography.

Of the Freshmen entered this term, 137 have announced their intention to study medicine at the University.

The period of five years for which Dr. Donald Macalister was elected as the University member of the General Medical Council expires on November 13. The Vice-Chancellor gives notice that an election will be held in the Senate House on Friday, November 9, from 2.30 to 3.0, at which all members of the Senate may vote. Dr. Macalister is eligible for re-appointment.

Dr. Charles Rieu, late keeper of the Oriental MSS. in the British Museum, has been elected Sir Thomas Adams Professor of Arabic in succession to Prof. Robertson Smith.

The Council of the Senate have issued a second report on special degrees (Litt.B. and Sc.B) for advanced study and research, in which they call attention to the steps in the same direction taken by the University of Oxford, the Scottish Universities, the Gresham (London) University Commissioners, and the University of Harvard. They propose that, as the bearings of the subject have greatly widened since their first report on post-graduate study, the whole question should be referred to a special Syndicate, with power to confer with other bodies and with the several teachers concerned.

WE have received an advance copy of the report on the work of the Examinations Department of the City and Guilds of London Institute for the session 1893-94. During this session the number of classes registered by the Institute was 853, viz. 701 in Technology and 152 in Manual Training. The total number of students in attendance was 25,718, viz. 22,703 in technology and 3015 in manual training. At the examinations this year, 11,631 candidates presented themselves, being 1377 in excess of the number examined last year. The examiners for the Institute, like those of the Department of Science and Art, find that the Honours papers are the least satisfactory. It is pointed out that Honours students should be taught in special Honours classes. To quote the report:—

"It often happens that facilities for higher or advanced instruction are not provided at the schools, and that the candidates for Honours seeking further teaching are only able to attend the ordinary class a second session. This absence of higher instruction is a matter to be carefully considered by the Technical Instruction Committees of County Councils. Elementary technical instruction is of little value unless it encourages the student to seek further knowledge; and efforts should be made, even where the number of students is small, either to establish advanced classes, or to enable students to pursue their studies at other institutions where such advanced instruction may be obtained."

MR. HERBERT TOMLINSON, F.R.S., has been appointed Principal of the South-West London Polytechnic Institute, now in course of erection in Chelsea. The institute, which will be of the same dimensions and be conducted on somewhat the same lines as the Battersea Polytechnic, will, it is hoped, be finished by April next.

IT is announced that Dr. William Peterson, who for the last twelve years has been the Principal of University College, Dundee, has been appointed to the post of Principal of McGill University, Montreal, vacated by Sir William Dawson, F.R.S., more than a year ago.

SCIENTIFIC SERIALS

American Journal of Science, October.—The standardisation of potassium permanganate in iron analysis, by Charlotte F. Roberts. A simple and rapid method for standardising a permanganate solution is to determine its strength, first, by comparison with electrolytic iron, and then by immediate titration with ferric chloride to determine the exact amount of iron in each cubic centimetre of the latter solution. This being ascertained, the ferric chloride solution can be employed at any time for the standardisation of potassium permanganate.—The detection and approximate estimation of minute quantities of arsenic in copper, by F. A. Gooch and H. P. Moseley. This is a modification of Sanger's process for wall-papers, whose application is rendered difficult by the fact that the presence of copper in the Marsh generator holds back the arsenic. The new process is based upon the simultaneous action of strong hydrochloric acid and potassium bromide upon the salt of arsenic.—Wave-lengths of electricity in iron wires, by C. E. St. John. A Lecher wire system was used in which the discs at the end towards the induction coil were left out, so as to obtain a form depending more directly upon the principle of electrical resonance. The indicator used was a bolometer as adapted by Rubens. It was found that the self-induction of iron circuits is greater than that of similar copper circuits under very rapid electric oscillations (115 million reversals per second). The difference in self-induction varies from 3·4 to 4·3 per cent., and increases with decreasing diameters. The increase in self-induction produces greater damping and a shortening of the wave-length of 1·5 to 2 per cent. The permeability