for the students. When the apparatus was handed in the student would also submit a diagram and a report on how he mastered the problem and what difficulties he encountered in the construction. The application of the apparatus was left for laboratory experimentation.

Comments like these were to be found in the student reports: "I really enjoyed making the apparatus, since it provided enjoyment and a realization that the finished product was of my creation and was to be used for the benefit of the present and future psychology classes."

Again, the student would report difficulty in construction and how he solved the problem: "The difficulty I encountered was the method of raising and lowering the drop (of the tachistoscope), which I finally solved by using the strings as I explained."

By this means the students gained insight into the purpose of laboratory apparatus. As well, the effect on the mind of the student and upon the learning activity as a whole was a highly desirable one. The students felt an intimate acquaintance if not kinship in using apparatus which they constructed and knew how to use.

Even if I had all the laboratory apparatus at my disposal I would still favor a plan whereby the apparatus should be disassembled in order to allow the students to reassemble the parts for each experiment.

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MICROPHOTOGRAPHS AND PHOTOMICROGRAPHS

IN regard to the controversy over the correct usage of "microphotograph" and "photomicrograph," I have found the following notation in the Oxford Dictionary (1928), under Photomicrograph: "In 1858 G. Shadbolt in 'Sutton's photographic notes' says: 'The word microphotograph originated, I believe, with myself and is applied, I think correctly, to very small photographs, not to photographs of very small objects which would more correctly be photomicrographs.'" However, by 1860 microphotograph was used incorrectly (according to the Oxford Dictionary) and since then seems to have been used rather loosely by all.

Since it would seem that the originator of a word should have the authority to interpret its meaning, it follows that microphotograph should indicate a microscopic photograph, and photomicrograph a photograph of a microscopic object.

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SCRIPTA MATHEMATICA

THE article "Dinner of the Society of Friends of *Scripta Mathematica*" (SCIENCE, No. 2212, p. 492) contains several inaccuracies due to errors inadvertently committed in the office of Scripta.

(1) The dinner was held in honor of Professors Eric Temple Bell, Cassius Jackson Keyser, David Eugene Smith and Mr. M. Lincoln Schuster for their contributions to public enlightenment regarding mathematics as an essential means to general culture. The opening address was made by Professor William P. Montague.

(2) *Scripta Mathematica* is a quarterly journal devoted to history and philosophy of mathematics published by Yeshiva College, and is edited by Jekuthiel Ginsburg with the cooperation of Raymond Clare Archibald, Adolph Frankel, Sir Thomas Little Heath, Louis Charles Karpinski, Cassius Jackson Keyser, Gino Loria, Vera Sanford, Joseph J. Schwartz, Lao Genevra Simons and David Eugene Smith.

(3) Among the Scripta publications in preparation are a volume entitled "Fabre and Mathematics," by Professor Lao G. Simons, and a volume entitled "Forum Lectures," being addresses given before the Forum of *Scripta Mathematica* by Professors Cassius Jackson Keyser, David Eugene Smith, Edward Kasner and Walter Rautenstrauch.

JEKUTHIEL GINSBURG

SCIENTIFIC BOOKS

REMINISCENCES OF J. J. THOMSON

Recollections and Reflections. By SIR J. J. THOMSON. New York: The Macmillan Company. Pp. v + 451. $4.00. 1937.

OF the many delightful characteristics of this most fascinating book, not the least is inherent in the simplicity and informal type of presentation. In many cases the author writes as though he were speaking to us, and we are brought into a very close personal touch with those situations which have marked the milestones in his life. When he informs us that "the examination for the Mathematical Tripos was an arduous, anxious, and very uncomfortable experience," and that it was "held in a room in which there were no heating appliances of any kind," and as we follow him through the description of the examination, we find ourselves transported in mind through more than half a century, and feel a real sympathy with that young man about to take the examination which means so much in his life. We are worried when we read that he suffers an attack of insomnia five days before the examination. We sincerely hope he will recover. On the morning of the examination we are quite nervous, but are relieved

when we know that the feeling of fatigue has passed away. We feel that it was a wise idea to take a shampoo between the morning and the afternoon examinations. We are a little disappointed that our hero comes out second, instead of first; but our disappointment is mellowed by the thought of the great richness which is to follow.

The fact of personal companionship with the writer remains with us throughout. The book abounds with incidents having to do with the various people with whom the author has had associations; and, while all is kindly said, Sir Joseph does not hesitate to voice his criticism when the occasion arises. We read how the mathematician, J. W. L. Glaisher, on being introduced to a pretty girl, would straightway go home and write a sonnet about her. We read that "he once stabbed a man and there was the dickens of a row. This gave a certain liveliness to his lecture, etc." We go on to read that "the dullness (as lecturers) of some of his contemporaries was hardly to be imagined."

Particularly interesting are the detailed accounts of methods of thought and work of some of the notable teachers and scholars of Cambridge whose activities have only been known to many of us through the formal channels of their writings. Among the more interesting of these is the short biography of E. J. Routh, the most celebrated mathematical coach of all time in Cambridge, a man who was the grandfather of more successful candidates in examinations than almost any other man living. The details of Routh's methods in instruction are most illuminating and can not help but be of profound interest to teachers in all generations, whether they would agree with or oppose the methods employed.

Among the most interesting parts of the book are those in which the author expresses his views concerning matters pertaining to education in general and to its relation to research. Those who, in our teaching institutions, consider themselves overburdened with teaching, will read with interest: "I am strongly of opinion that in general some teaching should be combined with research, and that the teacher should not regard his teaching as negligible in importance compared with his research. There is no better way of getting a good grasp of your subject, or one more likely to start more ideas for research than teaching it or lecturing about it, especially if your hearers know very little about it, and it is all to the good if they are rather stupid." Then again, "It is, I think, a general experience that new ideas about a subject generally come when one is not thinking about it at the time, though one must have thought about it a good deal before."

It presents the great J. J. Thomson in a new light when we read of his efforts to coach a pupil for the Tripos. He voices his satisfaction in declaring that the success of this man "was the greatest teaching triumph I ever had, for he was quite unable to follow any kind of mathematical reasoning. He could, however, learn pieces of book work off by heart, but without understanding them. I made him write out over and over again every piece of book work that was at all likely to be set in the elementary part of the Tripos until he could do them without mistake. This, however, did not make him safe, for there was no certainty that he could write out the right piece of book work in answer to a particular question, if the wording of the question differed to an appreciable extent from that to which he was accustomed. The issue became almost one of probability: if you have a number of balls, each with different numbers, and throw them at random into an equal number of holes, each hole having a number corresponding to that on one of the balls, what is the chance that the number of balls which go into the right holes is not less than the number of questions you have to answer correctly to get through the examination? Fortunately he had good luck and so obtained an Honours degree in mathematics in Cambridge University."

Speaking of the system of scholarships for undergraduates so prevalent in English universities as compared with the principle of working one's way through college, Sir Joseph, referring to the prevalence of the latter method in this country, remarks, "A considerable number did this by acting as waiters in summer hotels, tram conductors. . . . This all takes time and work and those who had to do it were seriously hampered in their studies. To reduce the necessity for this extra work it is very important to keep university expenses down as much as possible."

A suggestion arising out of the appointment of a professor in an American university will interest many in the scholastic field. Sir Joseph, on being consulted regarding the appointment to a certain chair of physics through the intermediary of the American ambassador, comes to the point where the matter of salary is being discussed. It seems that the salary available is rather low. However, the ambassador points out that though the salary was low, many wealthy men lived near to the university. These men had daughters, and professors held a very good social position in America, so that the successful candidate would have no difficulty in securing a wealthy wife.

Passing through the author's boyhood and early college and undergraduate days in Cambridge, in which we make the closer acquaintanceship of many lights of science formerly known to us only through their writings, we come to the history of the activities of the Cavendish Laboratory. Here again, we meet in personal intimacy such names as Clerk Maxwell, Lord Rayleigh, Sir Richard Glazebrook, Lord Rutherford,

H. R. Wilson, and indeed the whole galaxy of those names which have been associated with the growth of that great institution. We see the author actually working in the laboratory, not only in his researches, but in organizing courses for the teaching of the youth. We see him concerned with the matters of finance of the laboratory and we find him confronted with the problem of how to make both ends meet. We find a bond of sympathy with him when, speaking of a method of accumulating finances for the laboratory from certain fees he takes us into his confidence and remarks: "Another advantage is that it is possible with this system to wait until an instrument is wanted before buying it. In the more usual practice, when the University takes the fees and makes a grant to the Laboratory for apparatus, unless you spend the money in the year for which the grant is made, the authorities responsible will think that the grant is greater than you need and reduce it."

A chapter is devoted to psychical research, to such things as telepathy, water-dowsing and the like. It is interesting here to find that Sir Joseph has participated in many investigations in these fields. His attitude is always broad-minded. He usually leans to the side of seeking some ordinary physical explanation of the phenomena demonstrated, but is in no sense dogmatic and leaves his mind open to the possibility of the existence of phenomena in these realms to an extent which may be surprising to some who view these matters with but little sympathy. In this field, of course, we encounter other famous names of men who have been interested in the occult, Lord Rayleigh, Sir Oliver Lodge, and many others.

American readers will find much of interest in the history of Sir J. J. Thomson's visits to this country. His description of witnessing a game of baseball is particularly amusing. He tells us how the game had only been going on for a few minutes when most of the lawyers, doctors, bankers, professors and clergymen witnessing it had lost their power of articulation through cheers and exaltation, so that they could only croak. He adds, "I always myself get very much excited by a keen contest and feel for the moment that nothing on earth matters so much as that the side I am interested in should win." However, American enthusiasts will be much amused by his endeavoring to explain the game of baseball to Englishmen by comparing it with an English game of rounders, which is usually played by children with a soft ball, and in which the pitcher is replaced by one whose business is to throw the ball sufficiently straight so that you can hit it; and if you can't hit it, you get another pitcher. We are interested to observe Sir Joseph's opinion to the effect that if Woodrow Wilson had been a better diplomat conditions would not have developed so that he left Princeton. He would consequently not have become President of the United States during the great war.

There are interesting descriptions of the various colleges and educational centers in America. There is a certain tendency to inaccuracy in detail in some of these citations. Thus, we read of the University of Philadelphia. We read of Bryn Mawr University. The Institute for Advanced Study at Princeton is cited as an adjunct to Princeton University. We also read of the Universities of Haverford and Swarthmore.

Sir Joseph evidently came under the spell of the many amusing stories which are told of Bryn Mawr and concerning the period of presidency of Miss Carey Thomas, who, we read, "was a very capable woman with a very pronounced personality. She used the mailed fist rather than the gloved hand, and domineered over the staff and the governors." We have a citation of many of the amusing stories which are told in relation to that very prominent personality who ruled Bryn Mawr for so many years. Then follows a description of a visit to Canada and to Berlin. A chapter is devoted to Sir Joseph's association with work carried out during the war. In connection with his second visit to America to lecture at the Franklin Institute, a goodly account is given of the work of Benjamin Franklin. Next follows a chapter dealing more specifically with the history of Trinity College, Cambridge, and of Trinity College men with whom Sir Joseph has come in contact during his life. Finally, there is a chapter summarizing many of those researches with which the author has been more particularly associated, and which have played so great a part in building up the reputation which the Cavendish Laboratory possesses as one of the great research laboratories of the world.

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AUSTRALIAN PRE-CAMBRIAN FOSSILS

Australian Pre-Cambrian Fossils: A Memoir of the Late Pre-Cambrian Remains from the Adelaide Series, South Australia. By SIR T. W. EDGEWORTH DAVID and R. J. TILLYARD. Angus and Robertson, Sydney, Australia, 1936, 122 pages and 13 plates, 7s-6.

How, when and where life first began have long been baffling questions. For years the exact answers have eluded scientists, although periodically zoologists or paleontologists have been able to throw a little light on the subject. Now at last the biologists almost daily have new information concerning the borderland between the living and the lifeless. But whatever their findings, it will always be the record of the past that is most likely to yield definite replies to queries concern-