

### Microkinematography.

IN the article on "Microkinematography" in NATURE of December 14, 1911, there are one or two points which are expressed in a manner that may lead to misconception. Dealing with these as they occur, is it correct to describe the process as having been developed during the last few months? The method adopted by M. Comandon was described in *La Nature* so long ago as November, 1909, and reproductions of kinematograph films were used to illustrate the paper. In this country, too, Dr. Spitta has done and has exhibited numerous examples, and I believe I am right in stating that his work extends back to an even earlier date.

The method of illumination, which in any case is quite well known and in use in every well-appointed bacteriological laboratory to-day, is described as an application of the "ultramicroscope." This is incorrect. Illumination has clearly been effected by means of a paraboloidal or spherical surface dark-ground illuminator, and with this appliance any object, such as a bacterium or trypanosome, which is within the limits of the resolving power of the objective used, may be rendered visible.

In the ultramicroscope, much smaller objects than these are dealt with, but owing to the method of illumination the images obtained are not of necessity an indication of the size or form of the objects under observation. They appear as diffraction discs, which are visible or invisible, and vary in apparent size, according to the intensity of the source of light used.

In the case of certain colloids, for instance, it is possible to observe particles that approach molecular dimensions, and no ordinary method of dark-ground illumination could accomplish this.

Confusion of thought often arises from failure to appreciate that there is an important difference between the limits of visibility and of resolution in the microscope. The objects shown in the paper in question are well within the limits of resolving power of even a high-power dry objective, so that they are in no sense "ultramicroscopic." The term should only be applied in cases where the objects are in all dimensions beyond the limits of resolution of the best objectives, where special arrangements are necessary in setting up the object to ensure that only the particular layer under observation is illuminated, and where the source of light is of sufficient power to render visible isolated particles which are much smaller than the resolution limit. The subject is one on which much might be said, but it is clearly impossible to do more than indicate the line of argument.

*Spirochaeta pallida* is especially referred to, but even this is easily and perfectly shown under ordinary laboratory conditions by a dark-ground illuminator.

Is the statement literally true that "some thousands of successive photographs" are taken per minute? If so, then it appears to be necessary to give a much shorter exposure in the kinematograph than when taking instantaneous photographs of any of the subjects illustrated. Without wishing in any way to minimise the achievements described, it should be borne in mind that the main difficulty is the almost prohibitive cost. There are many photomicrographers who are competent to carry out such work and to overcome such technical difficulties as exist, but there are scarcely any who are able to face the great cost of the films. In the present case, the immense resources of Messrs. Pathé Frères have been placed at the disposal of the worker, so that this difficulty has not been experienced.

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King's College (University of London),  
Strand, W.C., December 18, 1911.

It may be admitted that the word ultramicroscope is misplaced, and its use may inadvertently cause some confusion, though the remarks which immediately follow should prevent any possible misconception as to the method employed. The large cost involved is, of course, a consideration of great importance to those actually concerned in the production of the films, but scarcely one to be insisted on in an article such as that under discussion.

THE WRITER OF THE ARTICLE.

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### UNIVERSITY EDUCATION IN LONDON.

WE published on June 15, 1911, an article giving some information as to the proceedings which led up to the appointment of the Royal Commission on University Education in London, and dealing with the second volume of evidence issued by the Commission. The third volume of evidence [Cd. 5528, price 3s. 8d.], recently issued, contains the evidence presented between November 10, 1910, and July 28, 1911. Much of this evidence is not of direct interest from the point of view of the promotion of science, dealing as it does with such matters as legal education, the position of individual colleges, and the relation of the University to secondary education, though the discussion of these questions is of importance as indicating the general form of organisation for the University which the Commission will propose, and which must in the future exercise a potent influence over scientific education in London and elsewhere. There are, however, two subjects of more immediate interest on which a good deal of new evidence is now published; first, the work and government of the Imperial College of Science and Technology at South Kensington, and its future relations to the University; and, secondly, the organisation of medical education in London. Each of these questions is extraordinarily complex, and might well engage the sole attention of a Royal Commission; and it will only be possible in a short article to indicate in a rough way the character of the evidence presented.

The witnesses for the Imperial College, who were heard on February 23, 1911, were Lord Crewe, the chairman of the governing body, Sir William White, Dr. R. T. Glazebrook, Mr. R. Kaye Gray, and Sir Alfred Keogh, and their evidence was based on the following resolution adopted by the governing body:—

The Imperial College of Science and Technology having been established "to give the highest specialised instruction, and to provide the fullest equipment for the most advanced training and research in various branches of science, especially in its application to industry," the governing body is of opinion that, in order to attain the purposes contemplated—

(i) The autonomy of the Imperial College should be maintained, and incorporation with the University of London should not take place; and

(ii) Some means shall be found, either by the establishment of an independent department or faculty of technology or otherwise, by which students of the Imperial College of Science and Technology who satisfactorily complete the associateship courses of the college, and students duly qualified by research, advanced study, or in other approved ways, may obtain degrees without further examination.

Throughout their evidence the witnesses laid great stress on the importance of the higher, or post-graduate, work of the college, especially in its industrial aspects, and the action already taken by the governing body in developing this side of the work of the college was fully reported. With reference, however, to the basing of the claim for autonomy on this special characteristic of the work of the college, the witnesses were subjected to somewhat severe examination by Sir Robert Morant in regard to the obligation imposed on the governing body in the charter to carry on the work of the Royal College of Science and the Royal School of Mines, which has been in the past, and, as statistics published in the volume show, is at the present time mainly undergraduate—that is, of the standard required for the first degree of a university. In reply, it was contended that the governing body had power to modify the courses in these colleges; but Sir Robert Romer

thought that the extent to which this power could be exercised under the present charter was one for a court of law.

"I doubt," he said, "if you could change it. You could not change its nature substantially. It is a question of substance. Minor modifications undoubtedly, but anything which would really change the nature of the school you have no power to do, and it would be changing the nature of it, if chiefly occupied with pre-graduate instruction—it would be a substantial alteration in my view—if you changed it into a post-graduate system of education" (Question 7840). To this Sir William White replied: "If it were considered desirable, on national grounds, to make the change, that would mean an alteration of the Charter."

This important question is discussed elsewhere in the evidence. Sir Arthur Rücker expressed himself as strongly opposed to the policy.

"If this policy were adopted at present," he said, "the institutions forming the Imperial College would be ruined financially. Then, again, it is more than doubtful if the ideal of having none but post-graduate students can be attained. The well-known case of Johns Hopkins University is in point. It started as a post-graduate institution, with the best professors that could be got, and it was a most successful institution, but some five or six years ago they had to give up their scheme, and the latest statistics I have looked at showed that about one-fourth of the college consisted of undergraduates, instead of being wholly post-graduate. I do not think that what, under the most favourable conditions, failed there is likely to succeed in London, and, if it does succeed, success cannot be attained for a very long time. We have already had something like 700 students; we are now spending just on a quarter of a million pounds on new buildings, and, putting it at a very low figure indeed, could very easily have 1000 students. If there were none but post-graduate students there, they would take up more room than the ordinary undergraduates, but if we say only 700, I think the ideal of having 700 post-graduate students in technological subjects concentrated in one institution in London is at present absolutely chimerical" (Question 9094).

While, however, the witnesses for the Imperial College maintained generally their claim to autonomy, they discussed in a not entirely unfriendly way the possibility of devising some faculty organisation in the University which would meet their special requirements. Such an organisation they regarded as a second-best alternative to the establishment of a distinct technological university, as to which, however, not much encouragement was forthcoming from the Commission. The chairman stated, early in the evidence, that "The Commission feel, that if it can be avoided, it is not desirable that there should be two bodies of university rank in the London area" (Question 7727), and this question was not further discussed.

In the evidence of Prof. M. J. M. Hill, then vice-chancellor, some interesting information is published, we believe for the first time, on the proposals put forward by the Senate of the University before the issue of the charter for the Imperial College, from which it appears that the Senate was prepared to consent to some alteration of its own constitution in the direction of increasing the representation of technical interests, and it advocated the government of the Science College and the Technical College by distinct committees.

With reference to the organisation of medical education in London, some very interesting evidence is published by Mr. Abraham Flexner, of the Carnegie Foundation of New York, Prof. Friedrich Müller, of

Munich, Sir William Osler, and others. There appears to be general agreement as to the urgent need for the reorganisation of the London medical schools in order to promote in a more thorough way the scientific study of medicine. It was admitted by several witnesses that London students have exceptional advantages in the amount and variety of clinical material available in the hospitals, but the system under which the clinical teaching is almost entirely undertaken by physicians and surgeons whose time is very fully taken up in the practice of their profession was considered to be defective, though there was no strong feeling that even the principal teachers should be rigidly barred from professional work. The Continental and American systems of hospital clinics are described in detail, and the desirability of organising one or more of the London hospitals and medical schools on similar lines is considered, with reference both to the financial aspects of the question and the difficulties arising from vested interests. As, however, the medical evidence is not at present complete, it may be well to defer further consideration for the present.

The fourth report of the Commission [Cd. 6015] was published on December 23. This is substantially the first report, for it is the first document which has been issued in which the Commission gives expression to its corporate opinions. On the whole the report must be pronounced as reassuring, for it shows that the Commissioners have risen above petty and sectional jealousies, and have formed a high ideal of the University which London should possess. The Commissioners evidently wish the University to put its house in order in a physical sense as a preliminary to a scheme of reorganisation in an academic sense, for the report deals exclusively with the need for a permanent building for the University, "appropriate in design to its dignity and importance, adequate in extent, and specially constructed for its purposes, situated conveniently for the work it has to do, bearing its name, and under its own control."

The present building of the University at South Kensington is condemned for various reasons, in particular its situation, Government ownership, and inadequacy. In adumbrating the form of new building required and the purposes to which it is to be put, the Commission is forced to deal to some extent with vexed questions of policy, but it lays special stress on the need for a great hall and for suitable accommodation to promote the social interest of teachers, graduates, and students. Lecture halls and some library accommodation would be required, but the Commission defer any definite judgment on the policy which has been urged upon them from some quarters of providing a series of research laboratories in direct connection with the University.

The Commission, in the last paragraph of its report, appeals in eloquent terms to the generosity of benefactors in order that an endowment may be provided for a reconstituted University, and a new building may be available which would be a visible sign of its recognition and acceptance as a great public institution. "A great university is not self-supporting, and can never be so. As an institution for learning, in which liberal education, instruction in the methods of advancing knowledge in a wide range of subjects, and the highest professional training, are combined with large scope for the free exercise of thought and with full opportunity and encouragement for the systematic prosecution of research, it can never exist financially on the fees of its students." The report is dated December 15, 1911, and is signed by all the Commissioners.