

late, but so much has been written at second-hand, as well as in the way of original treatment, that further reiteration is uncalled for. The work of Hertz and of his host of followers is familiar to us all. In the study of electrical oscillations even of very high frequency, photography has been used with success, and details of the phenomena of time-elements truly infinitesimal have been secured. By the labours of Wiener¹ waves of a still higher order than those which have occupied the attention of the electrician have been photographed, and a new field of the greatest promise has been thrown open to the optician. The isolation of a single light vibration may indeed still be as far from us as is the inspection of the molecule by means of the microscope, but in the meantime we have in the photography of a system of standing light-waves, an achievement well worth celebrating.

In the investigation of the phenomena of the time-infinitesimal, so far as periodic changes are concerned, we see that the experimenters of the present time are gaining much of detailed knowledge. There is another field equally important, in my opinion, which is as yet for the most part unexplored. The study of the beginnings of changes brought about by abrupt shifting of the conditions of equilibrium is one from which very much may be expected. Already suggestive beginnings have been made, but the researches have not been pushed to the limit of the experimentally possible. Oftentimes interesting observations of what might be termed "startling phenomena" have been recorded, but quantitative results are lacking. Take for example the brilliant work of Becquerel (*Comptes rendus*, 96, pp. 121, 1215, 1853) with the phosphorescope. What a mass of fascinating and suggestive material that savant has gathered into the first volume of his book on light! (*La Lumière*, i. pp. 206-422.) What a world of interesting material these preliminary observations present to him who shall undertake to determine quantitatively, wave-length by wave-length, the changes which the radiations from the numerous luminescent materials undergo, beginning with the instant of exposure and following the vanishing light until it is gone.

Of a few isolated cases which have been forced upon us by their practical importance we have some complete knowledge already. With the phenomena in cables when current is suddenly introduced or circuit is broken, we are reasonably familiar. The case of the charge and discharge of condensers has been treated analytically under assumptions the precise truth of which is still to be verified. The detailed study by experiments carried to the utmost refinement, of the very cases which seem to have been most completely covered by theory, is especially important; since in this way only can the assumptions upon which our analysis is based be rigorously determined, and the necessity of modifications be ascertained. For some of this work methods already in use in the study of periodic phenomena will suffice. The curve-writing voltmeter, for example, may be made to give records running to within a thousandth of a second of the instant when a process such as electrolysis, electrolytic polarisation, voltaic action, or the charge and discharge of a condenser begins. Instruments such as the von Helmholtz pendulum, for the isolation of definite small time intervals, may also be applied to a great variety of progressive phenomena, enabling us to approach by successive steps almost to the very beginnings of the changes to be analysed. Concerning known methods let me point out, in conclusion, that photography with the moving plate is a means, the limitations of which have not yet been discovered. It is equally applicable to periodic and to progressive phenomena, often with results of unexpected beauty and significance.²

The remarkable experiments of Mach (*Wiener Sitzungsberichte*, 95, p. 764, also 97, p. 41) and of Boys ("On Electric Spark Photographs," &c., *NATURE*, vol. xlvii. p. 415) indicate that the dry plate is still abundantly exposed within intervals so short that the swiftest of modern projectiles give images as of a body at rest.

The laws of electrical resonance have already been so far determined that we can construct condensers, the duration of the discharge of which is a matter of computation, and the precise

moment of the discharge of which after a given event is quite within control. This single device, consisting of the exposure of the photographic plate by means of a properly timed spark, brings under observation a set of time intervals of a new and higher order of brevity. Much is destined to be learned by means of it concerning the nature of matter, and much more, I think, from other, possibly still more powerful, methods which will doubtless be developed when the importance of the study of the time-infinitesimal is more generally recognised.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—At a meeting of the Ashmolean Society, held at the Museum on Monday, 27th inst., Prof. Odling was elected President for the ensuing year, and Messrs. F. J. Smith and G. C. Bourne were re-elected Secretaries. Mr. E. J. Stone read a paper on the rainfall at Oxford during the last seventy-eight years, and Prof. E. Ray Lankester read a paper on fresh-water jelly-fishes.

At the meeting of the Junior Scientific Club, on Friday, 24th inst., papers were read by Dr. Ritchie, on anthrax spores and bacilli; by Mr. G. B. Cronshaw, on explosions in coal-mines; and by Mr. A. L. Still, on plants and their standing army.

CAMBRIDGE.—The Special Board for Physics and Chemistry report that the Cavendish Laboratory, founded and equipped by the munificence of the late Duke of Devonshire, has become incapable of accommodating the large number of students desiring tuition in Physics. In the present term no less than 135 students are at work in a disused galvanised iron dissecting-room, which, on its vacation by the Professor of Anatomy, has been placed at the disposal of the Professor of Physics as a temporary laboratory. Its site will, however, soon be required for the Sedgwick Memorial Museum of Geology, and the Board feel that the time has come for the permanent extension of the Cavendish Laboratory. An adjoining site is available between it and the Engineering Laboratory; but the problem of funds for building and equipment is less easy to solve, unless a benefactor as generous as the late Chancellor should make his appearance. The high position deservedly held by the Cavendish Laboratory, entrusted as it is with much work of national importance, makes it reasonable to hope that Prof. J. J. Thomson will be able to obtain the means for the desired extension.

Mr. W. Gardiner and Mr. A. C. Seward have been re-appointed University Lecturers in Botany, and Dr. Hill, Master of Downing College, Lecturer in Advanced Human Anatomy, for five years. Dr. Hill has also been appointed Chairman of the Examiners for the Natural Sciences Tripos.

The Local Examinations Syndicate report that the work done in the scientific branches of the Higher Local Examinations during the past year was on the whole satisfactory. Imperfect experimental work in chemistry, and lack of practical instruction in zoology, are among the weaker points revealed.

The Examinations in Sanitary Science seem to be increasingly appreciated by medical men. During the present year eighty-seven candidates have presented themselves, and of these fifty-eight received diplomas in Public Health.

THE *Times* correspondent at Paris says that an International University alliance is in course of formation there. Its object is to facilitate the passing of students from one University to another, to promote travelling scholarships and the exchange of information, to multiply periodical celebrations, and to "draw the attention of the Universities to the question of introducing greater justice into international relations."

SCIENTIFIC SERIALS.

Wiedmann's Annalen der Physik und Chemie, No 11.—On the speed of electrolytic ions, by F. Kohlrausch. This is a compilation of tables of absolute velocities, of mobilities, and of coefficients of electrolytic friction according to the latest and most reliable data.—Contributions to the knowledge of the absorption and branching of electric oscillations in wires, by Ignaz Klemencic.—The resistance which causes evolution of heat during the passage of very rapid oscillations depends upon the magnetic permeability of the wire, but in a different

¹ "Stehende Lichtwellen und Schwingungsrichtung des polarisirten Lichtes." *Annalen der Physik N.F.* vol. xl. p. 203.

² In photographing the alternate current arc a single exposure of a continuous current lamp upon the moving plate, by way of check, brought out the seat and precise nature of the hissing of the arc in a manner scarcely to be reached in any other way. For the method used, see "A Photographic Study of the Electric Arc," *Trans. Am. Inst. Electrical Engineers*, vol. viii. p. 214, 1891.