

Dr. W. C. C. Pakes, who has been appointed bacteriologist to the Transvaal Government. The council has resolved that, in order to keep a permanent record of the legacy left to the college by Mrs. Morton Sumner, the lecturer in geology be hereafter called the Morton Sumner lecturer in geology.

The papers read at the recent conference of science teachers, arranged by the London Technical Education Board, are appearing in the *Technical Education Gazette*, with reports of some of the speeches. The January number of the *Gazette* contains addresses on the teaching of hygiene, by Miss A. Ravenhill; mental school hygiene, by Dr. F. Warner; and the teaching of natural history, by Mr. F. E. Beddard, F.R.S.

The Technical Education Board of the London County Council report that the reorganisation of London University is already having a marked influence for good on the polytechnics and other institutions. The advanced classes in science and engineering are being revised and brought up to a higher standard, gaps in the curriculum are being filled up, and more students are being induced to enter upon systematic courses of study, extending over three or four years, instead of attending isolated classes. Complete degree courses, under teachers of the University, will shortly be available for evening students at several of the polytechnics. The due recognition of engineering and higher commercial subjects was provided for by the establishment of separate faculties, and the Senate has now approved courses of study in which students will proceed to the degrees of B.Sc. and D.Sc. The regulations for the economic or commercial degree enable it to be gained in such subjects as the history, principles and organisation of banking, insurance, railway and shipping transportation, international commerce, local government, statistics, &c. By means of the Council's aid, the Senate has now determined on (1) the organisation of an institute of advanced chemistry, both organic and inorganic, at one centre; (2) the provision of advanced teaching in engineering at two centres; (3) the systematic organisation of the teaching of modern languages at all the University centres, including the polytechnics, and beginning with German; (4) the provision of a professorship of education in connection with the Council's proposed day training college for teachers; and (5) the appointment of University teachers in economic history and theory, commercial geography and history, banking, statistics, foreign trade, &c.

SCIENTIFIC SERIAL.

Bulletin de l'Académie de Sciences de St. Pétersbourg, 5th series, vol. xii.—On the compound (so-called stationary) radiants of shooting stars, by Th. Bredikhine (in French). The supposed existence of stationary radiant points (or radiant points of long duration) is an obstacle against all more or less admissible theories of shooting stars. Taking advantage of the 918 meteoric orbits calculated by J. Kleiber in 1891, and of subsequent data, the author concludes that each stationary (or long duration) radiant consists of several individual radiants, even when these radiants do not much differ from each other in their dates; this means that each stationary radiant is a compound radiant which originates from several individual radiants, each of which has its own position in space and its own origin, and all of which are intersected by the orbit of earth. Thus, in the well-known radiant of β Persei he finds "thirteen or fourteen different orbits, i.e. as many different streams" (p. 102). The author examines next the theories of Profs. H. H. Turner and A. S. Herschel, and concludes that "the deductions of Prof. Turner are only admissible under the impossible supposition that the earth moves with a uniform speed along a straight line. But if the theory itself is inconsistent, its secondary complications, such as the spinning of the meteoric stream, the resisting medium, &c., have no more signification" (p. 115). Applying his explanation next to the polar stationary radiants of Mr. Denning, the author shows that in the radiant ζ Draconis (No. 36 of catalogue A), one may recognise "twelve different individual streams (twelve comets) apparently composing one single stationary radiant." The author's final conclusion is:—"A stationary radiant does not originate from a single individual stream or from one single comet; it must be named a compound radiant, because it is produced by several comets or independent streams. The phenomenon is so simple that all complicated and artificial theories are useless and superfluous. . . . Thanks

to the numerous and careful observations of Mr. Denning, the phenomenon has lost its supposed individuality and has become decomposable and explicable."—On photographic observations of the satellite of Neptune at Pulkova, by S. Kostinsky (Russian; with a plate).—Report on zoological researches at Sebastopol in 1899, by A. Kovalevsky: hypodermal fertilisation with the leeches; on *Batrachobdella laistii*; on *Helyle Tyrtowii* (n.sp.); on *Pseudovermis paradoxus*, Periasl.—On faint lines in stellar spectragrams, by A. Belopolsky.—On a MS. in Coptish language attributed to Dionysius Areopagita, by Oscar Lemm.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 23.—"Mathematical Contributions to the Theory of Evolution. XI.—On the Influence of Natural Selection on the Variability and Correlation of Organs." By Karl Pearson, F.R.S.

The influence of directed—natural or artificial—selection on the characters of a race is one which it is fundamental for the purposes of evolution to appreciate quantitatively. I have already shown in an earlier memoir of this series the effect of random selection, or what it is better to term random sampling, on the characters of a population. Isolation of a few individuals who form a random sample may produce very sensible modifications of race characters, but it is to directed selection that we must look for changes on the largest scale. The subject is a very broad and complex one—no less than the total effect upon a population containing individuals at all ages of a selective death-rate applied for a long period and a function not only of the organs of each individual, but of the relationship of these organs to each other, and of the stage of growth of the individual. In the present memoir, attention is confined to the influence of selection in altering a complex of organs, no reproduction taking place during the selection.

A very definite distinction is at once reached, namely, that between directly and indirectly selected organs. It may be said that, although it is possible for the recruiting sergeant to select stature, and in so doing differentiate the arm-length of his troop from that of the general population, yet that in natural selection we are given only the modified organs, and so we cannot tell which of them have been directly and which indirectly selected. Both are changed; how discover which was the source of the change? The answer is: In the same manner as we could distinguish between two recruiting sergeants, one of whom selected his troop from the general population by stature, and the other by cubit; in either case the stature and cubit would be both modified, but the mathematical theory of regression would enable us to distinguish between the methods of operating of the two men, and even between them and one who selected by *both* stature and cubit at once. The mathematical theory as developed in this paper shows us that, although the whole complex of characters may have been changed, still, if direct selection has only occurred in p out of n possible cases, there will be certain of the partial regression coefficients which remain unmodified and which will theoretically enable us to distinguish among the whole group of differentiated organs, between those directly selected and those modified only because they happen to be correlated with the directly selected organs. Thus the distinction becomes one of singular importance, for though the selection of a few organs modifies the means, variabilities and correlations possibly of the whole complex of characters, certain functions of those quantities remain constant, and such constants ought to be discoverable, at any rate in theory, and should serve as the criterion of a common origin, when we deal with local races as having been subjected only to a selection directly differentiating a comparatively few characters.

If selection has changed a race from a condition A to a condition B, it becomes of much interest to determine the nature of the selective death-rate by which the process has been carried on, and it is found that this death-rate as represented in the surface of survival rates enables us to distinguish two kinds of selection, termed in the memoir positive and negative selection. In the first case, a race is modified, because the nearer its members are to having their organs with a certain system of values, the better fitted they are to survive; in the second case, the nearer the individuals are to this system the less fitted they