The spectrum of the Nova suggested that it might display the same peculiarity of focus hat we find in regard to planetary nebulæ, but a series of observations made between August, 1901, and January, 1902, failed to give any indications of this phenomenon.

The determined position of the Nova with regard to fourteen stars in its immediate vicinity—of which Prof. Barnard gives a chart—agrees fairly well with that already published by Prof. Aitken (Lick Observatory *Bulletin*, No. 8), and a comparison of the two sets of observations confirms no real motion of the Nova.

The observations of brightness, which extend from July 30, 1901, to April 15, 1902, show a gradual decrease in the magnitude of the Nova, with occasional brightenings in which, however, there appears to be no definite periodicity. After special measurements, Prof. Barnard disagrees with the Potsdam magnitude of the reference star B.D. 43° 270 and uses his own estimated value, which is about 0·2m. fainter than that of Potsdam, *i.e.* it is 7·56m.

Careful observations with the great telescope have failed to reveal, visually, the nebulosity surrounding the Nova, the light of which is probably mainly photographic, nor has Prof. Barnard been able to discover the 12·0m. star recorded by Prof. Ceraski as being 0·31s. following and 7″ south of the present position of the Nova (*Astronomische Nachrichten*, No. 3755).

NEW VARIABLE STARS.—The two new variables, as given below, are recorded in No. 3796 of the *Astronomische Nachrichten*.

11, 1902, *Lyrae*.—Mr. Stanley Williams reports the variability of the star, the position of which, as measured on various negatives, is 19h. 7m. 37s.·4 +41° 3′·7 (1855); its magnitude ranges from 11·10 to 12·20. Examination of the various records shows that the brightness of this star was approximately the same, in September, in 1899, 1900 and 1901, so that its period is probably exactly one year, or possibly one half-year.

12, 1902, *Pegasi*.—Herr K. Graff reports the variability of the star, the position of which is 22h. 7m. 30s.·15 +14° 4′ 10″·0 (1902), its range of variability being from 8·7m. to 9·4m.

DELAY OF THE MINIMUM OF U CEPHEI.—In No. 3796 of the *Astronomische Nachrichten*, Mr. J. Plassman records a delay of about 2h. 27m. in the minimum of U Cephei, on April 27, after the time of minimum recorded at Münster.

EARTHQUAKE NOTES.

THE seventh and eighth numbers of the new series of publications issued by the Earthquake Commission of the Kaiserlichen Akademie der Wissenschaften in Wien respectively refer to earthquakes which have been noted in certain parts of the Austrian Alps and in the Carpathians. The first of these, by Dr. R. Hoernes, is a register of 208 shocks observed in Styria between the years 1000 and 1870. Many of these disturbances are described in detail, and to each description there is appended a criticism of the various sources from which the author has derived his information. To complete this work, earthquakes which shook Styria, but originated beyond its borders, have to be considered, and, lastly, the districts shaken and the lines along which shocks have been distributed have yet to be determined. In short, what E. Suess has done for lower Austria and H. Hoefer for Carinthia is to be done for Styria. The second publication, by Prof. W. Láska, is an historical account of the earthquakes of Poland. It refers to a period practically identical with that considered by Dr. Hoernes. The author commences by saying that "earthquakes in Poland are rare," but as reference is made to earthquakes of distant countries which were synchronous with observations made in Poland, the description of Galician shocks extends over thirty-six pages. As an example of these references we read that the first earthquake in 1834 occurred on January 23 at 8h. 45m. and was observed in Tarnopol. On the same day there was an earthquake in England, the epicentrum of which was five miles north of Chichester, and it is worthy of note that there was a similar coincidence in 1666. The probability, however, is that if we had before us a register of all the earthquakes of the world, a coincidence might be found for each of the Carpathian records. In the general remarks attached to these registers we find several interesting notes on the emotional effects produced by those who have predicted the occurrence of earthquakes on specified dates. An accidental realisation of a widely published prediction took place on February 27, 1786, with the result that processions were organised and prayers were offered that earthquakes should not only shake Poland, but that a few should be arranged for Prussia.

In November, 1900, Prof. E. Ōdone gave an account in the *Bollettino della Società Sismologica Italiana* (vol. vi.) of forms of apparatus he proposed to introduce into seismometry which did not have the character of pendulums. The object of the first piece of apparatus was to measure the relative motion of two points of ground separated by a short distance. A seismographic arrangement identical with that proposed by Prof. Ōdone was used in Japan in the years 1884 and 1885. It showed that for fourteen earthquakes the relative motion of the heads of two stakes 3 feet from each other varied between 1 mm. and ·08 mm. (*Trans. Seis. Soc.*, vol. xii. pp. 63–66). The second piece of apparatus has the character of a manometer, and in its improved form as now constructed is described in the *Rivista di Fisica* (Pavia), December, 1901. It consists of a chamber about 2 m. in height and holding 200 l. of water, embedded in the foundations of a wall. At the upper and lower ends of this chamber are two passages closed by sheets of iron. On one side these sheets are in contact with the soil in which the foundations are buried and on the other side with the water of the manometer. Should a shock be transmitted through the soil, these metal diaphragms are deflected, with the result that the water from the chamber rises in a small tube 0·85 cm. in diameter, which is attached to the upper end of the manometer. The effect of vibrations due to explosions of powder in mines—in one instance amounting to 10,000 kgr., the apparatus being at a distance of 1 km.—have been studied, and it is seen that the changes of level in the manometric gauge are such as can be easily measured. From this apparatus it is expected to obtain certain direct measurements of earthquake energy, and from a manuscript note attached to the copy of the paper describing the same it is also anticipated that it may record volcanic sounds.

STATISTICAL METHODS IN BIOLOGY.

THE third part of *Biometrika*, published in April, contains several important contributions, the first of which is by Prof. Karl Pearson, who describes "a systematic method of curve-fitting by moments." For practical purposes it is found that if good quadrature formulæ are used this method is as good as the well-known method of least squares, and in some cases is applicable where the older method fails. Examples of the application of the new method are given. A communication on the sources of apparent polymorphism in plants comprises an editorial introduction and four papers by Messrs. G. Udny Yule, W. L. Tower, Dr. Alice Lee and Prof. Karl Pearson, and Mr. Yule respectively. Those who have considered the "multimodal" character of many botanical distributions as furnishing evidence of the existence of subspecies or local races will find reasons for reconsidering their views in these papers. In this part also Prof. Pearson contributes a controversial paper under the title "On the Fundamental Conceptions of Biology," in which he deals with discontinuity, differentiation and variation, and replies to Mr. Bateson's criticism of his memoir on the principle of homotyposis published in the *Philosophical Transactions* (vol. cxcvii. pp. 285–379). Another controversial paper by Prof. Weldon deals with Prof. De Vries's first volume on the theory of the mutation of species ("Die Mutationstheorie," &c., Bd. 1, 1901). The facts adduced by De Vries in favour of this intermittent and apparently anomalous mode of evolution are considered by Prof. Weldon to be inconclusive, and he comes to the conclusion that the evidence is insufficient to warrant the acceptance of this theory in preference to the selection theory of Darwin.

Among other contributions we may call attention to Mr. Blanchard's paper on "grandparental inheritance," in which he emphasises the need for further experimental work on "blending" as distinguished from "alternative" inheritance, and suggests for this purpose insects and some of the smaller mammals. Miss Lewenz publishes the completion of an investigation first started by Miss Whiteley and Prof. Pearson on the variation and correlation of the bones of the hand in woman. The conclusion is suggested "that if efficiency depends on high correlation, it is not to external measurements of the skull that

we must look for tests of intellectual efficiency." Not the least interesting paper at the present time is Dr. W. R. Macdonell's note on the result of previous vaccination on the effect of small-pox when incurred. According to the abstract "he shows that the correlation of foveation and size of scar with severity of attack is only moderate, but that there is very considerable correlation indeed in all the recent epidemics, not only between recovery from, but between the severity of the attack and the existence of the scar." It has not hitherto been found possible to obtain statistical data for deducing the correlation between the presence of the scar and the habit of life of the persons attacked. To the miscellanea Mr. Yule contributes a note on local death rates. It is evident from this synopsis that the standard of the publication is being well maintained and that the new biometric methods are capable of extension over the most diverse fields of biological science.

AVIAN ORGANOGENY.[1]

DR. MITCHELL has already devoted considerable attention to the study of the intestinal tract of birds, and in the present contribution he gives us the results of his latest researches, which have embraced all orders of birds and many of the smaller groups.

Adopting the method of investigation pursued by Cuvier, the intestinal tract is removed from the body by severance at the plyorus and the cloaca, and along the mesentery close to the body-wall. Next, the cut ends of the gut are pinned down and its coils unravelled, until they stand revealed as a corrugated tube suspended by the ventral edge of the mesentery.

In tracts so displayed, Dr. Mitchell recognises three distinct loops, a duodenal, a rectal, and a large loop lying between these two which he calls Meckel's tract. The comparison of the varied forms which these loops take constitutes the subject of Dr. Mitchell's researches.

Evolution is rightly the key-note of this work, and accordingly the author starts with a detailed description of what he regards as the most primitive type of gut, from which all others have been derived. This type—found not, as one might have expected, in one of the Ratitæ, but in the ancient goose-like bird, Palamedea—he calls the archecentric type, whilst modified conditions thereof are distinguished as apocentric. Three kinds of apocentricity are recognised—multiradial, uniradial and pseudocentric. Multiradial apocentricities are those which are purely adaptive or homoplastic, and accordingly are of no value as indications of kinship, since they may, and do, occur repeatedly and independently in different groups. Uniradial apocentricities, on the other hand, Dr. Mitchell defines as complex modifications "of a kind that we cannot well expect to be repeated independently, and. . . . must be the most certain guides to affinity."

Not seldom a uniradial apocentricity will form a new centre around which new diverging modifications are produced, and such centres he proposes to call metacentric.

Pseudocentric apocentricity appears to be extremely common and very difficult to distinguish from the archecentric condition. Generally, however, its secondary nature is revealed by some small and apparently meaningless complexity.

The valuation and nomenclature of these characters form a special section of Dr. Mitchell's paper. It is extremely suggestive, and will be read with interest by many who are not directly interested in avian morphology.

The systematic description, which follows this discussion, occupies the bulk of the paper, the intestinal tract of every order of birds being reviewed, copious illustrations serving to bring out, not only the very striking modifications which have taken place, but also the difficulty of the work undertaken.

Space forbids us dwelling, as we would fain do, on this section and the summary thereof at greater length. Suffice it to say that the very remarkable modifications of these loops, which Dr. Mitchell has brought to light, are extremely interesting and very suggestive. We venture to doubt whether a good case has been made out for the position, near the Ralline forms, which has been assigned to the Tinamous. Markedly apocentric though they may be in the matter of their intestinal coils, yet we see no reason why they should not be allowed to remain among or very near the Ratitæ.

The concluding section, on "Characters and Classification," forms a most admirable summary. "In the systematic descriptive part," the author writes, "my task was to treat the characters of the patterns displayed by different birds as nearly as possible as if the gut were the whole animal, and the various phylogenetic figures and the three plates display what I take to be the relations of the intestinal tracts, and not necessarily the relations of the possessors of these tracts. I have been taking, in fact, the anatomical structure as the unit, and not the individual or the species. . . . Granting that the plates attached to this paper represent with approximate accuracy the phylogeny of the intestinal tract in birds, we have yet to learn the relation of the phylogenetic tree of this structure to the phylogenetic trees of other structures, and the relation of all these to the phylogenetic trees of those impermanent combinations of characters which we call species."

We would fain quote more of this interesting section, but enough has, we trust, been set down here to draw the attention of morphologists generally to a contribution which is at once valuable and suggestive, and likely to remain the standard work of reference on this subject for some years to come.

W. P. P.

[1] "On the Intestinal Tract of Birds: with Remarks on the Valuation nd Nomenclature of Zoological Characters." By P. Chalmers Mitchell, M.A., D.Sc. (*Trans.* Linn. Soc., vol. viii. part vii. 1901.)

PHOTOGRAPHY AS APPLIED TO ARCHITECTURAL MEASUREMENT AND SURVEYING.[1]

WHILE the impressions which a photographic picture yields to a casual observer may or may not be correct, the relationship which exists between a photograph and the objects the images of which are depicted is always definite, and a little careful attention in arranging the conditions under which a picture is taken will suffice to make easy the correct interpretation of it.

To understand the geometric nature of a photograph it must be noted and always remembered that for practical purposes a photograph is a surface of two dimensions, which for choice should be a plane surface, and it is only possible to obtain by photography exact copies of similar object surfaces, and these only when the surfaces to be copied are exactly parallel to the picture surface.

Under these conditions written or printed documents or drawings can be, and often are, copied by photography, so as to be practically exact copies of the originals. The copies may be the same size, or larger or smaller, but all proportionate dimensions will be the same, whatever the relative sizes of object and image may be.

To illustrate the first elementary principles of the subject a photographic picture of straight lines and right angles, arranged to form a set of regular squares, was projected on a movable screen. It was shown how, when the screen was parallel to the lantern slide, there was no perceptible bending of the lines and no perceptible enlargement or diminution of any of the angles, from which it might be concluded that there could have been no perceptible distortion in any part of the picture. By moving the screen nearer to, and further from, the lantern, it could be seen that while the forms of the squares remained constant their areas varied with the distance, in obedience to the ordinary laws of rectilinear radiation, from a point, and it was shown how a photographic picture may be legitimately regarded as being made up of a number of points, each one of which is at the picture end of a straight line, which may be taken for practical purposes to have travelled from a corresponding object point through a station point at the apex of a cone of rays radiating towards the picture.

The geometric relationship between distant objects and photographic images of those objects can be most easily appreciated if the lens is supposed to be replaced by a pinhole at the station point, when it is evident that a straight line from any point of the image to the pinhole will, if prolonged, pass through the corresponding object point, and *vice versâ*. Thus any number of true direction lines can be obtained at will.

For making plans, these direction lines can be projected as horizontal rays on a ground plane as in plane table surveying, and positions can be fixed on the plan by the intersection of

[1] Abstract of a paper, by Mr. J. Bridges Lee, read before the Society of Arts on April 16.