precisely as pigmented individuals are, in respect to the intensities of the pigments transmitted, and even in respect to color-patterns (spotting and the like). All that the albino seems to lack in comparison with a pigmented animal, is an activating substance, and even this may be present in small amounts in the albino, as, for example, in the Himalayan rabbit and in the similar variety of the albino guinea-pig. My albino guinea-pigs of chocolate parentage have brown-pigmented extremities, those of black parentage have black pigmented extremities.

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## *ASTRONOMICAL NOTES*

### THE ASTROGRAPHIC CATALOGUE

VOLUMES I. and II. of the Oxford Section of the Astrographic Catalogue, by Herbert Hall Turner, D.Sc., F.R.S., Savilian professor of astronomy, have recently been issued. The Oxford Section extends from Dec. $+24°$ to $+32°$.

The International Congress on Astronomical Photography met in Paris, in April, 1887. Oxford was one of the eighteen observatories which offered to take part in the mapping of the heavens by means of photographs. Two schemes of work were planned, each to cover the entire sky, one with short exposures of 6m, 3m and 20s, the other with exposures of about one hour. Twenty years have elapsed since that time. From Oxford we now have the two volumes above referred to, which are to be followed by six others. The whole bears witness to the ability and energy of the author and his assistants, and will no doubt prove of great value to astronomy. It also illustrates well the magnitude of the original schemes, which appear to have been unwisely large, since these eight volumes will complete only the study of the plates of short exposure. Professor Turner says:

> No attempt has, however, been made to take the long-exposure series at Oxford, as there has never been the least prospect of obtaining funds for publishing the charts, either at Oxford or at the majority of the participating observatories.

Evidently some decades must yet elapse before the completion of the original schemes, even if the need for their completion should remain urgent.

The Oxford plates were made by an instrument of the pattern proposed by the Henry Brothers, of Paris. It has an object-glass of 13 inches aperture, and a focal length of $11\frac{1}{4}$ feet, so that on the plates 1 mm. equals approximately 1′. The work was undertaken by the late Professor Prichard, but his death, at the advanced age of eighty-five years, took place before much had been accomplished. The catalogue gives the positions of the stars, expressed in rectangular coordinates, and the diameter of the stellar images, from which the magnitudes may be derived. In many cases it would be undesirable to use either of these quantities in the form here given. Tables are given, however, by means of which the rectangular coordinates may be converted into right ascensions and declinations. For the conversion of diameters into magnitudes, the formula is given: magnitude $= a - b\sqrt{d}$, where $a$ and $b$ are constants and $d$ is the diameter of the image. This formula, as Professor Turner points out, introduces large errors for the faint stars. The precision of the positions is much more satisfactory, the

total probable error of a coordinate, made up of errors from all sources, being only 0."39. The number of stars measured in Volume I. is 65,750, and in Volume II., 66,718. Many of these are duplications, owing to the overlapping of the plates, but aside from this desirable duplication, the number of different stars measured in the whole Oxford section will be very great.

VARIABLE STARS

Two contributions to the subject of variable stars have recently appeared in the *Annals* of the Harvard College Observatory.

Volume XLVII., Part I., gives a detailed photographic study, by Mrs. W. P. Fleming, of the comparison stars for the 222 variables of long period, nearly all of which were discovered by her by means of their spectral peculiarities. No star having a spectrum of the class designated Md, that of the third type with the hydrogen lines bright, has yet been found which is not variable, although many stars having a different spectrum are also variables of long period. The present volume deals only with the identification, positions and magnitudes of the comparison stars. Rectangular coordinates, referred to the variable star as a center, are employed. The methods of measurement and reduction have been already explained in the *Annals*. At the time this work was undertaken no good method existed for the determination of photographic magnitudes. Those used in the present volume were derived from measurements of the stars with a scale having a series of images of different intensities. Each image, after the first, which had an exposure of one second, had an exposure three times as long as that of the preceding image. The intervals thus obtained are assumed to represent one magnitude. The magnitudes thus obtained are made to depend upon the visual magnitudes of the brighter stars of the sequence. This method furnishes a scale of magnitudes which, however large systematic errors it may contain, appears to be consistent within itself. Later, when the method which Professor Pickering has devised, or any other method for the determination of absolute photographic magnitudes, is available, systematic corrections can be applied to the values here given to reduce them to an absolute scale of magnitudes. A later volume will furnish a discussion of the observations of the variables themselves.

Volume LV., Part I., contains the Second Catalogue of Variable Stars, prepared by Miss A. J. Cannon. As explained by Miss Cannon, the history of variable star catalogues extends as far back as 1844, when a list of 18 variables appeared, compiled by Argelander. In successive lists the number of objects has increased since that time, at first slowly, but later with great rapidity through the introduction of photographic methods, until we come to the present catalogue, which contains 1,957 variables. This includes the 500 variables found in the globular clusters, but not the 1,800 found in the Magellanic clouds. Altogether, at the present time, about 3,750 stars are known to be variable, of which about 2,900 have been found at the Harvard Observatory. A study of the number and distribution of the variable stars over the whole sky seems now to be within reach. The present catalogue is the result of about ten years of compilation and observation. The foundation of a card catalogue of variable star literature was begun in 1897, by Professor W. M. Reed. This bibliography, carried forward by Miss Cannon, now consists of more than 35,000 cards. This vast amount of material, as well as much unpublished data belonging to the Harvard Observatory, has been used by Miss Cannon in making up the present volume. The main table gives, after the various designations of the star, and its position, the maximum and minimum magnitudes, the period when known, the epoch, class of variable, type of spectrum, provisional number in order of discovery assigned by Kreutz, and the date and name of the discoverer. Auxiliary tables and remarks give much information in regard to the peculiarities of many of the variables. Part II. of the same volume will contain further information, including a study of all the published maxima and minima of variables of long period. S. I. Bailey.