

PARALLAXES OF PROCYON AND ALTAIR.—Among the large number of stellar parallaxes recently determined by photographic methods at the Leander McCormick Observatory, Dr. S. A. Mitchell has directed special attention to the results for Procyon and Altair (*Pop. Ast.*, vol. xxv., p. 38). For Procyon, the values which have been previously determined are remarkably consistent, ranging from 0.287" to 0.34", and Dr. Mitchell's parallax of 0.309" ± 0.007" is in perfect agreement with the mean of all. The parallax arrived at for Altair is 0.218" ± 0.007", and this again accords very closely with the weighted mean value 0.220" derived from earlier determinations.

DENSITIES OF VISUAL BINARY STARS.—An interesting attempt to advance our knowledge of the densities of stars of different classes has been made by E. Öpik, of Moscow, in a discussion of the probable densities of visual binaries for which orbits have been calculated (*Astrophysical Journal*, xlv., p. 292). He proceeds by developing a series of formulæ by which the density can be determined when the surface brightnesses of the components are known. The surface brightness itself is determined from the spectral type, in conjunction with the corresponding effective temperatures given by Wilsing and Scheiner, and an application of the radiation formula of Planck. The mass-ratio of the two components must also be known, and where such data are not available, approximate values are estimated from the differences in magnitude. The densities calculated in this way for forty pairs cover a wide range (0.012 to 5.9, in terms of the sun), but a considerable proportion of them approach the density of the sun. The mean values for the different spectral classes, which are only to be regarded as roughly approximate, are as follows:—

Spectral type	No. of stars	Density
A 0-A 5	9	0.65
F 0-F 8	19	0.59
G	7	0.23
K, K <sub>5</sub>	5	0.072

So far as they go, though the author does not comment upon this point, the figures show an order of density opposite to that which would be expected on the supposition that celestial evolution is along a line of descending temperature only. When accurate magnitudes and spectral types (or colour-indices) become available for each component, it will be possible to obtain separately the densities of the components, and an important region of stellar statistics will be opened up.

### EXPERIMENTS ON ASCARIS INFECTION IN HONG KONG.

AN important paper by Capt. F. H. Stewart, Indian Medical Service, appeared in the *British Medical Journal* for July 1, giving the life-history of *Ascaris lumbricoides*, which is extremely common both in man and the pig at Hong Kong, where the author is stationed with the 74th Punjabis. In this preliminary communication he showed that the parasite presents an alternation of hosts. Thus, when ripe eggs reach the alimentary canal of the rat or mouse the larvæ are liberated, and six days after infection they are found in the blood-vessels of the lungs and liver, and the host is seriously ill with pneumonia. They next pass from the blood-vessels into the air-vesicles of the lung, causing hæmorrhage into them. On the tenth day they occur only in the vesicles and in the bronchi. If the disease does not prove fatal, the host recovers on the eleventh or twelfth day, whilst on the sixteenth day it is free from parasites. The affected animals

could readily contaminate by the nose or mouth the food of man or the dust and earth of his surroundings.

Capt. Stewart has continued his experiments since the foregoing date both with *A. lumbricoides* and *A. suilla*, and finds that the larvæ appear in the bronchi, trachea, and mouth of the rat and mouse on the night of the seventh day and during the eighth day after infection by the mouth, and he believes that they pass by means of the saliva on to the food which is being nibbled by the rodents. It is possible that one attack of Ascariasis in rats renders them immune against subsequent attacks, but further confirmation is necessary. He found that the larvæ survived longest (twenty-four hours) in blood on moist bread. In water, normal salt-solution, and in mouse's blood they survived three hours.

Out of five experiments to test the infection of pigs from the foregoing rodents, three gave positive results, two negative. In estimating the value of the negative experiments the very high mortality among the parasites employed under somewhat unnatural conditions must be kept in mind. Capt. Stewart endeavoured to obtain an estimate of this mortality by comparing the number of ripe eggs given to a mouse with the number of larvæ found in the lung. An average dose contained about 5000 eggs, whilst the number of larvæ found in the lungs did not exceed fifty. The transfer from the rodent to the pig is probably the most vulnerable part of the life-cycle, since the larva is a very delicate organism. The author also carried out control experiments with the pig.

Lastly, Capt. Stewart carried out some experiments which demonstrated that *A. marginata* of the dog has also its intermediate host in the mouse.

He concludes by stating that if ripe eggs of *A. lumbricoides* are swallowed by rats or mice they hatch. The larvæ bore into the venules of the portal system or ascend the bile-duct. They are found in the dilated capillaries of the liver between the second and the fifth days. As their diameter is three times that of a blood-corpuscle in the mouse, they cannot pass through a normal capillary. The liver-cells in the neighbourhood of the larvæ undergo rapid degeneration, and the larvæ are thus enabled to pass by the hepatic vein and vena cava to the heart, and by the pulmonary artery to the lungs, where they are filtered off at the entrance to the capillary field. Embolism of the arterioles takes place, and the larvæ pass with the effused blood into the air-vesicles on the sixth day. They are found in the bronchi on the seventh day, and in the trachea and mouth on the eighth day, after infection. The larvæ from the lungs of rodents can infect the pig, and it is probable that in Nature infection of both man and the pig takes place by food contaminated by rats and mice.

W. C. M.

### SEX-LIMITED FACTORS IN HEREDITY.

FEW of the results obtained in recent years by students of heredity on Mendelian lines have appealed to biologists as a whole more forcibly than such cases of "sex-limited" inheritance as are exemplified by colour-blindness in mankind or the special type of wing-marking in the magpie-moth (*Abraxas grossulariata*) described by Dr. Leonard Doncaster in his work on the "Determination of Sex." Those who have followed the progress of research on the subject during the last five years recognise how important have been the results obtained by Prof. T. H. Morgan and his colleagues in their studies of inheritance in fruit-flies of the genus *Drosophila*.

An admirable summary of these studies, entitled

"Sex-Linked Inheritance in *Drosophila*," by Prof. T. H. Morgan and Dr. C. B. Bridges, has now been issued by the Carnegie Institution of Washington (Publication 237, 1916). These flies are excellent subjects for investigation, as they can be reared in very large numbers, and they show an extensive series of characters in eye-colour, body-pattern, wing-nervation, etc., which are definitely sex-linked, being transmitted by the male to his daughters only, who show a character if dominant, and conceal it if recessive, while the female transmits such characters to her offspring of both sexes impartially. Many of these characters have appeared as "mutants" in the course of the experiments, which have thus furnished proof of the segregation of new forms. But the most striking feature of the researches on *Drosophila* is the apparently certain connection between the observed inheritance of the sex-linked characters and the behaviour of the sex-determining ( $x$ ) chromosomes. "Over a hundred characters that have been investigated as to their linkage relations are found to fall into four groups, the members of each group being linked in the sense that they tend to be transmitted to the gametes in the same combinations in which they entered from the parents. . . . A most significant fact in regard to the linkage shown by the *Drosophila* mutants is that the number of linked groups corresponds to the number of pairs of the chromosomes."

The authors claim that there is conclusive evidence of the  $x$ -chromosome's part as sex-determinant, and they believe that they can locate the position in this  $x$ -chromosome of many of the sex-linked factors. In a small proportion of individuals of the  $F_2$  generation it sometimes happens that the sex-linked characters are not distributed according to expectation. In such cases "an interchange has taken place between the two  $x$ -chromosomes in the female in such a way that a piece of one chromosome has been exchanged for the homologous piece of the other." This "crossing over" of pieces of paired chromosomes is one of the most remarkable hypotheses founded on sex-limited inheritance, and would help to explain various anomalies in Mendelian results. "There are," the authors remark, "certain facts familiar to the cytologist that furnish a clue as to how such an interchange might take place." Those who wish to follow the subject further may consult with profit Dr. H. J. Muller's series of papers on "The Mechanism of Crossing Over," the last of which, with a summary, appeared in the *American Naturalist* of July, 1916 (vol. 1, No. 595), as well as Dr. A. H. Trow's "Criticism of the Hypothesis of Linkage and Crossing Over" (*Journ. of Genetics*, v., No. 4), enforcing the "extraordinary difficulties" which prevent some students of heredity from accepting a theory "simple enough at first sight."

A short paper on "Sex-Limited Colour in Ayrshire Cattle," by Prof. E. N. Wentworth, has been published in the *Journal of Agric. Research* (vi., No. 4). The author concludes that black-and-white—a combination long known in the breed—is a simple allelomorph to the more favoured red-and-white, black-and-white being dominant in bulls and red-and-white in cows.

Miss R. Haig Thomas describes studies of "Colour and Pattern Transference in Pheasant-Crosses" (*Journ. of Genetics*, v., No. 4); her paper is illustrated by a good series of coloured plates and photographs. The Swinhoe, Silver, Formosan, and Reeves species formed the subjects of the experiments, which afford interesting examples of sex-limited inheritance analogous to those shown in other organisms. "The male parent always transmits the female characters of his species to his female offspring, and the female

parent transmits to her male offspring many of the male characters of her species. . . . The phenomenon of pattern- and colour-transference is present in all the experiments made in pheasant-crosses up to date. These consist sometimes of transference from one area to a different area in the same sex, or from one area to a different area in the opposite sex, or from an area in one sex to the same area in the opposite sex. . . . In the fertile hybrids, plumage, dimension, leg colour and structure, habit, call, are all correlated, but moult is independent and liable to great disturbance in hybridisation."

Sex-linked factors in domestic animals may determine characters of much economic importance. For example, the work of Dr. Raymond Pearl with barred Plymouth Rock fowls has shown that high winter egg-production depends on two Mendelian factors, one of which is sex-linked. In the *American Naturalist* (xlix., 1915, No. 586) Dr. Pearl gives an account of the results of selection-breeding for this character over a period of seventeen years. From 1898 to 1907 "mass selection" for breeding of high producers was carried on without any test of the progeny from particular matings, and this was found to be ineffective in improving the strain. Since 1907 the fight thrown on the problem by research on Mendelian lines has enabled selection to be based on the genetic nature of the birds as shown by the performances of their progeny, and such selection "was extremely and quickly effective," so that "if one selects genetically high producers . . . he succeeds very rapidly in fixing a high-producing strain."

To many students the facts of sex-linked inheritance, together with the difference indicated by the presence of one or two  $x$ -chromosomes in the nuclei of one or the other sex, have strongly suggested the conclusion that maleness and femaleness are themselves to be regarded as Mendelian alternative characters (allelomorphs), and that sex is irrevocably determined in the fertilised egg. As mentioned above, this conclusion is strongly urged in Morgan and Bridges's memoir on *Drosophila*. Yet such facts as the development of female characters in male crabs parasitised by *Sacculina*, demonstrated by the late Dr. Geoffrey Smith's well-known researches, forbid sweeping generalisations as to the determination of sex throughout the animal kingdom solely by the nuclear constitution of the germ-cells. On this fascinating subject Dr. O. Riddle has lately published a contribution (*American Naturalist*, 1, No. 595) on "Sex Control and Known Correlations in Pigeons." Acknowledging that "when one nowadays states that he has obtained a real control—a reversal—of the development of sex, he can feel assured that his biological audience demands a very large volume of rigid proofs," the author believes that such proofs are forthcoming from the work on pigeons of the late Prof. Whitman, supplemented by researches of his own. He states that "width of cross" in pairing leads to a high proportion of males in the offspring, and that in the ordinary reproduction of pigeons of the same species males predominate among chicks hatched from the early, small-yolked eggs, and females among those from the later, large-yolked eggs. By appropriate treatment it was found possible to "begin the production of females at earlier and earlier stages of the season." It is likely that Dr. Riddle will not succeed in convincing those biologists who have faith in the absolute determination of sex from the nuclear structure of the fertilised egg, but his paper may be effective in checking the tendency to too positive statements on this fascinating subject.

G. H. C.