

Pilot Balloon Observations at Mauritius*

THE study of the upper wind currents over Mauritius with the aid of pilot balloons was begun in July 1925, and the results obtained in the early years have been discussed by Walter and McCurdy (Geophysical Memoir No. 39 of the British Meteorological Office and Miscellaneous Publications of the Royal Alfred Observatory, No. 9 are two of the papers dealing with this subject). In Part I of the memoir under review is summarised all the ascents from July 1928 until December 1929 in tables giving the speed and direction of the wind mostly for steps of 500 or 1,000 metres height; and also, in the form of monthly means and frequencies, the results of recent and earlier ascents. As many as 28 ascents have reached a height of 8,000 metres and 80 a height of 6,000 metres; the general summary is taken up to 8,000 metres.

In Part 2 the results are discussed. This discussion is much more thorough than is usual in such work. It is an endeavour to "build up a scheme of the upper wind structure within the tropics and show how the scheme is modified by the seasons", to quote the authors' own words. In it they remark that meteorologists appear to be diffident in applying the geostrophic wind formula—which covers the case of air motion along a great circle—to regions within the tropics, and that their own experience has suggested to them that the isobaric chart between latitudes 5° and 25° S. is normally composed of "straight isobars", to which the geostrophic formula applies, and that the observed winds fit the isobars "at least as well, both in speed and direction, in latitude 5° as in latitude 50°".

They then proceed to derive from the geostrophic formula an expression for the height of the reversal layer between the lower easterly and the upper

westerly wind currents over that part of the tropics that lies more than 5° from the equator. The formula obtained is as follows:

$$-\frac{H}{67.4} \cdot \frac{P_0}{(T_h)^2} \cdot \frac{dT_h}{d\lambda} = \frac{dP_0}{d\lambda}$$

where H is the height of the reversal layer in metres, T_h is mean temperature of the air from the surface to height H , in degrees Centigrade absolute, λ is latitude, and P_0 is pressure at sea-level, in millibars.

The values given by this equation after various plausible assumptions such as the constancy of mean horizontal temperature gradients at all heights (based on the known smallness of horizontal temperature gradient at the surface over the tropical oceans, and the probability that lapse-rate varies very little) range from 17,700 metres in latitude 10° to 3,200 metres in latitude 20°.

The authors compare the theoretical figures with those found over various tropical islands, for example at Apia, Guam and Honolulu, and allowing for the seasonal disturbance caused by the shifting of the thermal equator with varying declination of the sun, obtain fair agreement on the whole, though the figures are not applicable in the neighbourhood of large land areas. The work concludes with diagrams showing the observed seasonal variation in the height of the reversal layer over Mauritius, monthly means of velocity up to 8,000 metres, and wind roses up to the same height.

The mathematical analysis in this memoir may possibly be open to criticism here and there, but a serious attempt to go beyond the descriptive stage and to relate local conditions with the general atmospheric circulation is rarely made in papers dealing with upper winds, and is particularly welcome when the region studied forms part of an immense area for which few meteorological data relating to such winds are available.

* Miscellaneous Publications of the Royal Alfred Observatory, No. 11. "Pilot Balloon Observations at Mauritius." By R. A. Watson and N. R. McCurdy. Pp. 17+3 plates. (Mauritius.)

Sexual Cycle in the Rhesus Monkey

DR. CARL G. HARTMANN has recently published* an account of his detailed investigation of menstruation and pregnancy in the monkey, *Macacus rhesus*. Corner's generalisations concerning the cellular content of the vagina of the monkey are fully corroborated; the leucocyte number falls near the middle of the cycle and the number of cornified cells rises to a peak near the end of the interval. Instead of the vaginal smear method, vaginal lavage has been adopted and has proved more instructive since it enables the cells to be studied in the living condition, vitally stained with methylene blue, which also affords a ready means of differentiating the kinds of cornified cells in the vaginal lumen. The amount of desquamation from the vaginal wall can be quickly read off, after lavage, in terms of the percentage of sediment in the collecting tube. Because of the constancy and reliability of the curve of vaginal desquamation as compared with the character of the cornified cells and leucocytes recovered, the latter are no longer studied and recorded; the amount of desquamation and of uterine bleeding are

the two principal factors now studied in menstruating females. When the vagina is practically free of desquamated cells the animal is at a low ebb sexually, and the uterus and ovaries are small and hypofunctional.

Forty-two females, mostly full grown, have furnished data for more than seven hundred menstrual cycles—from a few to fifty-one for the individual females. The average of four hundred cycles for twenty-two of the more vigorous females is twenty-seven to twenty-eight days, but the variations are wide. The average duration of flow approaches four to six days. Dr. Hartmann's paper adds to the literature several hundred proven cases of menstruation without ovulation; the same individual, with regular menstrual rhythm, may alternate ovulatory with non-ovulatory cycles. From an inspection of the ovaries in summer and in winter it was found that the almost complete sterility of the female Rhesus in the warm months of the year was due to her failure to ovulate. A tentative estimate of the age of puberty (the time of the first menstruation) and of maturity (the capacity to ovulate and conceive) is three and four-and-a-half years respectively.

* Carnegie Inst. of Washington: Contributions to Embryology, vol. 23, No. 134, August, 1932.

Precise data can now be presented on ovulation and conception-time in a menstruating primate. The most exact figures relate to nearly forty cases in which the day of ovulation was precisely determined by palpation, and information almost as exact was furnished by nearly fifty conceptions based on limited mating periods. The optimum conception day is the end of the thirteenth or the beginning of the fourteenth day. The ovaries do not necessarily alternate in ovulation; alternation is the more usual condition but the same ovary may discharge an egg twice or even thrice in successive cycles. The placental sign—due to the leakage of blood into the uterine lumen from dilated uterine glands about the site of implantation, occurred in all the cases of pregnancy observed. The sign is as infallible in the monkey as in the rat, and begins about the time the menses of the animal are due, on the average seventeen days after conception.

The span of gestation in Rhesus, based on thirty cases, is on the average 164 days, but varies with the physique of the individual—the more vigorous individuals keep the foetus longer. A 6 per cent longer time *in utero* was associated with 26.5 per cent greater birth-weight; the latter is not considered a consequence of the former but both as a function of vigour on the part of the mother. All the mothers nursed their babies when these were viable. Seven

months seems to be the usual length of time in which lactation inhibits the menstrual cycle; then cyclic manifestations increase gradually, the ovaries and uterus increase in size, but ovulation may be delayed for months although the menstrual cycle proceeds more or less regularly.

Rectal bimanual palpation of the genital organs is easy to carry out in Rhesus and gives very accurate information about the condition of these organs. It is possible not only to differentiate ovulatory from non-ovulatory cycles but also to determine the exact time of ovulation by the very evident change in size and consistency of the ovary with the collapse of the follicle. After the collapse of the Graafian follicle the corpus luteum may be felt growing from day to day and the uterus keeps pace. Pregnancy may be diagnosed by rectal palpation with relative certainty by the nineteenth day and with practical certainty by the twenty-first day. On the basis of twenty pregnancies a chart has been constructed in which the size and consistency of the uterus and the size of the foetal head are recorded as found at each of the twenty-three and a half weeks of pregnancy, and the author states that this should enable the investigator, after a single palpation of a pregnant female, to predict the approximate date of birth. The paper is illustrated by six plates and ten figures in the text, and protocols are appended.

Fuel Research

THE Annual Report of the Fuel Research Board for the year ending March 31, 1932 (H.M. Stationery Office, 2s. net) refers to the incidence of the financial crisis, which necessitated a retardation of those branches of its activities which seemed less likely to produce immediate practical results.

Apart from the carbonisation plant, referred to below, considerable attention has been given to the study of tar, the most advantageous disposal of which is vital to an industry of low temperature carbonisation. Work is following two lines: (a) hydrogenation of the tar to produce Diesel oils and motor spirit, and (b) fractional distillation to recover constituents of potential value in chemical industries. The production of road tar is also being studied.

Experiments on the direct hydrogenation of coal are directed towards elucidating the influence of catalysts. Yields of motor spirit up to 145 gallons per ton of coal have been obtained, but the commercial future of the process would be dependent on the existence of a subsidy. The Coal Survey of Great Britain has now been extended to cover the whole of the national coal areas, and progress is being steadily made. This

is one of the Board's most valuable tasks, for only those who have considered the selection of coal for special purposes know how limited has been the supply of authenticated data.

The Fuel Research Board has made carbonisation at low temperatures, especially in continuous vertical retorts, one of its chief studies. Cast iron retorts did not prove commercially successful but a new design of firebrick retort has been developed which, after two years' working, is considered very promising. An account of experience with them is given in Fuel Research Technical Paper No. 35, "Low Temperature Carbonisation. Narrow Brick Retorts at the Fuel Research Station" (H.M. Stationery Office, 6d.). A wide range of coals—even the most strongly caking—has been successfully carbonised at reasonable speeds, yielding products of satisfactory quality. The use of firebrick instead of iron has been advantageous in allowing the use of higher temperatures, which relieves the operator from many of his anxieties. The report prompts the conclusion that the plant in its evolution tends to approach existing designs of commercial carbonisation plant.

Genetic Studies on *Drosophila**

THIS work referred to below is divided into three portions, dealing respectively with inverted sections of the autosomes in *Drosophila melanogaster*, with translocations between the second and third chromosomes, and with two new lines in which the X-chromosomes of the female are terminally attached to each other. The treatment is highly condensed

and technical, with a wealth of new breeding data and some new interpretations.

In 1921, Sturtevant suggested that cases of reduced crossing-over which appeared only in the heterozygous condition might be due to inversion of a section of a chromosome. He has since shown that several such reducers are actually due to an inverted section—so that homologous genes do not correspond in position. In the present paper, sixteen new cross-over reducers in chromosome III are investigated. They fall into three groups and nearly all are shown to result from

* "Contributions to the Genetics of certain Chromosome Anomalies in *Drosophila melanogaster*." By A. H. Sturtevant and T. Dobzhansky. (Publication No. 421.) Pp. v+81. (Washington, D.C.: Carnegie Institution, 1931.)