tion with the lowest bid of $6,000. This sum would afford us the chance of buying a small house as a refuge for our collections and library, which are in constant danger of being burned out.

It seems to me that all who appreciate the importance of Mendel's contribution should be actively interested in this message. Just what can and should be done and how to go about it are matters for discussion. I would suggest that those interested express their views in the columns of SCIENCE. However, some may wish to communicate directly with Dr. Iltis. His local address is Bäckergasse 10, Brünn, Tschechoslwakei.

E. B. BABCOCK

## NOTES ON METEOROLOGY AND CLIMATOLOGY

### DETERMINING THE TRUE MEAN TEMPERATURE

WHAT is the true mean temperature? It is a much easier task to define the true mean temperature than to determine it, but the prosecution of meteorological and climatological work demands that this element be determined. A very detailed and thorough discussion of the question has been published by Mr. C. E. P. Brooks, of the British Meteorological Office, in the *Monthly Weather Review*,[1] and it is of interest to review the varied nature of the problem and the solutions offered.

The "true mean temperature" is the mean height of a thermograph trace corrected for any sources of instrumental error. In practise, however, the mean of twenty-four hourly observations, or even the mean of observations every two, three, or four hours, is sufficiently close to yield the daily mean temperature. But it is not always feasible to secure such frequent observations, and the problem of reconstructing the true mean from three observations daily and the maximum and minimum faces the meteorologist. There are four ways of accomplishing this:

First, the combination of the means of the three daily observations at fixed hours, or the maximum and minimum, in proportions that have been found to be satisfactory at certain standard stations. If observations at 7 A.M., 1 or 2 P.M., and 9 P.M. be designated by $I$, $II$, and $III$, respectively, and the true mean by $T$, it is found that

$$T = (I + II + 2 \times III)/4$$

gives the best results, in general; but, in Greenland, where the morning observation occurs at 8 A.M., the formula commonly used is

$$T = [2(I + II) + 5 \times III]/9.$$

The author carried out an investigation of this type of formula by the method of least squares, for various groups of stations, such as western Europe, subtropics, and tropics, and found that for the first the usual one (given above) gave the best results; for the subtropics, the best combination is

$$T = [I + II + III - \tfrac{1}{10}(II - III)]/3;$$

and for the tropics, this last can be used, although it is not as accurate for the tropics as for the subtropics. An alternative formula which gave very satisfactory results for Batavia is

$$T = [2(I + II) + 3 \times III]/7.$$

These apply, of course, to the hours specified above. It is further pointed out that the maximum and minimum can be combined into such formulæ, instead of the three observations, and examples are given for Hamburg, in which the maximum and minimum are combined with the morning and evening observations; and for Tunis and Egyptian stations in which the minimum only was combined with the three daily observations.

Second, "the calculation of appropriate additive corrections for various combinations of hours or for the mean of the maximum and minimum at standard stations, and their transference without modification to other stations in the vicinity." This method is only applicable to those stations or regions where the conditions are similar, such as are to be found in Russia and Siberia, or in the eastern half of the United States. The method is to plot the corrections for standard stations and to read off for the intermediate stations the appropriate correction. In mountainous districts, such as western United States, or the mountains of India, this scheme is unsatis-

[1] April, 1921, pp. 226–229.

factory. A combination of this method with the first one above is often helpful, and has been used in Chile.

Third, "the corrections at the standard station may be multiplied by a factor proportional to the daily range (or to the difference between midday and evening observations) at the station to be corrected." This method depends upon properly correcting for any difference in daily range which may exist between nearby stations, as, for instance, between hill and valley stations where the daily ranges may be quite different. But care must be used to see that the climates of the two places are similar, for the daily amplitude of variation may be the same, but the shape of the curve different. This was found to be the case in applying the method to Los Andes (valley) and Santiago (coastal slope), Chile, in which the amplitude is the same but the sharp night minimum at Los Andes was markedly different from that at Santiago.

The fourth, and last, method is that in which "all direct use of standard stations may be avoided and the reduction to true mean based on considerations connected with the general phenomena of the diurnal variation of temperature." This makes no use of standard stations but bases the whole system upon a normal diurnal curve which may be expressed by the Fourier series

$T_h = T + a_1 \sin (t_h + A_1) + a_2 \sin (2t_h + A_2)$, in which the coefficients of the first and second harmonics may be calculated as follows:

$$a_1 = -0.72 + 0.44 (M - m),$$
$$a_2 = +0.54 + 0.08 (M - m).$$

This method has been thoroughly tested and has given satisfactory results, but is chiefly valuable when the stations are so situated that the other methods are not applicable.

A. Buchan favored the mean of the daily maximum and minimum as the most satisfactory expression of true mean temperature, and the view has become widely accepted. But there are objections, not only from the instrumental standpoint—for maximum and minimum thermometers are more likely to develop systematic errors than are dry-bulb thermometers—but also because the ratio of this mean to the true mean is dependent upon location, time of year, and cloudiness. For that reason, the author advises meteorologists in English-speaking countries to make less use of the mean of the daily extremes and more of suitable combinations of the observations at fixed hours, such as the first formula above.

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## SPECIAL ARTICLES

### ON THE ELIMINATION OF THE X-CHROMOSOME FROM THE EGG OF DROSOPHILA MELANOGASTER BY X-RAYS

SOME of the results of the investigation of the biological effects of X-rays point to a specific effect of the rays on the nuclear matter of the dividing cell and especialy the germ cell.

1. Actively growing tissue whether normal or pathological is the most susceptible to X-rays.

2. It has been found comparatively easy to sterilize a number of different species without apparently otherwise injuring them.

3. Perthes[1] has found that X-rays have a destructive effect on chromosomes in the ova of *Ascaris megalcephala.*

The experiments to be described were performed with a view to determining if X-rays by affecting the X-chromosome could disturb the inheritance of a sex-linked character. Wild type (red-eyed) females of *Drosophila melanogaster,* homozygous for red-eye, were X-rayed soon after emerging from the pupa with a dose just under the sterilization dose and mated to white-eyed males. Sisters of the rayed females were used as controls and mated to white-eyed males. The white eye color is sex-linked and recessive to the red and when there is no non-disjunction the offspring in tht first generation of a cross between a homozygous red-eyed female and a white-eyed male are all red-eyed.

In all, four experiments have been performed. In three of these, numbers 71, 76, and 77, thirty-five virgin females, homozygous for

[1] Perthes, *Deut. Med. Woch.,* 30, 1904.