In order to increase the number of test matings, the males, 4,595 and 4,388, were mated with females which were merely *heterozygous* for angora coat, animals which were themselves short-haired but which had one parent an angora. Therefore only half the gametes of these females, viz., those which bore angora, would be useful in the test matings. Accordingly half the total young from such matings have been deducted before entering the totals in Table I., and of course the deductions have been made from the *short-haired* classes, equal numbers being deducted from the English and the non-English groups. Apparently male 4,595 gives a lower percentage of cross-overs than male 4,388, and the female double heterozygotes give a lower percentage than either male, but the totals are not large enough to give much weight to these ideas. The average result for all test matings is a cross-over percentage of 9.0 ± 1.5, which means linkage of strength 82 ± 3, on a scale of 100. This certainly is a significant result, which indicates that the characters English and angora have their genes in the same chromosome.

W. E. Castle

Bussey Institution,
December 1, 1921

THE HYDROGEN-ION CONCENTRATION OF CULTURES OF CONNECTIVE TISSUE FROM CHICK EMBRYOS

In view of the fact that tissue cultures in Locke-Lewis solution were to be used in observing the behavior of living cells when exposed to bacteria and other foreign substances, it became necessary to determine the optimum and the final hydrogen-ion concentration of the cultures themselves. For the purpose several hundred cultures of connective tissue of chick embryos were prepared, in Locke-Lewis solution with varying hydrogen-ion concentrations and containing different amounts of dextrose.

The normal solution was composed of 85 c.c. of Locke's solution (NaCl 0.9 per cent. plus KCl 0.042 per cent. plus $CaCl_2$ 0.025 per cent. plus $NaHCO_3$ 0.02 per cent.), together with 15 c.c. of chicken bouillon and 0.5 per cent. dextrose. This solution has a hydrogen-ion concentration between 6.6 and 7, depending upon that of each lot of bouillon. For the experiments the hydrogen-ion concentration was varied from pH 4 to pH 9.2 with an increment of 0.2, and the amount of dextrose was varied from 5 per cent. to none at all.

The hydrogen-ion concentration of the cultures explanted into these solutions was determined at different stages of their growth, namely, when they failed to grow, when they exhibited extensive and healthy growth, and when they had degenerated after vigorous growth. This determination was made by a colorimetric method devised by Felton (1921) by means of which it is possible to test the small hanging drop of a culture.

Early in the investigation it was discovered that not all kinds of coverglasses were suitable for the experiments because of the change in hydrogen-ion concentration exhibited by control drops (without explant) when incubated upon this glass. It became necessary, therefore, to select coverglasses on which the control drop remained constant when incubated for a period of three weeks.

When cultures of embryonic chick tissue were prepared on reliable coverslips, those explanted into a medium with a hydrogen-ion concentration of 4 to 5.5 seldom showed any growth; those in a medium pH 5.5 exhibited growth in a few instances; while those in media having a hydrogen-ion concentration from pH 6 to pH 9 usually showed abundant growth. Approximately one hundred cultures were explanted into solutions pH 6, 7, 8, and 9. The percentage of growth which occurred in these cultures was respectively 71, 93, 89 and 81, while that of the normal cultures (pH 6.6–7) was 90 per cent. The optimum hydrogen-ion concentration seemed to be about pH 7.

When the hydrogen-ion concentration of these cultures was tested at different stages of their growth, it was noted that while it differed markedly, this was dependent much more upon the state of the culture at the time the test was made, and also upon the amount of dextrose in the medium, than upon the initial hydrogen-ion concentration of the medium.

Regardless of what the latter had been, cultures which contained healthy and extensive growth tended to be neutral, those which failed to grow had usually become slightly acid, and those that had exhibited extensive growth and then degenerated were most frequently slightly alkaline. These results, however, apply only to solutions containing not more than 0.5 per cent. dextrose, for when 1 per cent. or more dextrose was added to the medium the cultures were often found to be acid when death took place.

In these observations the optimum hydrogen-ion concentration for tissue cultures in Locke-Lewis solution was pH 7. The final concentration depended upon the amount of dextrose in the medium. Cultures in media containing no dextrose usually had a hydrogen-ion concentration ranging from 7 to 7.6; those in media having 0.25 to 0.5 per cent. dextrose ranged between pH 6 and pH 7.8, mostly pH 7.2 and pH 7.4; while those in media to which 3 per cent. and 5 per cent. dextrose had been added were often pH 6 and pH 5.6 respectively.

M. R. LEWIS,
LLOYD D. FELTON
THE JOHNS HOPKINS MEDICAL SCHOOL

AN ELECTRICAL EFFECT OF THE AURORA

DURING the past year I have been making observations on the diurnal variation in electric potential difference between the earth, as represented by the water system of Palo Alto, and an uncharged, insulated conductor kept inside an earthed metal cage. The records of this variation have been registered continuously by a photographic method since July 20, 1920. For two weeks, or more, preceding the great aurora of May 14 these records were different from any which had preceded them, and two days before the beginning of the aurora there was a sudden change in the potential difference being measured which seemed to indicate an increase in the negative charge of the earth.

After the aurora the record of the diurnal variation was of a very different character from anything which had been obtained before. In Fig. 1, the continuous line represents the mean variation of the recorded potential-difference in millivolts for ten days preceding the aurora, and the broken line gives the same data for the ten days following the aurora. The mean daily range of the recorded potential difference on my record was 99.5 millimeters for the ten days preceding the aurora and 35.5 millimeters for the same period following the aurora.

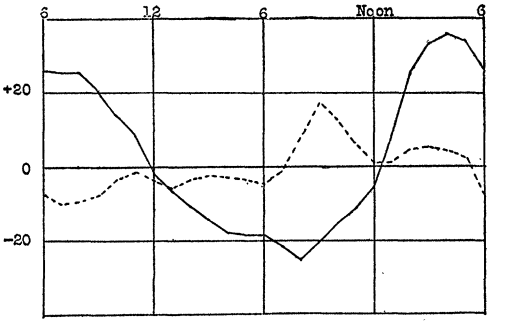

FIG. 1. Diurnal variation in potential difference between the earth and an uncharged, insulated conductor for ten days preceding and ten days following the aurora of May 14, 1921.

The mean diurnal variation in millivolts for the ten months, August, 1920, to May, 1921, is shown by the curve in Fig. 2.

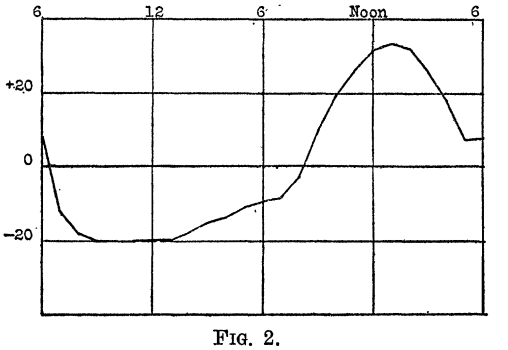

FIG. 2.

A simultaneous record of the change in the north component of the earth's magnetic field was made on the same sheet with the electrical record. For three days at the time of the aurora the magnetic record was too much disturbed to admit of measurement. The mean range of magnetic variation for