

wireless equipment, or one of the several wireless telegraph companies will take the matter up; for although it may not lead to a better understanding of aurora, it might help to the understanding of 'freak distances' over the wire.

C. J. STUART.

MONTREAL, October 29, 1906.

THE GLACIAL EPOCH.

TO THE EDITOR OF SCIENCE: While I much regret having overlooked the references to which Professor Chamberlin calls attention in the first few lines of his communication to SCIENCE (October 26, page 531), his further remarks (tending to demonstrate that Dr. Manson's theory is untenable), when considered in connection with the equally modern and equally reliable views of Professor E. W. Hilgard (as expressed in the last paragraph of his paper quoted on page 440 of this journal) afford an instructive illustration of how difficult it is, even for an able and conscientious investigator, to avoid dogmatism in science.

J. M. SCHAEFERLE.

ANN ARBOR,

October 29, 1906.

SPECIAL ARTICLES.

VARIATION IN PARTHENOGENETIC INSECTS.

IF, as the Neo-Darwinians claim, amphimixis is the principal cause of variation (of the continuous or fluctuating sort taken by Darwin and Weismann to be the material used by natural selection for species-building), it would seem to follow that much less variation, of this type, should occur among parthenogenetically produced individuals than occurs among individuals of bi-sexual parentage. The Neo-Darwinians explain variation as a product of sex and sex as a product of the necessity for variation.

The variation of bisexually produced individuals is proved by limitless miscellaneous observation and the more recent better compiled and expressed work of biometricians. But data and facts concerning the variation in parthenogenetically produced individuals are not so readily accessible. In the following paragraphs will be found a summary statement of the results of certain observations

made by several assistants¹ and myself, on the variation exhibited in certain series of parthenogenetically produced insect individuals.

It is obvious that a comparison of the variation in agamically produced individuals with that of those of bi-sexual parentage *in the same species* would be particularly pertinent. And this we have been able to make in the case of the honey-bee. The variation² of various wing characters (dimensions of wings and vein-parts, modification of venation, number of costal hooks of hind-wing, etc.) has been studied in series of drones (parthenogenetically produced individuals) from queen-laid eggs (and also in series from worker-laid (!) eggs) and in series of workers, which are of bi-sexual parentage. Among these series are some (both of drones and of workers) in which the individuals were taken directly from the brood-cells (just as they were ready to issue) and hence before their exposure to any intra-specific (individual) selection on a basis of their adult characters (among which are all wing characters), and other series made up of actively flying, *i. e.*, exposed individuals. There are also series of drones hatched from worker-laid eggs and reared in worker cells (instead of in the usual larger drone cells), the variation in these series having a special interest because of the possibility of its modification by the extrinsic factor, size of cell. In addition to the bee series the variation in wing characters in a series of parthenogenetically produced female plant-lice (Aphididae) has been studied. The studies are all statistical and quantitative and have been compiled, tabulated and summarized according to the now fairly familiar methods of biometric variation study. In this note only the baldest statement of results can be made, and their presumable significance suggested.

Variation in drone (parthenogenetically produced) and worker honey-bees (of bi-

¹ R. G. Bell, B. E. Wiltz, A. Wellman and F. Yantis.

² Some of these data of variation in the honey-bee have already been published by Kellogg and Bell, 'Studies of Variation in Insects,' *Proc. Wash. Acad. Sci.*, Vol. 6, pp. 203-332, 1904.