characteristic of continental sediments, the local breaks not representing a loss of geologic time of any marked historical value."

The plants certainly do not uphold this contention, but they do indicate a very considerable hiatus between the top of the acknowledged marine Cretaceous section and the inauguration of the Lance. The Laramie is not known within this area, but can it be doubted that it was the interval during which in other areas beds of Laramie age were laid down and subsequently removed in whole or in part? That there was an important interval of some kind is also shown by the fact that it was sufficiently long for over 60 per cent. of the marine Cannonball fauna to be derived through modification of the typical Fox Hills fauna.

F. H. Knowlton

PROOF OF NON-DISJUNCTION FOR THE FOURTH CHROMOSOME OF DROSOPHILA MELANOGASTER

During the spring and summer of 1920 I secured genetic evidence that strains of *D. melanogaster* haploid for the fourth chromosome had been produced by non-disjunction, and in November cytological verification was obtained. The fact that non-disjunction of the fourth chromosome is known to occur is perhaps the strongest reason for believeing that the aberrations observed by Dr. Little[1] may be the consequences of non-disjunction. The direct evidence presented by Dr. Little by no means proves such to be the case, which is unfortunate, considering the ample means in *D. melanogaster* for checking up this hypothesis by means of other fourth-chromosome mutants (bent, shaven) and especially by direct cytological examination. Probably Dr. Little will include such evidence in his forthcoming detailed report. For the present, his published evidence is in better conformity with the assumption of a less extreme eyeless allelomorph, or of a dominant fourth-chromosome "minus" modifier. On the non-disjunctional view selective reduction of the three fourth chromosomes present is required, but there is no obvious reason why E and e should always go together in the manner assumed. A simple explanation is supplied on the weak-allelomorph view, for Ee is the weak allelomorph and the selective reduction Ee — e is simply *segregation* in the e^w — e compound. *Linkage* supplies the explanation on the modifier view, for the E is then a dominant minus modifier in the fourth chromosome, and Ee — e is simply M^ee — e. As far as can be judged from the short account given, all the observed ratios are in conformity with either of these views. Thus, Dr. Little has not proved by direct and available means that the case is actually one of non-disjunction, nor has he proved it negatively by excluding well-recognized alternative hypotheses which are equally valid and even more in harmony with the facts of the case as stated.

C. B. Bridges

[1] Science, 53: 167.

SURVEYING FROM THE AIR

The article on "Surveying from the Air," December 17, 1920, is a summary of the work of the Coast and Geodetic Survey along the lines of aerial photography, and of necessity does not go into the requisite detail regarding the reasons for making the following statement:

> These experiments proved very conclusively that photographs from the air, using present-day equipment, are of little practical value to the hydrographer.

This statement has been noted by Mr. Willis T. Lee, of the U. S. Geological Survey in Science, February 18, 1921, who cites *Comptes Rendus* Tome 169, October 27, 1919, in which mention is made of experiments near Brest where successful photographs were obtained of the bottom at a maximum depth of 17 meters.

During the experiments at Key West, the results of which were the only ones then known to me, occasional successful photographs of the bottom were obtained in depths of 35 feet and less. No attempt was made to photograph at greater depths. When the conclusion regarding the "practical value" of the photographs was arrived at, all factors regarding their use for hydrographic purposes were considered. Obviously, a comparison was made with the present-day methods of hydrographic surveying.

It may be argued that aerial photography is more rapid, because a photograph of more than one square mile is made in a fraction of a second, and a strip 70 miles long and over a mile wide can be photographed in an hour. There are several problems to be overcome by both the aviator and the hydrographer before this can be done. Weather conditions along the sea coast are not as suitable for aerial photography as might be expected. Let us see how the photographs as made by the French would apply to our waters. These photographs were made under the following conditions: Focal plane horizontal; altitude, 2,600 meters; at time of low water; the sun high above the horizon; calm sea. Along the coast of the United States, a calm day is generally hazy, so much so that it is impossible to make photographs from an altitude of even 4,000 feet without special treatment of plates or films. We are aware of recent experiments regarding the penetration of haze, but at the time the Key West experiments were made, little was known of this new process. Further developments may make it possible to penetrate haze at altitudes of 2,600 meters. But disregarding haze, those days that are calm and cloudless are infrequent. It is difficult to obtain data regarding meteorological conditions as affecting aerial photography along the coast, but from available data, it is ventured that about one day a month would fulfill conditions as called for by the French, and that is believed to be an optimistic estimate.

Regarding control for the photographs, very few places along our coast are as ideally fitted for control of aerial protographs as the area chosen near Brest. This locality is dotted with numerous small islets, and ample control could be obtained for each photograph. At Key West, it was necessary to use boats as control points, so that the speed at which an area was covered was limited to the speed of the vessels. There are a few places along our coast where enough land stations would appear for control, but these areas are generally in bays or rivers where water is not clear enough for good photographic work. Buoys or rafts may be used as control points, but the cost and labor of handling them would be excessive. A raft about 10 feet in diameter would be needed in order to be legible on a 1:10,000 scale photograph. The problem of handling a large number of these floating signals would require a good sized vessel and crew.

The uncertainty of results is another factor. The French have solved some of the problems by using the stereoscope, so that the confusion, brought about by vari-colored bottom of uniform depth, is partly eliminated. Some shoals will show clearly, while others close by do not appear in the photograph, probably due to a difference in color or lighting. The photographs will not record all shoals as seen by the aviator. It is often necessary to fly over the same area repeatedly in order to obtain good results.

Unless ideal conditions prevail, the cost of an aerial survey with present-day equipment, will far exceed that of a wire drag survey, and will not give as certain results. We believe that aerial photo-hydrography is of some use in a few limited locations, and there are possibilities of future development, but at the present date, revision work by photographs on land holds forth greater promise, and is one in which more certain results can be obtained.

It may be of interest to quote a sentence from a letter dated January 10, 1921, from Le Directeur du Service Hydrographique addressed to the Director of the Coast and Geodetic Survey, in which the following statement is made regarding aerial photography along the coast of Syria in 1920.

Les circonstances n'ont d'ailleurs pas permis de l'employer systematiquement. (The circumstances do not, however, permit of its systematic use).

A careful analysis of the conclusion reached in the article "Surveying from the Air," especially of the qualifying words "using present-day equipment," and "little practical value," will probably derive the result that the statement is not as hastily worded as it was first thought to be.

E. Lester Jones

SCIENTIFIC BOOKS

Physics of the Air. By W. J. Humphreys, C.E., Ph.D., Professor U. S. Weather Bureau, Philadelphia. Published for the Franklin Institute by J. B. Lippincott Co., 1920.

Professor Humphreys states in his introduction that "it is obvious that an orderly assemblage of all those facts and theories that together might be called the *Physics of the Air,* would be exceedingly helpful to the student of atmospherics."

Of this there can be no doubt, and the author has rendered a great service by thus bringing together and making easily available material that otherwise would have remained scattered through technical magazines, official publications like the *Monthly Weather Review* and journals of organizations like the Royal Meteorological Society.

The volume had its inception in a series of lectures delivered by Dr. Humphreys at the San Diego Aviation School in 1914. These lectures revised and printed from month to month in the *Journal of the Franklin Institute,* 1917, 1918, 1919 and 1920, are now consolidated in one volume.

As late as 1917 our military authorities failed to appreciate the importance of a knowledge of aerography, that is, the structure of the atmosphere. In June of that year a high officer of the Signal Corps, at that time entrusted with aviation, wrote:

> It has frequently happened in the past that men who might otherwise have made good pilots became so alarmed in advance over the subject of "holes in the air" and so impressed with the terrible dangers of aerial navigation, that they never succeeded in gaining the necessary confidence to become good pilots, etc.

This was given as a valid reason for refusing to utilize recent advances in meteorology! And again:

> So little time is available and so great the necessity for extreme haste in preparing aviators for service overseas that there is no opportunity to give more than the elements of meteorology in one or two lectures.

These views are referred to here, simply to show in some measure the amount of official inertia which had to be overcome. After many promising lives had been sacrificed, the need of the fullest knowledge possible was manifest; and before the war ended aerography had come into its own in both army and navy schools of instruction.

Professor Humphreys divides his treatise into four main parts; mechanics and thermodynamics; atmospheric electricity and auroras; atmospheric optics; and factors of climatic control. The author had the great advantage of access to the Weather Bureau Library, and critical readings by his colleagues. Furthermore, the text appeared in type before final publication. The work is unusually free from typographical errors.

There are a few slips, however. On page 49 the symbol for temperature of the isothermal region T might with advantage have been placed in front of the radical, or at least in some way separated more than at present. Again, it would be a gain if instead of saying that the temperature of a black radiator, in this case the earth, was 259° C. absolute, the author had used the more common form 259° A., adding if he thought it necessary, in degrees C. It is desirable in a text-book to avoid confusion, by using consistent notation. The reviewer holds that it is not good form to speak of a given temperature as *259° C. absolute* on one page and on the next page give a diagram expressing the same value in degrees Centigrade, that is, —14° C. One may expect to meet a slip from such loose practise and sure enough it occurs. On pages 75 and 76 it is stated:

> The effective absolute temperature of the earth as a full radiator is approximately 260° C.

Rather a warm condition; but of course the author means that the effective temperature on a certain approximate absolute scale is