services of the Weather Bureau, that the value of the prospective, but definitely realizable, improvements in the general reliability of weather forecasts, of all types are well-nigh certain to be measurable in many millions of dollars and in the saving of a great many human lives. Through the cooperation of the Departments of Agriculture, Commerce, the Army and the Navy these improvements can easily be effected without prohibitive expense, especially since some substantial counterbalancing savings to the taxpayer will be made if the whole meteorological service, including communications, is unified under the chief of the Weather Bureau, reporting as at present directly to an officer of the Cabinet. This will involve placing on the Weather Bureau the responsibility for the transmission of all meteorological data as well as the recording and interpretation of these data. This, of course, is not intended to suggest that the meteorological work of the Army and Navy should be curtailed, since this is recognized as an essential part of these services.

The Weather Bureau serves such a diversity of interests and is of such great importance to all of them that it is clearly imperative that it have the opportunity to serve them all impartially. Subordinating it to any one of them, such, for example, as a hypothetical department of transportation, would inevitably tend to destroy its usefulness to the others. This, of course, means first, that the integrity of the Weather Bureau should be preserved in any event, and second, that the whole meteorological service should be unified under a single responsible control. This consolidation will in itself decrease costs although the expense involved in responding to the demand for an improvement in the forecasting service, so urgently demanded by aviation and also needed by agriculture, commerce and navigation, will somewhat more than absorb the savings. However, the total annual cost of the Weather Bureau service to the people of the United States has never exceeded $4,500,000 and last year's budget was only $3,200,000. In the same year the Government's appropriation to the air mail service alone was $15,000,000 and that for the extension and maintenance of the airways $6,000,000.

(*To be concluded*)

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW METHOD FOR THE STUDY OF CHROMOSOME REARRANGEMENTS AND THE PLOTTING OF CHROMOSOME MAPS

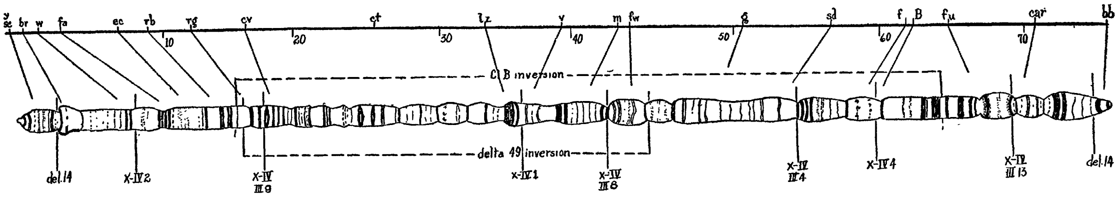
IT has long been known that in the functioning salivary glands of many dipteran larvae the chromosomes show an elongated and annulated structure. For the past year the writer has been studying such chromosomes, principally by the acetocarmine method, in larvae of *Drosophila melanogaster*. From this study the following conclusions are warranted:

(1) Each of the chromosomes has a definite and constant morphology and is made of segments, each of which has a characteristic pattern of chromatic lines or broader bands, which appear to run around the achromatic matrix. The same chromosomes, or characteristic parts thereof, may easily be recognized in different cells of an individual, or in different individuals of a species. If the position of one or more segments is shifted, by some form of dislocation (translocation, inversion, etc.), the exact morphological point (or points) of breakage can be determined and the segments identified in their new position. This discovery places in our hands, for the first time, a qualitative method of chromosome analysis and once the normal morphology of any given element is known, by studying chromosome rearrangements of known genetic character, we can give morphological positions to gene loci and construct chromosome maps with far greater exactness than has been heretofore possible.

(2) In old larvae, homologous chromosomes undergo a process of somatic synapsis. This union is more than a simple apposition, for the elements pair up line for line in the most exact way and form one apparent structure. If one of the homologues carries an inverted section we get typical inversion figures, such as we would expect in meiosis. If one of the homologues is deficient, at some point, the two mates unite except at the point of deficiency where the normal element usually buckles. Thus we can readily determine exactly how much of the one chromosome is missing. It is probable that the force which causes homologues to unite in salivary glands is the same that operates in meiosis, and while, so far as is known, these specialized chromosomes never divide, we can at least study how aberrant chromosomes unite at synapsis, a fact which should prove of great value to geneticists.

(3) In salivary glands the two arms of the v-shaped autosomes appear as independent elements with no obvious connection between them. As a result, after somatic synapsis, we find six elements in the nucleus, not the haploid number.

(4) The inert region of the X-chromosome does not appear as an organic part of this element, nor does it show in any other as yet recognized form in the nucleus. Likewise, the only part of the Y-chromo-



some which has been identified is a short piece which, morphologically, is homologous to part of the right-hand end segment of the X. This part of the X (see figure) carries the normal allelomorph of bobbed. Either the inert material of both the X and Y has been eliminated during ontogeny, by diminution or some similar process, or this material exists in the salivary nuclei in some unrecognized form not visibly connected with the chromosomes. The inert area comprises about ⅜ of the volume of the oogonial metaphase chromosome.

The accompanying figure is a drawing of the X-chromosome made by uniting camera lucida sketches of various regions. Fine details are omitted. Above the figure, a crossover map having the same length as the X is shown. The symbols of gene loci, which have been located, are given together with lines showing their approximate morphological positions. The points of breakage are indicated on the X, with the name of the break given below. Thus, deletion 14 (at the left) broke the X between the loci of scute and broad. The morphological point of breakage is shown on the drawing, and, of course, scute must lie to the left of the break and broad to the right. In a similar way the position of other gene loci has been determined. Geneticists will be interested to note the morphological (and genetic) limits of the C1B and delta 49 inversions as shown by the figure, and in the close correspondence between the cytological and crossover maps.

The writer has two articles in press, one dealing with the technique and the general morphological characters of the salivary chromosome, the second, a detailed study of the X-chromosome from which the drawing herewith presented was taken. Similar studies of the autosomes have been under way for some time, and a number of students are at work on various cytological and genetic problems opened up by the new method of attack.

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PROPOSED IMPROVEMENT FOR PLANKTON NETS

When plankton nets were first put to use for quantitative purposes two problems made themselves apparent. First, control of the net in regard to selection of a given operating level beneath the surface of the water without contamination of the sample from intermediate levels; second, the determination of the quantity of water filtered. The first problem was solved at an early date for vertical nets, and at a much later date (to a satisfactory degree), with some difficulty, by Kofoid for horizontal nets.

The second problem has not yet been solved to the satisfaction of planktologists, and even with the use of a complicated system of calculations, only a fair approximation to accuracy is attained. Hensen (1901)[1] developed a net which had a mouth small in proportion to the silk filtering surface in an attempt to insure the immediate filtering of all water entering the net; a coefficient of filtration was determined for various sizes of nets. The volume of filtered water was then calculated from the size of the mouth, filtering area, mesh, speed of the net, etc., these factors being subject to numerous variations and consequent corrections. However, this method, and modifications of it now in general use, does not make allowance for clogging of the pores of the net which in the case of certain types of plankton becomes an important factor.

It is the writer's desire to suggest another approach to the problem; *i.e.,* to measure the water leaving the net after it has been filtered rather than that entering the net before it is filtered. It seems that this could be done very simply by adding to the net an outside jacket of suitable waterproof material, opening at the tail into a cylinder sufficient in dimension to take a suitable type of current meter. This means that the water could enter the net in any quantity, and only the filtrate would be measured by the attached current meter, such measurement being independent of clogging. The actual volume would be arrived at by the simple equation, $F(\pi r^2)$, when F is the linear measure of the water column as indicated by the current meter.

As far as can be seen without actual experiment this method would offer no serious difficulties in development; and it is believed that it would supply more accurate data, and incur a higher degree of dependability than the methods now employed.

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[1] Hensen: "Uber die quantitative Bestimmung der kleineren Planktonorganismen und über den Diagonal-Zug mittelst geeigneter Netzformen." Wissenschaftliche Meeresuntersuchungen, Abth. Kiel, N.F. Bd. 5, pp. 69–81, 1901.