this size allowing about 1/32 inch on all sides for free movement of the plunger. One end was flattened to drill the hole for the connecting link. Binding posts were then attached to the leads from the solenoid and the mercury tube.

In the heating circuit the tube was operated as a single-pole, single-throw switch. The current for the solenoid was supplied by an ordinary 6–8 volt a-c bell-ringing transformer. A 0.25-microfarad condenser was used across the terminals of mercury thermostats (not shown). The final adjustment of the stop (J) was made while the instrument was in operation. A 5/16-inch movement of the plunger would make and break the circuit, but to insure positive action of the mercury tube the stop was set for a ½-inch arc. The mercury contact tube used in the construction of the relay was a General Electric KON-NEC-TOR, 40KRI. Other types of mercury tubes would give the same results with the relay, but it would be necessary to change the length of the arm, depending on the tilting action.

This relay has been used with open and closed types of mercury thermostats with no failures. The relay may be used with direct current (4–7.5 volts), but it will be necessary to determine the direction of the lines of force through the solenoid before soldering to the base.

A Punched-Card Technique for Computing Means, Standard Deviations, and the Product-Moment Correlation Coefficient and for Listing Scattergrams

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Punched-card techniques are not familiar to the general scientific public. While laboratory workers are devoting hours to tedious calculations, machine facilities frequently have completed monthly routine reports and are lying idle in the accounting department. But with sketchy information at the level of this note the laboratory man should be able to speak the language of the punched-card specialist well enough to arrange basic computations and tabulations. Although the specialist will know punched cards and in all probability will be able to clear up at once any problems in planning the card, his knowledge is likely to be deficient in the special applications of cards to statistical studies.

The sorting and tabulating operations to obtain means, standard deviations, the product-moment coefficient, and the scattergram are detailed step by step below. Only two points must be grasped to understand these operations. The first is that, after two consecutive sortings of data, the individual groupings resulting from the second sort are in order according to the first sort. The second point is the theory underlying the method for computing sums of squares and sums of cross-products by progressive additions. Details can be found elsewhere (*1, 3*), but they can be reconstructed readily if one recalls that multiplication may be accomplished by adding the multiplicand as many times as the multiplier.

Machine Sorting and Tabulating Operations After Cards Are Punched

(1) Sort cards so that they are in order from largest to smallest according to one of the items (hereafter referred to as variable Y).

(2) With the cards in this order, next sort them so that they are in order from largest to smallest according to the second item (variable X). The cards are now in order with respect to both X and Y; that is, all cards with any given X digit are in order from large to small according to Y.

(3) Insert a blank card wherever any digit is missing in the X series in the range from the largest number in X through to zero. Then place the cards in the tabulator so that the card with the largest digit will go through first.

(4) Tabulate the following columns with a minor control on Y for a card count and intermediate control on X for sums:

X Y Card count Sum of X Sum of Y

(5) Tabulate the following progressive totals with an intermediate control on X, printing the following columns in this order:

X	Progressive card count	Progressive total of X	Progressive total of Y

(6) Remove the cards interpolated for missing X digits, sort a second time on variable Y, and insert blanks for any missing Y digits. Repeat step (5), but this time control on Y and print Y instead of X.

Subsequent Hand Computations

The following statistical data can then be computed. In step (4), N is the total card count, the tabulation being adjusted so as to omit blank cards; *mean* X is the final total *sum of* X divided by N; *mean* Y is the final total *sum of* Y divided by N; and a scattergram can be completed at once by copying from the several card counts to the corresponding spaces of the scattergram. In step (5) the sum of the *progressive totals of* X is the sum of squares for X, and the sum of the *progressive totals of* Y is the sum of the cross-products, XY. In step (6) the sum of *progressive totals of* Y is the sum of squares for Y, and the sum of *progressive totals of* X is once again the sum of the cross-products, XY. Incidentally, the sum of the progressive card count will also be the sum of the variable which is the intermediate control. These data may then be combined by conventional formulas to yield the product-moment coefficient and the standard deviation for X and Y.

When zero is represented in the score range, the directions are modified to the extent that the sums of progressive totals do not include the progressive totals tabulated for the last, or zero, control card.

There is still some hand labor in translating the machine computations and tabulations to correlation results. Some installations may be able to handle part of that labor also. For example, if the tabulator is fitted with digit selectors, it will print the final scattergram directly (*2*). However, most offices are not equipped with expensive special features. The above operations require only a sorting machine and a numerical tabulator with a progressive-totals plug or switch and so can be carried out by any ordinary installation.

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Plastic Cages for Insects

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During the course of feeding and handling large numbers of mosquitoes used in the experimental transmission of malaria, it seemed desirable to find a more satisfactory cage. The ones formerly in use (*1*) were convenient but were relatively expensive and easily broken, being of hand-blown glass (Fig. 1).

Two companies (Lusteroid Container Company, South Orange, New Jersey, and Celluplastic Corporation, Newark, New Jersey) were found that made cages out of cellulose nitrate base material according to our size specifications.

The cages used are of two sizes: $2\frac{1}{2}$ inches long by $1\frac{1}{2}$ inches inside diameter, and 2 inches long by $1\frac{1}{8}$ inches inside diameter. They are cylindrical in shape and open at both ends with the edges rolled back in a flange (Fig. 1). This flange serves as a barrier which holds a rubber band which in turn secures the bobbinet end coverings. The larger size holds up to five mosquitoes conveniently; the smaller size is for individual mosquitoes.

During the past two years about 9,000 of these cages made by the Lusteroid Container Company have been used with quite satisfactory results. The advantages of the plastic jar are that (a) there is practically no danger of breakage when it is dropped or crushed—an important consideration when infectious insects are being handled or shipped; (b) the cost is low, less than \$.04 each when purchased in large quantities, or about one-tenth the cost of the hand-blown glass cages; and (c) the jar is easily washed and stored.

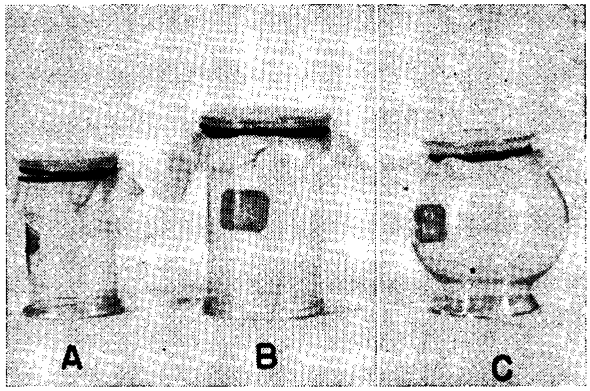

Fig. 1. Plastic and glass feeding jars with bobbinet in place on one end: A and B—small and large plastic jars; C—hand-blown glass jar.

The glass cages were heavier and stayed in position better during experimental feeding. However, with a little care the plastic jar was satisfactory. Also, the glass cages provided slight magnification of insects due to curvature of the sides. This was not significant, however, in the over-all appraisal.

The plastic cages are readily cleaned in either soapy cold water or alcohol. Some of the first cages received seemed to have a residuum toxic to mosquitoes, but this disappeared after thorough washing.

For over two years other types of plastic materials have been utilized in cage construction. Plastic screen, 16-mesh per inch, satisfactorily replaces galvanized screen for adult colony cages and does not rust.

Satisfactory emergence cages have been constructed of sheet plastic, 22 inches by 10 inches, bent into a semicylinder and tacked to a wooden base 10 inches square. The back of this cage is of plastic screen and the front is a muslin sleeve.

The above suggests the use of plastics instead of glass for various other types of insect cages.

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