is of large size and is hardy in captivity. It is also valuable for many other types of work

Previous attempts to rear it have proved unsuccessful. This organism has now been successfully reared for 19 months. In December, 1931, a female collected in the open the previous month laid eggs and from these a strain has been reared continuously since.

The flies are kept in wire cages, 15 × 15 × 15 cm, containing watch glasses filled with cheese cloth moistened with tap water. In these cages are also small wooden feeding troughs filled with a mixture consisting of equal parts of dry poppy, *Eschscholtzia californica,* pollen and powdered cane sugar. On this food the flies live perfectly and lay many fertile eggs.

The cages are kept before a laboratory window but are not exposed to the direct rays of the sun.

The eggs are collected and placed on human feces in a vessel also containing moist earth. Fresh feces are added daily. The larvae pupate in the soil.

At a temperature of between 20 and 25 degrees C., a typical female began laying eggs 10 days after emergence and laid about 3,000 eggs in about 60 days. The eggs hatch in about 36 hours after they are laid. The duration of the larval and pupal stages is about 2 weeks and 8 days, respectively, at about 22 degrees C. Oviposition has been observed at various temperatures between 20.5 and 30.5 degrees C.

The pollen can be purchased from the Knapp and Knapp Pollen Gardens, North Hollywood, California, or it can be raised. The poppy blossoms are collected each day. The anthers are clipped off with scissors and dried in the sun for 12 hours. The pollen separated from the dried anthers by means of a sieve with a fine mesh is kept in a desiccator over calcium chloride. Pollen rapidly deteriorates on exposure to moisture.

Since the methods for culturing it are comparatively simple Eristalis is now available for work throughout the year.

WILLIAM L. DOLLEY, JR.
C. C. HASSETT
W. B. BOWEN
GEORGE PHILLIES

BIOLOGICAL LABORATORY
UNIVERSITY OF BUFFALO

SPECIAL ARTICLES

A NOTE ON THE STABILITY OF RESISTANCE TO COLDS[1]

IT is knowledge derived from ordinary experience that persons under apparently uniform conditions of exposure are highly variable in respect to the number of colds suffered in a given period of time. For example, approximately twenty-five per cent. of college students have four or more attacks in an academic year while about the same proportion escape completely or have only one attack.

The distribution of the number of attacks suffered may be usually closely approximated by the terms of the expanded function,

$$N\left[\left(1-\frac{1}{N}\right)+\frac{1}{N}\right]^n,$$

where N is the number of persons in the population and n the total number of colds suffered by that population in the academic year. The first term of the expansion gives the number of persons expected to suffer no attack, the second term one attack, and so on. The probabilities involved are based clearly on the hypothesis that the colds are distributed by the operation of chance alone.

[1] From the John J. Abel Fund for Research on the Common Cold, and the Department of Biostatistics (Paper No. 188) of the School of Hygiene and Public Health, the Johns Hopkins University; and the Department of Hygiene and Bacteriology of the School of Medicine of Western Reserve University.

It is of interest to note that an exponential series like Poisson's may also be used to approximate the distribution of the number of attacks suffered. The series may be written,

$$e^{-m}\left(1+m+\frac{m^2}{2\,!}+\frac{m^3}{3\,!}+\ldots\right),$$

where m is the mean number of colds per person in the academic year, and the successive terms of the product are the probabilities, respectively, of a person's being attacked 0, 1, 2, 3, . . . , times during the academic year. To obtain the number of persons expected to suffer 0, 1, 2, 3, . . . attacks it is obviously only necessary to multiply each term of the product successively by the population.

It is pertinent to ask if there is a characteristic persistence of resistance or susceptibility to colds with the passage of time. It is perhaps generally believed that persons who are infrequently attacked and who fall therefore well to the left of the mode of the distribution, and those frequently attacked who fall well to the right, are in their respective positions not by chance but because of possessing differing powers of resistance. And, although not supported by records of prevalence, these cold-resistants and cold-susceptibles are believed to remain in these categories for a period of years, and possibly for life. According to this conception there should be a high positive correlation between the number of attacks suffered by a person in different periods of time.

In the studies of the Abel Fund there have become available for the first time requisite data to test this theory. The data are furnished by the Student Group and the Family Group. The first group comprising chiefly students in medicine of the Johns Hopkins University reported from September, 1928, to June, 1932, or four academic years. The second group containing about 100 families residing in Baltimore reported without interruption from November, 1928, to November, 1930. For the study of frequency of attacks in the same persons in two successive years there are the records of 155 students for the first and second years of the study, of 194 for the second and third years and of 54 for the third and fourth years. There were enrolled 114 students in the first year who also were enrolled in the third year, and 56 who reported both in the second and fourth years, thus affording data on the stability of resistance after an interval of one year. Also 49 students were observed in the first and fourth years, which permits analysis of possible change after an interval of two years. The Family Group makes available for two calendar years the records of 144 persons under fifteen years of age, and of 147 of fifteen years and over.

The analysis of these data is based on the computed Pearsonian product-moment coefficient r. The coefficients of the Student Group range from $.16 \pm .10$ to $.41 \pm .05$, and the coefficients yielded by the lower and upper ages of the Family Group are $.64 \pm .06$, and $.54 \pm .06$, respectively. The coefficients of both Student and Family Groups indicate that there is a tendency for persons to remain in the same cold-number class at least for successive years; when the years observed are separated by one year the results are doubtful, and when the interval is two years, a single observation indicates no definite tendency for persons to remain in the same class.

Further available data in the records useful to test stability of resistance and susceptibility comprise the results of continuous observation for three academic years of 111 of the students, and for four academic years of 45. The trend, in general, in each group of students, of the average yearly number of colds reported by those suffering few or many colds when projected into the future or back into the past is towards the average or mean yearly number reported by the total population. With reference to stability, whether of resistance or susceptibility, the data indicate that such a phenomenon was not characteristic of either group of students.

The report will appear in full in the November, 1933, issue (Epidemiological Number) of *The American Journal of Hygiene*. The bibliography will contain a check list of the publications from the John J. Abel Fund for Research on the Common Cold.

WILLIAM M. GAFAFER
JAMES A. DOULL

EXANTHEMA IN PEARS AND ITS RELATION TO COPPER DEFICIENCY

IN previous publications[1] it was shown that pear and other deciduous trees affected with Exanthema can be cured by application of $CuSO_4$ to the soil or to the trees.

In further work on this disease carried on recently it was found that treatments of Bartlett pear trees affected with the disease resulted in marked improvement following spraying with Bordeaux mixture, or after the introduction of soluble copper salts into the trunks of the trees. Similar treatments with iron citrate, manganese chloride and zinc sulfate, respectively, were without effect.

Analyses of leaves and twigs showed that the copper content of diseased leaves was lower than that of leaves from trees in a healthy section of the affected orchard and was considerably lower than that of leaves from localities free of the disease. The copper content, on dry weight basis, of leaf samples collected between June and October was as follows:

	Parts of copper per million
Leaves affected with Exanthema	3.1– 5.1
Normal appearing leaves from diseased trees	3.5– 4.9
Normal leaves from part of orchard free of the disease	5.6– 7.6
Normal leaves from localities free of the disease	11.0–20.0

These results strongly suggest that Exanthema in pear trees is due to a deficiency of copper. It should be added, however, that the copper content of healthy looking leaves from diseased trees does not vary significantly from that of the diseased leaves from the same trees. This relation is very similar to that obtained in plants affected with chlorosis due to a deficiency of iron, in which case green leaves often contain less than yellow leaves from the same trees. This relation can be explained by the larger amount of "active iron" in the green leaves.[2] Similarly, it may

[1] R. E. Smith and H. E. Thomas, "Copper Sulphate as a Remedy for Exanthema in Prunes, Apples, Pears and Olives," *Phytopath.*, 18: 449–454, 1928.
H. E. Thomas, "The Curing of Exanthema by Injection of Copper Sulphate into the Tree," *Phytopath.*, 21: 995–996, 1931,

[2] J. Oserkowsky, "Quantitative Relation between Chlorophyll and Iron in Green and Chlorotic Pear Leaves," *Plant Physiol.*, 8: 449–468, 1933.