lary 3 has a bore through which water will flow, when tube 3 is full, at a rate equal to the flow through capillary 2, etc. Since the rate of flow depends chiefly on the height of liquid, exerting a pressure through the capillary, and since the tubes become progressively shorter, it is easy to see the reason for the increase in the bore of the capillaries. The tubing T leads to a cup Y, to the bottom of which is attached a U-shaped tube ending in a piece of rubber tubing, the opening of which can be adjusted by means of a pinch-cock.

To prepare the instrument for use, the following procedure is carried out: the nematodes are placed inside of the cup Y, the pinch-cock Z is turned to shut off the opening entirely, the cup is filled with water to the level L and it is then fitted to the stopper

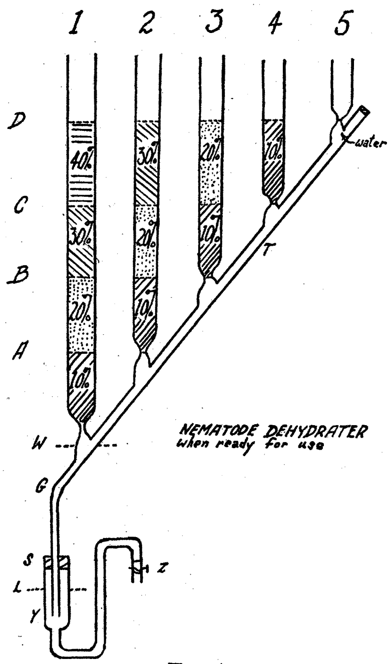


FIG. 1.

S, whereupon water is driven up the tubing to about the level W. Into tube 1 is now poured 40 per cent. alcohol until level A is reached in tubes 1 and 2. Into tube 2, 30 per cent. alcohol is now poured which pushes out the 40 per cent. alcohol from tube 2 and then flows under the 40 per cent. alcohol in tube 1 raising the liquid to the level B. There is now in tube 1 a lower layer of 30 per cent. alcohol upon which rests a layer of 40 per cent. alcohol, while in tubes 2 and 3 there is only 30 per cent. alcohol to the level B. Now 20 per cent. alcohol is poured into tube 3, which forces out the 30 per cent. alcohol from 3 and then rises under the 30 per cent. alcohol in tubes 2 and 1 until the level C is reached in tubes 1, 2, 3 and 4. There is now in tube 1 a lower layer of 20 per cent., a middle layer of 30 per cent., and an upper layer of 40 per cent. alcohol; in tube 2 there is a lower layer of 20 per cent. and an upper layer of 30 per cent. alcohol, while in tubes 3 and 4 there is only 20 per cent. alcohol. Into tube 4 is now poured 10 per cent. alcohol until the liquid in tubes 1, 2, 3, 4 and 5 reach the level D. There is now in tube 1 a lower layer of 10 per cent., a second layer of 20 per cent., a third layer of 30 per cent., and a top layer of 40 per cent. alcohol; in tube 2 there is a lower layer of 10 per cent., a second layer of 20 per cent., and an upper layer of 30 per cent. alcohol; in tube 3 there is a lower layer of 10 per cent. and an upper layer of 20 per cent alcohol; and in tubes 4 and 5 there is just 10 per cent. alcohol to the level D. Into tube 5 there is now poured a little water—enough to drive out the alcohol from tube 5 and to clear out the tubing T. The apparatus is now ready to be used.

The pinch-cock is opened and the liquid drains from all the tubes at once. First the 10 per cent. alcohol flows from tubes 1, 2, 3 and 4, leaving tube 4 empty; next 20 per cent alcohol flows from tubes 1, 2 and 3, leaving tube 3 empty; then 30 per cent. alcohol flows from tubes 1 and 2, leaving tube 2 empty; and finally 40 per cent. alcohol flows from tube 1, emptying it. The rate of flow and therefore the speed with which the nemas are taken up through the dehydrating fluids can easily be regulated by opening or closing the pinch-cock. The process is now repeated, using 50 per cent., 60 per cent., 70 per cent., 80 per cent. and 95 per cent. alcohols.

If the capillaries are made so that each will deliver about 50 cc a minute, the apparatus can be filled in about 7 minutes and need not be touched for the entire length of the run-up. The change from an alcohol of a given percentage to one higher up is very gradual, because the two alcohols, stratified as they are because of their different densities, nevertheless diffuse somewhat at the interface of the layers. If the nematodes are very small, a piece of chamois placed on the bottom of a plaster-of-paris cup, which can be molded to fit inside of the glass cup Y, may be utilized. The nemas, placed on the chamois through which alcohol readily passes, can be easily seen and handled.

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## CULTURE OF THE DRONE FLY, ERISTALIS TENAX

*Eristalis tenax* has been shown to be especially valuable for the study of its reactions to light,[1] because it is uniformly positive and orients accurately in light,

[1] W. L. Dolley, Jr., and H. G. Haines, *Scientific Monthly*, 31: 508, 1930; W. L. Dolley, Jr., *Jour. Exp. Zool.*, 62: 319, 1932.

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.

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# 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.

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 corre-

[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.