Journal of the Minnesota Academy of Science

Volume 24 | Number 1 Article 17

5-1956

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Recommended Citation

Keith, M. M. (1956). Technique For Demonstrating The Chromosomes in the Salivary Glands of the Fruit Fly, Drosophila melanogaster. *Journal of the Minnesota Academy of Science, Vol. 24 No.1*, 74-76.
Retrieved from https://digitalcommons.morris.umn.edu/jmas/vol24/iss1/17

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TECHNIQUE FOR DEMONSTRATING THE CHROMOSOMES IN THE SALIVARY GLANDS OF THE FRUIT FLY, DROSOPHILA MELANOGASTER

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The discovery of the polytene type of chromosome in the salivary glands of the midge larvae, *Chironomus,* by Balbiani in 1881, led later investigators to study the salivary glands of other diptera. Because of its availability, ease of culturing, and the small number of chromosomes, the fruit fly early became the object of intense genetic study. In 1910, T. H. Morgan and his collaborators, Muller, Sturtevent, Bridges, and others, commenced their work on this little fly which has contributed so much to our present knowledge of inheritance.

It is not the purpose of this paper to review the enormous amount of research that has been done on *Drosophila* but, rather, to present a comparatively simple technique for demonstrating the chromosomes which have been so intensely studied and discussed and pictured in textbooks. It is rather common practice for the more dynamic biology teachers to make the study of genetics more realistic by having their students use the fruit fly to illustrate the monohybrid and dihybrid crosses and the inheritance of sex-linked characters. I have found that the study can be made still more interesting by having my students dissect out the salivary glands and stain them so that they can actually see the chromosomes that carry the genes for these characteristics. Of course, they cannot see the genes as they have never yet been observed for certain by the most competent research workers in genetics, but they can at least see the bands and bars that are regarded as being the loci of the genes.

If the following procedure is followed, most any high school or college biology student should be able to make very good demonstrations after a few trials.

I. MEDIA FOR REARING THE LARVAE: The agar-agar media recommended by Bridges is probably the simplest and best for rearing the larvae since it is easy to prepare and if there is an excess, it may be kept for several months in a moist jar under refrigeration. The formula is as follows:

40 grams of agar-agar
200 grams of corn meal (yellow or white)
140 cc. of "Karo" syrup
140 cc. of "Bre'r Rabbit" Molasses
2000 cc. of water
Sterilize for 15 minutes at 15 lbs.

When ready to use, inoculate with a few drops of yeast dissolved in sterile water with an eye dropper.

II. PARENT FLIES: Since we are not concerned with the inheri-

tance of any characters, any variety of Drosophila may be used. One pair of flies per bottle is sufficient. The distinguishing of sex requires a bit of practice. The female has a broader abdomen than the male and there are several small lines across the end of the abdomen; the male, which is smaller, has a black-tipped abdomen.

III. LARVAE: It takes about six or seven days for the eggs to hatch and the larvae to mature to the pupal stage. When the larvae are ready to pupate, they will crawl up the sides of the rearing bottle. Select the largest specimens as they have the largest glands. Transfer the selected specimen from the rearing bottle to a small drop of normal salt solution on a microscope slide by means of a dissecting needle.

IV. REMOVING THE SALIVARY GLANDS: Place the slide under a binocular microscope, using reflected light over a black background. While holding the larvae *gently* secure with one dissecting needle placed at about the middle of the body, decapitate by placing another needle just slightly behind the black mouth hooks and carefully move it forward. After a little practice, the head can be removed leaving the digestive tract attached to it. The salivary glands, which are tubular in shape, lie on either side of the oesophagus. The glands are attached anteriorly by their ducts which unite just before entering the mouth. On the medial side of each gland is a long whitish fat body. Carefully remove this and then free the glands by cutting their ducts.

V. STAINING: Spread a small drop of egg albumen fixative on the middle of a microscope slide and wipe off as much as possible with the palm of the thumb so as to leave only a very thin coat. Allow to dry thoroughly. Place a small drop of stain on the albumenized slide and transfer the glands into it. Transfer may best be accomplished by means of a capillary tube drawn from a 4 mm. glass tube that has a glass-tipped rubber tube that may be placed in the mouth attached to it. While watching the process under the microscope, draw the glands up the capillary tube and expel them into the stain by blowing gently into the tube. Allow the stain to act for about *ten minutes* and then draw off most of the stain with the capillary tube so that the glands will not float away when the cover glass is dropped on to them. Place a piece of blotting paper or paper toweling over the coverslip and, with the thumb, apply a large amount of pressure. The pressure must be sufficient to break the nuclear membrane so that the chromosomes will spread out for better observation. Several trials may be necessary before the correct amount of pressure can be determined. Spreading of the chromosomes must be accomplished on the first trial.

VI. DEHYDRATING: Place the slide into a coplin jar with just enough 95% alcohol to cover only the lower fourth of the coverslip and let it remain there for 12 *hours*. Then add enough more 95% alcohol to cover the entire coverslip. The coverslip will usually drop off of its own accord, or can easily may be made to do so, leaving the

glands attached to albumen fixative. Transfer the slide to a jar of absolute alcohol for 5-6 minutes and then into a jar of xylene for clearing. Mount in damar or other mounting medium.

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THE DEVELOPMENT OF A GENERAL EDUCATION COLLEGE CHEMISTRY COURSE

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ABSTRACT

Purpose of the Study

The purpose of the study is to develop philosophically a first-year general education college chemistry course which will serve the general education student as well as the specializing student. The course is based upon modern philosophy of science and education with emphasis upon objective scientific thinking.

Assumptions in the Development of the Course

Four assumptions are made as a basis for the course:

1. That in our democratic society objective thinking based upon understanding of scientific principles relating to the structure and interaction of matter leads to a better life and should, therefore, be a part of the education of all.

2. That the chief function of a general college chemistry course is to provide experience in objective thinking regarding the structure and interaction of matter, especially as it relates to life in our society and culture.

3. That one learns most effectively when new learnings are associated with past experiences so they are meaningful to the individual in controlling, predicting, and testing future experiences.

4. That a general education chemistry course should begin with modern atomic theory and be developed upon it.

Criteria in the Development of the Course

To select and organize content and experiences in keeping with these basic assumptions, criteria were established. Applying the fourth basic assumption, those materials concerning the atom which were