Science Education Collection

Drosophila Maintenance

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Abstract

Drosophila melanogaster, commonly known as fruit flies, are a frequently used model organism for life science research. Although starting a collection of these critters may seem as easy as leaving a banana on your kitchen counter for too long, a productive fly colony in the lab requires careful husbandry and maintenance.

This video demonstrates the necessary steps for maintaining a healthy fly stock. The overview begins with the preparation and storage of the yeast and sugar-containing media on which flies feed. Next, the vessels most commonly used for housing *Drosophila* are shown, as well as how and when to move flies between these containers. Finally, the presentation also includes examples of the ways in which housing and feeding conditions are manipulated for biological experiments.

Transcript

Successful *Drosophila melanogaster* research hinges upon correct maintenance and husbandry of this valuable model organism. The following video will discuss the necessary steps required to provide proper nutrition, housing, and handling of the fly.

Though commonly know as the fruit fly, *Drosophila melanogaster* actually subsists on the microorganisms, such as yeast, that grow on fermenting fruit. In the lab, the fly's diet is modified for practical purposes. Several recipes are available, and all contain the essential components: sugar and yeast. The following recipe is from the University of Indiana in Bloomington, famous for its vast variety of fly stocks. It consists of: sterile water, yeast, soy flour, yellow cornmeal, agar for texture, corn syrup, and propionic acid to inhibit mold and bacterial growth. These ingredients are combined, heated, stirred, and then distributed into plastic housing vials using a pump. After they are filled, the vials are plugged with a cotton top, wrapped, and cooled at 4 °C. Once solidified, food is sterilized via autoclaving.

Now that we've learned a bit about what flies eat, let's have a look at where they live and how they're handled.

A variety of containers are used for housing flies. Vials are used for fly maintenance and optimally contain 50-100 adults. Bottles are used for larger cultures and house 300-600 adult flies. Incubators control the environment and are capable of holding hundreds of vials and bottles. The normal storage conditions for flies are 25 °C and 60-65% relative humidity.

When working with flies, it is important to practice proper labeling and documentation, and to keep a clean environment to maintain the integrity of fly lines and experiments. A container must be changed when about half of the pupae have eclosed, or left the pupal casing. The casings will appear clear.

FYI, the pupal stage occurs between the larval and adult stages, and is the time when the larvae incubate and develop into an adult. To identify pupal casings as clear, hold the container up to a light source and inspect the pupa.

Flies are transferred to vials with fresh media — a fancy name for fly food — via a process known as flipping flies. Before flipping flies, inspect the media for integrity. Flies cannot survive on food cracked with dryness or contaminated with mold or bacteria.

To flip flies, first, tap the fly vial gently on the counter to knock flies off the sides of the vial. Then quickly remove the stopper, and invert the flies from the old container rapidly into a new one. This process is done rapidly, to prevent flies from escaping or being crushed by the stopper, and to prevent loose flies from entering the vial during flipping.

While flipping flies is the preferred method for the bulk transfer of Drosophila, anesthetization is required for sorting flies. Two methods of anesthetization will be discussed here: chilling, and using carbon dioxide. To chill flies place the culture in a -20 °C freezer for 8-12 minutes. Then place flies onto a chilled, flat workspace for selection. Flies can also be anesthetized using cold by chilling them directly on a frozen surface.

Carbon dioxide is a preferred method for anesthetization because it does not cause acute mortality in flies or danger to the researcher. The CO2 delivery system is made up: of a CO2 tank; a tube connected to a needle, to anesthetize flies in vials and bottles; and a tube connected to a CO2 plate for analysis under the microscope.

To anesthetize flies, insert the CO2 needle through the stopper. Alternatively, tap the container on a surface, remove the stop, and quickly invert the flies onto a CO2 plate, keeping a closed seal until the flies are immobile. Using a brush or forceps, gently move the flies into the new container.

To discard unwanted flies, dump them into a fly morgue, which consists of a large bottle filled with isopropanol or ethanol and mineral oil topped with a funnel.

Now that we've seen how flies are maintained and handled in the laboratory, let's have a look at how housing and feeding conditions are modified for different experiments.

Some experiments require alternative housing in order to contain a greater amount of flies.

In this experiment, the researcher uses a fly population cage to collect a large quantity of embryos. A fly population cage is clear, plastic box capable of holding thousands of flies. The researcher releases the desired flies from several bottles into the fly population cage, then places agar plates into the cage to collect embryos.

Some experiments demand the manipulation of the fly diet.

In this experiment, the researcher wants to observe the escape response of transgenic flies that express a light-activated ion channel in neurons that regulate the flies' escape response. The *Drosophila* diet is supplemented with all-trans-retinal, which is a cofactor for this channel and allows it to function. This is done by melting the food and adding the reagent. The fly is then exposed to blue light that activates the channel and induces the escape response, and the time taken to fly measured.

A variety of housing and handling conditions can be manipulated for experimentation.

In this experiment, an elaborate power tower is created to study the effects of exercise on Drosophila. The power tower is a machine that continually rises and drops, taking advantage of the fly's natural response to move upward, against gravity, which is known as negative geotaxis.

The performance of the flies exercised in the power tower is measured using a Rapid Iterative Negative Geotaxis assay, or RING assay for short. Flies in empty vials are placed in front of a camera. The vials are tapped, and the distances climbed are recorded. This experiment shows that compared to a control group exercise had a positive impact on activity over time.

This JoVE video has covered the maintenance and husbandry of *Drosophila melanogaster*. After watching this video you should be able to prepare fly food media, properly identify appropriate housing, flip flies, and perform simple experiments. Thanks for watching!