Using of *Drosophila Melanogaster* in Genetic Research

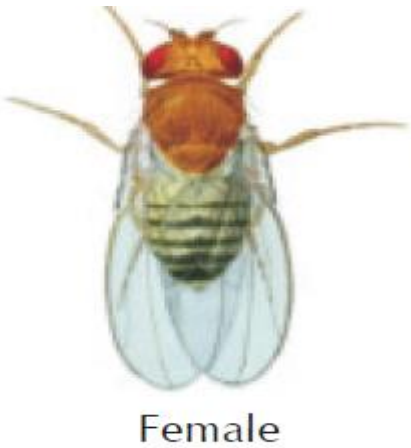
Drosophila melanogaster (Black-bellied Dew-lover) a dipteran (two winged) insect, is the species of fruit fly that is commonly used in genetic experiments; it is among the most important model organisms. In modern biological literature, it is often simply called ***Drosophila*** or (common) fruit fly.

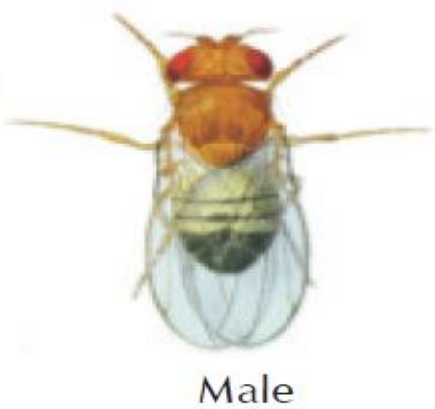
Classification:

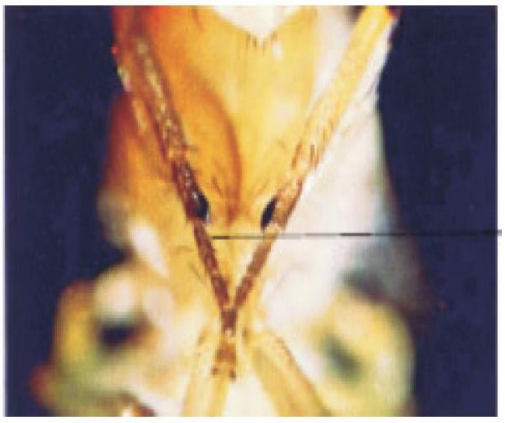
Domain: Eukarya
Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Diptera
Family: Drosophilidae
Genus: ***Drosophila*** ("dew lover") Species: ***melanogaster*** ("dark gut")

The flies have red eyes, a yellow-brown color, with transversal black rings across their abdomen. They exhibit sexual dimorphism. Features to determine the sex of adult fly:

- **Size of adult:** The female is about 2.5 millimeters long and is generally larger than the male.
- **Shape of abdomen:** The tip of the abdomen is elongated in the female, and somewhat more rounded in the male.
- **Markings on the abdomen:** Alternating dark and light bands can be seen on the entire rear portion of the female, the last few segments of the male are fused.
- **Appearance of sex comb:** The males have so called sex combs, a fringe of about ten stout black bristles on the distal surface of the basal (uppermost) tarsal segment of the fore leg. Such bristles are lacking in the female.


Female


Male

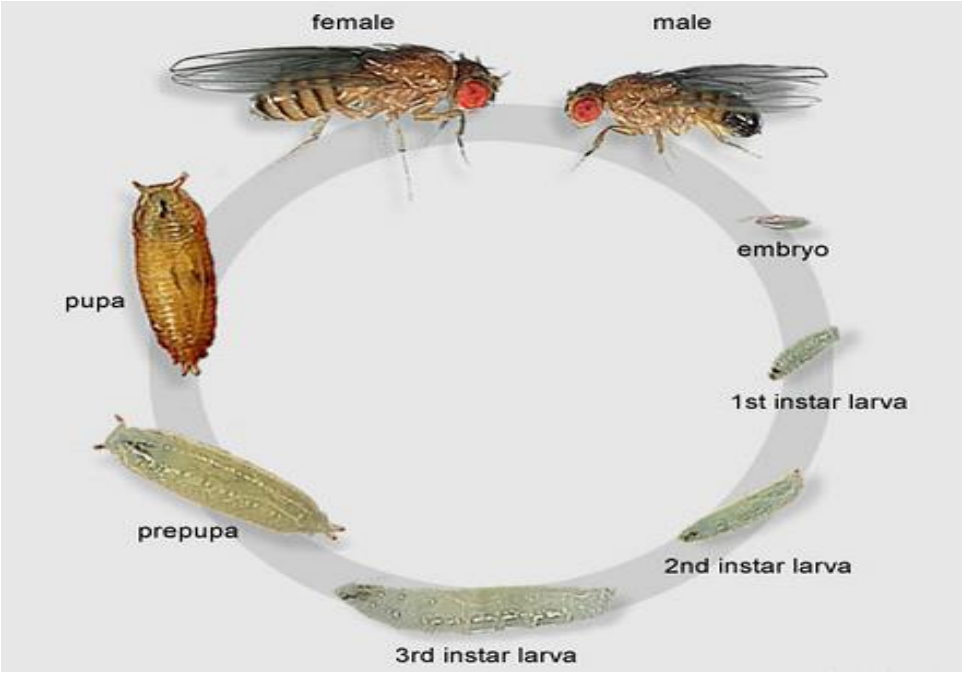


Life cycle of *D. melanogaster*

D. melanogaster exhibits complete metamorphism, meaning the life cycle includes an egg, larval (worm-like) form, pupa and finally emergence (eclosure) as a flying adult. This is the same as the well-known metamorphosis of butterflies and many other insects. The larval stage has three instars, or molts.

Life cycle by day

Day 0: Female lays eggs
Day 1: Eggs hatch
Day 2: First instar (one day in length)
Day 3: Second instar (one day in length)
Day 5: Third and final instar (two days in length)
Day 7: Larvae begin roaming stage. Pupariation (pupal formation)
Day 11-12: Eclosion (adults emerge from the pupa case). Females become sexually mature 8-10 hours after eclosion



- ✓ The time from egg to adult is temperature- dependent. The above cycle is for a temperature range of 21-23 degrees ^{0}C. The higher the temperature, the faster the generation time, whereas a lower (to 18 degrees ^{0}C) temperature causes a longer generation time.
- ✓ Females can lay up to100 eggs/day.
- ✓ Virgin females are able to lay eggs; however, they will be sterile and little in number.

Why use *Drosophila*?

Fruit flies have been used in genetic studies for several reasons:

1. They are **small and easily handled**.
2. You can **anesthetize** them easily and manipulated individuals with very unsophisticated equipment.
3. ***Drosophila*** are sexually dimorphic (males and females are different); making it is quite easy to differentiate the sexes.
4. Flies have a **short generation time** (10-12 days) and do well at room temperature.
5. The care and culture requires little equipment, **is low in cost** and uses little space even for large cultures.

Similarity to humans

Although humans and flies differ greatly in terms of their gross morphological and cellular features, many of the molecular mechanisms and the internal organ systems of Drosophila melanogaster are functionally analogous to those in vertebrates, including humans. Genetically speaking, people and fruit flies are similar. About **75%** of known human disease genes have a recognizable match in the genetic code of fruit flies, and **50%** of fly protein sequences have mammalian analogues. ***Drosophila*** is being used as a genetic model for several human diseases including **Parkinson's, Alzheimer's and Huntington's.**

Using Drosophila melanogaster in medical and genetic research

- Fruit fly has been used as a model organism in both medical and scientific research. Work by Thomas Hunt Morgan (1866–1945) and his students at Columbia University led to great discoveries such as **sex-linked inheritance** and **ionizing radiation causes mutations in genes**.
- Drosophila was not limited to genetic research. Experimentation with this model organism has also led to discoveries in **neuroscience and neurodevelopment**. The complex nervous system, conserved neurological function, and human disease related loci allow Drosophila to be an ideal model organism for the study of neurodegenerative disease, for which it is used today, aiding research into diseases such as Huntington's, Alzheimer's and Parkinson's.

Mating Drosophila melanogaster:

Select about six or eight virgin females of one genotype and the same number of males of the second genotype, gently transfer the flies to a vial that has been previously prepared with media. Do not place the flies directly on the media. Rather with the vial lying on its side place the flies along one dry plastic side of the vial and insert the foam plug. Let the vial remain on its side until the flies are awake and active. Be sure to label the vial with the date, parental genotypes.

How to Feed Drosophila melanogaster?

In laboratory, fly food is based on some fruit types, such as banana or apple. Other ingredients include cornmeal, corn syrup or molasses for extra sugar, ethanol, yeast, and gelatin. Growing larvae will feed on the yeast, but too much yeast will kill the culture.

How to Maintain Drosophila

Fruit flies are extremely low maintenance. Once they are in a vial with food, they do not need additional food or water. The adults can reproduce throughout their life, the vials become full. Therefore, the best way to maintain flies is to move groups of adults to fresh vials every two weeks. It is ideal to keep them at a constant 25°C.