

# Fruit Flies in Central Virginia: Capstone Research Projects at a Community College & Partnership with a University Genomics Lab

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## Introduction

Biology 299 is a required one-semester, two-credit independent research and methods course for students seeking an A.S. in Science. Biweekly class meetings focus on

- research design
- experimental iteration
- analysis
- interpretation
- communication

Students design and conduct an authentic research project with guidance from a faculty mentor. Other students and faculty and laboratory staff form a community of practice and provide support and feedback. The semester concludes with a celebratory lunch and poster session open to the college community.

Research projects span a wide range of questions, with several common features: the answers are not known, the cost of the project is low, and the experimental phase can be completed in eight to ten weeks.

In Fall 2020 due to COVID restrictions, PVCC faculty were looking for outdoor projects and we established a partnership with a University of Virginia lab studying the evolutionary biology of fruit flies living in a local orchard. Students frame their studies, pose unique questions, and use standardized methodologies to address their research questions. Upon completion of their projects, the preserved fruit flies are shared with the university researchers. This partnership extends field biology opportunities at the community college, while also increasing the university lab's collection efforts.

## Materials & General Methods

- BioQuip 59 ml clear styrene collecting vials
- BioQuip Drosophila Net or Aspirator attached to a falcon tube with trimmed 1 ml pipette tip
- Nikon SMZ645 Dissecting Microscope
- *The Encyclopedia of North American Drosophilids Volume 1: Drosophilids of the Midwest and Northeast*
- Ethanol

- Students write proposal and outline specific hypothesis and methodology, approved by faculty mentor.
- Students and mentors meet with members of the Bergland lab (UVA) at Carter Mountain for project discussion, collection training.
- Students use 1 of 2 collection methods: arial insect net or aspirator.
- After collection, fruit flies are transferred to PVCC lab
- Fruit flies are euthanized at -20°C.
- Dissecting microscopes and field guide are used to differentiate and record species types.
- Students analyze data and prepare a poster or presentation.
- Flies are placed in ethanol in microfuge tubes for transport to the UVA lab for further research

## Project titles from Fall 2020 and Fall 2021

- Apple Type Preference in Common Drosophilids of Virginia (K. Crow)
- Distribution of Drosophila Species Over A Season Change (K. Scott)
- Fruit type preference of Piedmont Virginia fruit flies: Oviposition vs Feeding Differences (A. Blackburn)
- Drosophila Biodiversity in Fuji versus Jonagold Apples in Carter's Mountain (C. Vasquez-Caballero)



Figure 1. View of field site (left) and vial of collected flies (above). Carter Mountain Orchard, Albemarle County, Virginia

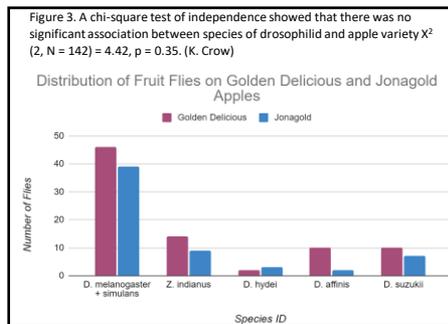


Figure 2. *Drosophila melanogaster/simulans* under the lens of a Nikon SMZ645 Dissecting Microscope (K. Scott)

Table 1. Number of flies of each species collected per fruit type from the mason jars (after a week in the lab). The species composition in the lab-collected flies between the apples and peaches was significantly different,  $\chi^2$  (2, N=3)=9.1232, p=0.01. (A. Blackburn)

| Species | Species           |                        |                    |
|---------|-------------------|------------------------|--------------------|
|         | <i>D. affinis</i> | <i>D. melanogaster</i> | <i>D. simulans</i> |
| Apples  | 10                | 21                     | 13                 |
| Peaches | 2                 | 34                     | 9                  |

## Sample Student Work



"The research experiment allowed me to push myself out of my comfort zone academically and helped me gain confidence in my problem-solving abilities." -- C. Vasquez-Caballero

Table 2. *D. melanogaster*, *D. hydei*, and *Z. indianus* varied by apple type  $\chi^2$  (2, N=358) = 35.85, p=0.00001. Species diversity also differed between the two different collection dates.  $\chi^2$  (4, N=1811) = 14.85, p=0.005. (C. Vasquez-Caballero)

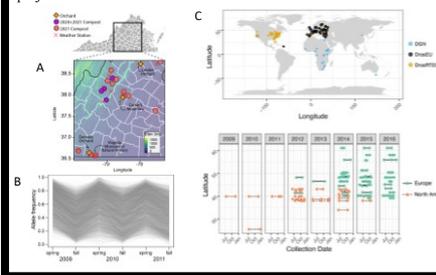
| Species                        | Fuji Collection at 66°F | Fuji Collection at 75°F | Jonagold Collection at 66°F | Jonagold Collection at 75°F | Total       |
|--------------------------------|-------------------------|-------------------------|-----------------------------|-----------------------------|-------------|
| <i>Drosophila melanogaster</i> | 278                     | 449                     | 222                         | 258                         | 1207        |
| <i>Zaprionus indianus</i>      | 85                      | 94                      | 176                         | 210                         | 565         |
| <i>Drosophila hydei</i>        | 2                       | 2                       | 2                           | 9                           | 15          |
| <i>Drosophila suzukii</i>      | 1                       | 8                       | 2                           | 6                           | 17          |
| <i>Drosophila robusta</i>      | 3                       | 0                       | 3                           | 1                           | 7           |
| <b>Total</b>                   | <b>369</b>              | <b>553</b>              | <b>405</b>                  | <b>484</b>                  | <b>1811</b> |



Figure 4. Fall 2021 Poster Session. K. Scott presenting her research

## UVA Genetics Connection

- Fly samples collected by PVCC students are incorporated into a larger state-wide collection effort led by the Bergland lab. (A, below)
- These samples will be used to study genetic changes in populations through time, in response to seasonal fluctuations in the environment. (B, below)
- Samples collected in Virginia are incorporated into a large dataset of *Drosophila* genomes collected over the species range and over a decadal timescale (C, below). This consortium-based work is led in part by the Bergland lab and represents a unique and rich resource for the scientific community.
- Thus, the independent research projects conducted by Biology 299 students will have a direct impact on an ongoing international research project.



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