

Undergraduate Research Grants Application Form

Due May 7, 2012

1. Student Information

First Name Nick Last Name Platner

Major BS Biology, Conservation Student ID# ~~00123456~~

Email Address ~~nick.platner@sjcsu.edu~~ Phone ~~(924) 483-8888~~

Class Standing: Freshman Sophomore Junior Senior

GPA ~~3.5~~ Have you been the recipient of this award before? Yes No

2. Faculty Information

First Name Susan Last Name Lambrecht

Email Address susan.lambrecht@sjcsu.edu Phone 924-4838

Department Biological Sciences College/School Science

3. Project Information

Title of Project Selection on flower size in Leptosiphon androsaceus (Polemoniaceae)

Project Timeframe: Start Date 06/04/12 End Date 05/15/13

Will this project use (check all that apply)

- Animal Subjects
- Biohazards/Human Blood
- Human Subjects
- Recombinant DNA
- Radiation/Isotopes/Lasers
- Controlled Substances

TO BE COMPLETED JOINTLY BY THE STUDENT AND THE FACULTY MENTOR:

In a few sentences, describe the goals of the research or creative project you will be working on together.

The goal of the research is to observe how selection on flower size may be constrained by climate and by other plant traits. In a long-term field study of the native plant *Leptosiphon androsaceus* (Polemoniaceae, phlox family) along a naturally occurring precipitation gradient, I have observed that flower size declines as moisture becomes more limiting. This pattern is in spite of consistent pollinator-mediated selection for large flowers across the precipitation gradient. My research has been exploring the possible reasons for variation in floral size. One hypothesis is that water loss from large flowers may become limiting in dry environments, so there is environmentally-mediated selection for small flowers in those environments. Another hypothesis is that there is selection for morphological (e.g., low specific leaf area) and physiological (e.g., high water-use efficiency) traits that confer drought tolerance in dry environments, and small flower size is simultaneously inherited due to genetic constraints. For example, genes for flower size may be on the same chromosome as genes that confer water-use efficiency, so selection on one trait leads to the simultaneous inheritance of the other.

In the proposed study, Nick will be growing *Leptosiphon androsaceus* in a greenhouse facility at San Jose State University to determine whether flower size is constrained by other plant traits. Using hand pollination, he will cross-pollinate plants with the largest flowers with other large-flowered plants to create artificial selection for large flowers. Similarly, he will hand-pollinate small-flowered plants to generate selection for small flowers. Both selection lines will be raised under well-watered and drought conditions. Nick will repeat this artificial selection for at least three generations to observe 1) whether there will be divergence between the two selection lines in flower size, 2) if flower size covaries with other morphological or physiological traits that may be important for drought tolerance, and 3) whether variation and inheritance in flower size is affected by imposed drought in the greenhouse.

Enumerate the general activities the **student** will perform as part of their participation in this project. Provide a rough timeline.

June 2012: Field seed collection. Nick will visit two field populations in Henry Coe State Park to collect seeds of *Leptosiphon androsaceus*.

June 2012: Discussion of literature and design of research study.

July 2012: Nick will initiate seed germination and will transplant plants to pots for research study.

August 2012: Plants will start flowering. Nick will make measurements of morphology (such as flower size, leaf size, plant height), life history (the number of days to initiate the first flowers), and physiology (photosynthesis, water-use efficiency). From each of the two field populations, Nick will select the ten plants with the largest flowers and cross-pollinate them (total 20 large-flowered plants). He will do the same with small-flowered plants. The pollinated plants will be allowed to set seed, while the remaining plants will be destroyed. Seeds will probably be mature in September.

September 2012-February 2013: Nick will repeat the experiment for at least two more generations.

February-March 2013: Data analysis

April 2013: Preparation of poster to be presented at the College of Science Student Research Day, which occurs in May.

Enumerate the general activities the **faculty mentor** will perform as they supervise or guide the student throughout this project.

1. Reading and discussing relevant literature. This project is one component of a larger, long term research project ongoing in my lab. It is important that Nick understands how his research will fit in with the overall goals of this project. So, he and I will read and discuss the relevant background research in the primary literature. In doing so, we will also pay special attention on the phrasing and research questions and hypotheses, and on the design of experiments to test those hypotheses.
2. Statement of research questions and experimental design. Nick has not yet had any courses in statistics or experimental design, so we will discuss the importance of well-phrased objectives and carefully designed experiments.
3. Training on measurement techniques. Nick will need to be trained in lab and greenhouse measurement techniques.
4. Training on careful data recording and note taking. Nick will keep a lab notebook detailing the work he is doing, and we will go through his notes weekly to discuss any serious errors or omissions.
5. Data analysis. I will train Nick on some basic statistical techniques to analyze his data and how to interpret the results.
6. Poster creation. I will want Nick to present his research at the College of Science Student Research Day poster session. I will work with him to show him how to present his data in a research poster format. If possible, I will also have him present his poster at a regional or national scientific conference.

How will the student's participation in this project contribute to their educational and/or career goals?

After completing his undergraduate degree at San Jose State University, Nick plans to enter graduate school or seek employment in a non-profit doing research in conservation biology or climate change. The research he will be doing during this project explores how evolution in response to climate may be constrained, which is important if we want to understand how changing climate will affect future biodiversity. Therefore, this current project will introduce him to the research literature and techniques that are relevant to his future plans. Furthermore, he will get experience presenting his research at the College of Science Student Research Day and possibly at a larger scientific research conference. Finally, he will be included as a co-author on any manuscripts or presentations that include his research. His own presentation(s) as well as any co-authorship are significant accomplishments for an undergraduate student.

4. Budget and Justification (Budget itself to be submitted on Budget Form)

Explain how the funds requested for this project will be expended. Grant funds can be used to cover project related software, equipment, materials, supplies, travel, data collection and analysis, and other project related expenses. Up to one half the grant can be used as student assistant funds. Funds may not be used for faculty compensation or travel or to purchase food.

Supplies:

Water-use efficiency. The standard method of assessing water-use efficiency is through the use of stable carbon isotope techniques. If we assess 30 plants in each of three generations, the result is 90 plant samples. I receive a discounted rate of \$9.11 from the Facility for Isotope Ratio Mass Spectrometry lab at UC Riverside.

Planting supplies. We will need potting soil in which to plant seeds. We need plant labels in order to label plants as part of the small-flowered or large-flowered selection lines.

Travel. The field populations in Henry Coe State Park are very remotely located. At least two seed collecting trips will occur. Each trip is 140 miles roundtrip. Current SJSU travel reimbursement is \$0.555 per mile.

5. Signatures

Student Signature



Date

5-7-12

Faculty Signature

Susan Lambrecht

Digitally signed by Susan Lambrecht
 DN: cn=Susan Lambrecht, o=San Jose State
 University, ou=Biological Sciences,
 email=susan.lambrecht@sjsu.edu, c=US
 Date: 2012.05.07 09:38:06 -07'00'

Date

05/07/12

Department Chair
Signature

Michael Sneary

Digitally signed by Michael Sneary
 DN: cn=Michael Sneary, o, ou=Biological
 Sciences, email=Michael.Sneary@sjsu.edu,
 c=US
 Date: 2012.05.07 14:49:07 -07'00'

Date

5/7/12

Save & Print Form

Submit completed application with supporting documents to the Center for Faculty Development (IRC 213) or email to cfcd@sjsu.edu no later than **5:00 p.m. Monday, May 7, 2012.**