

Scientific Proposal Writing Using the Bugscope Model



Introduction

Bugscope is an educational outreach project based at the [University of Illinois at Urbana-Champaign](#). The primary goal of the Bugscope project is to demonstrate that relatively low cost, sustainable access to a scanning electron microscope can be made available to K-12 classrooms. Participating classrooms have the opportunity to control an [Environmental Scanning Electron Microscope](#) to image insects at high magnification. Students and teachers control the microscope using web browsers from their classroom computers. The microscope is located at the [Beckman Institute](#) at the [University of Illinois at Urbana-Champaign](#). Because of widespread national publicity regarding this project, viewing opportunities are available to classes on a competitive basis. Students typically view class-collected specimens they sent to the Beckman Institute and prepared for viewing. This activity centers around writing a proposal for viewing time.

Proposals must be submitted by teachers, though they may be authored by students. Applications from schools who have successfully used Bugscope can be accessed from the Bugscope [Completed Applications Page](#). Your proposal should include:

- student, class, or group background in the study of arthropods
- anticipated student, group, or class background and experiences prior to Bugscope viewing session;
- type(s) of specimen(s) you would like to examine;
- anticipated follow-up activities; and
- description of method of evaluation.

Some of the more competitive teacher/4-H leader written proposals follow:

Sample Middle School Proposal

I would use Bugscope with my 7th grade life science students. We have just begun our study of the animal kingdom. We started out with sponges, worms, cnidarians, and mollusks. Now we are getting ready to begin our unit on arthropods, insects, and echinoderms. As a graduate student with a concentration in technology, I try to incorporate use of technology as often and as creatively as I can. We have already participated in two other Internet based projects this year. One was the Great Chocolate Experience and the other was the Dirty Dirt Project. For this, we had to send a soil sample from the school grounds to be analyzed. We are awaiting the results so that we can generate graphs and decide how we can improve the soil for planting.

When we did our worm study we used "The Yuckiest Site on the Internet" to get a close up view of worms and the use of worm bins. We also learned about planaria, tapeworms, and leeches.

I can envision that the Bugscope site would have the same benefits for my students. The one place where we are lacking is our ability to have a class set of microscopes. We generally use a video microscope that is hooked up to a television screen. But even that is not the best. Having access to a site like Bugscope with the capabilities of operating an electron microscope would be a wonderful experience for my students. They are an enthusiastic bunch and would enjoy an opportunity like this and would benefit by it immensely. Since we have the capability of using four Pentium PCs right in my classroom, it would be very accessible for the students. Right now, we use these computers to email our responses to math questions from Swarthmore

University. It is very convenient having them right in the room with us at all times. But when I want all students to be on a computer at one time, we also have access to the MAC lab.

Sample 4-H Summer Program Proposal

I would like to use the Bugscope project for our 4-H sheep group. The kids would be looking at internal and external parasites that are on their 4-H Market lambs and utilize the information to manage their sheep. This information is vital in sheep management. Additionally, we would utilize the program for other 4-H projects such as the Entomology group, which collects and mounts insects. The group could look closely at the structure of the insect that they collect. This would help with the identification of the insect.

The Monte Vista 4-H has a broad range of age groups from 4th graders through high school seniors, thus Bugscope would impact a good cross section of students.

Please consider our proposal for the summer. We would be able to utilize the program from June 1st through the end of September, when most of our market lambs would be sold.

Sample High School Proposal

First and second year students in Croton-Harmon High School's three year science research course will investigate the impact of the woolly adelgid (*Adelges tsugae*), an aphid-like insect, on several species of hemlock (*Tsuga* spp.) ---with a specific focus on the effectiveness of integrated pest management (IPM) approaches in slowing hemlock mortality rate. Students will use Dialog, an online international database, to access relevant journal articles. Based on his/her reading, each student will design an experiment involving the use of the ESEM. One experiment will be chosen and carried out, hopefully in conjunction with a scientist/mentor in the field. The student whose experiment is selected will operate the microscope remotely.

The ESEM session can be viewed by all Science Research students, all Biology students, and middle school life science students (approximately 300 students) in the high school auditorium using a Dell laptop, a high quality video projector, and a T1 line. Images can be captured with a digital camera and printed on a large format printer. Moreover, I believe that the session can be carried into individual classrooms throughout the district as well (the elementary, middle and high schools are linked together by intranet and a T1 line).

Having worked as an electron microscopist for 10 years at Yale Medical Center before I became a teacher and having participated in the Rockefeller University's Science Outreach Program since 1992, I have long been interested in helping students experience the thrill of looking at living things very closely---I will always be fascinated by the incredible level of organization that persists even as the magnification increases. I am certain that if our project is selected, students will be very actively involved. Moreover, I have been seeking a way to immerse the Science Research students in designing an experiment. All too often, students read and become highly knowledgeable in their topic of interest, find a mentor, and then have difficulty developing an experiment. This project will give students a focus and a vehicle for developing a potentially valuable experiment using technologically advanced equipment. Hopefully, this is the wave of the future for science education!

Most of the equipment we plan to use in this project was obtained through a \$43,000.00 Learning Technology grant I received from the Newark State Education Department in 1997, for integrating technology into the Science Research curriculum. Bugscope provides an ideal opportunity to develop this goal further than I'd thought possible! My training in teaching Science Research was funded by the National Science Foundation, which recognizes the strength of this particular curriculum. I hope to develop a model

lesson with Bugscope that can be used/adapted by other Science Research teachers.

Activity Instructions

1. Begin by examining the [Bugscope](#) web site. Examine images collected by classes.
2. Follow up this activity by examining several web sites featuring galleries of ESEM images. A fun place to start this search is the [Ugly Bug Contest Homepage](#). Be certain to examine the diverse array of student-submitted specimens at <http://www.uglybug.org/04dex.shtml>.
3. After viewing a number of electron micrographs, read through the bulleted proposal components and review the past proposals presented earlier in this document.
4. Review arthropod-related classroom topics and activities. Begin to assemble a list of possible arthropod characteristic structures you would like to examine using the ESEM. A number of possibilities will likely arise as you re-examine Advanced Arthropod Studies Curriculum activities performed this far. Be creative, but reasonable, in your list production. A few possibilities to consider from Advanced Studies Arthropod Curriculum Studies activities are listed below.
5. Working individually or as part of a group, develop a proposal which includes each of the bulleted proposal components.

| Advanced Arthropod Studies Curriculum Activity | Possible Organisms/ Structures to Examine and Compare Using Bugscope |
|---|--|
| Microarthropod Collection and Examination | Mites, Spiders, Millipedes, Centipedes, Pseudoscorpions, Pillbugs, Proturans, Diplurans, Collembola (Springtails) |
| Microarthropod Variation and Taxonomy | Mite Variations, Differences in Millipede and Centipedes Mouthparts/Leg Regions, Variations in Pseudoscorpion Claws (Pedipalps), Leg/Antenna Variations in Diplurans, Variations in Collembola Body Structure, Furcula (springs) and Collophores |
| Quantitative Study of Arthropod Ecology | Size Differences and Variations Within Taxonomic Groups Collected from Different Sampling Areas |

Proceed to [Teacher's Guide to Scientific Proposal Writing Using the Bugscope Model](#)

Return to [Advanced Arthropod Studies Curriculum Home Page](#)

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