



# Phage Genome Sequence Phailure Results in Creative Use of Local Collaborations

Louise Temple, Department of Integrated Science and Technology, and Steven G. Cresawn, Department of Biology, James Madison University, Harrisonburg, VA 22807



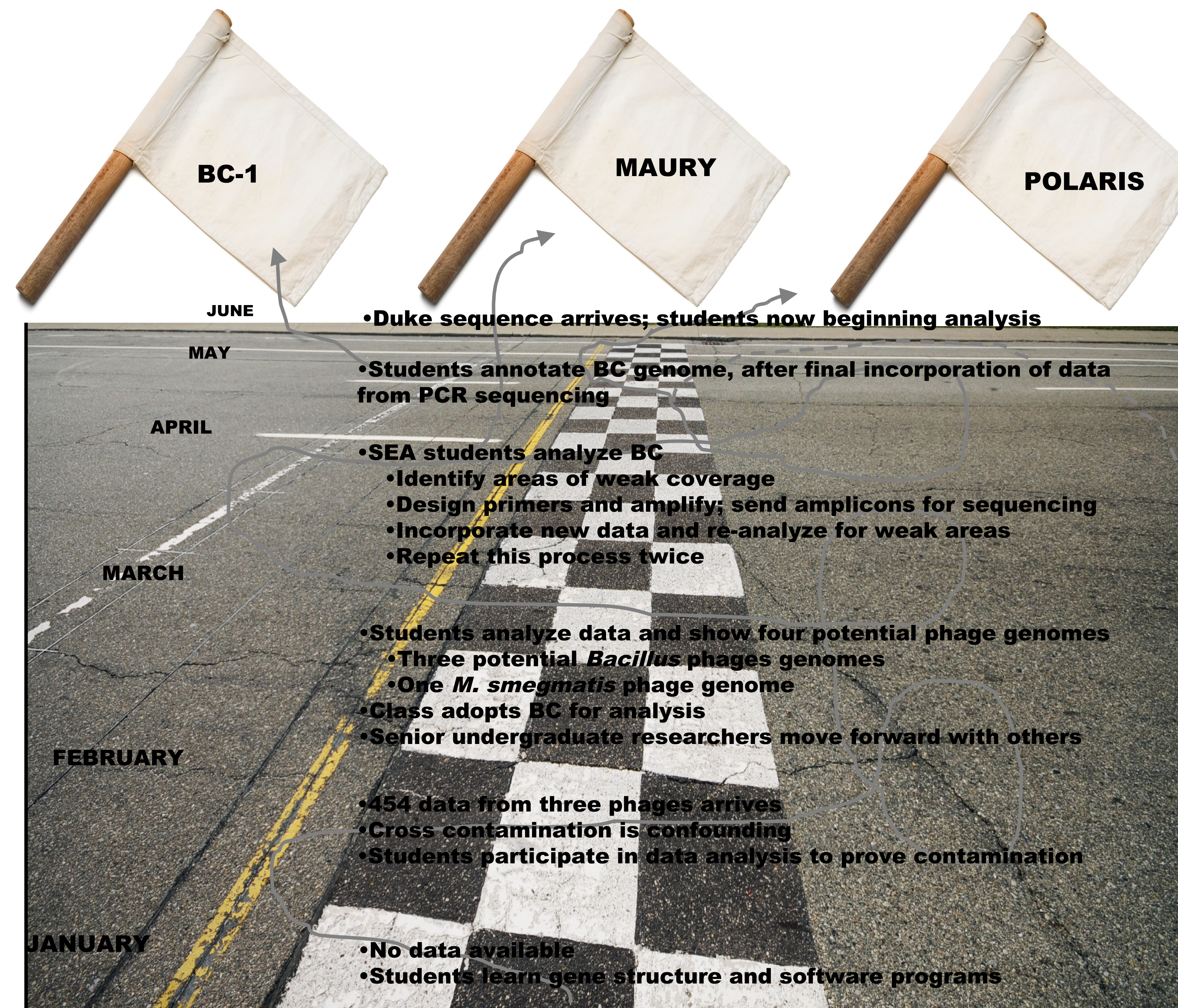
## ABSTRACT

**Background and hypothesis:** Bacteriophage discovery, biology, and genomic analysis have been used successfully in the past by undergraduate educators, including the authors of this submission. Supported by the HHMI-SEA program, we began an effort to increase enrollment and retention in the STEM disciplines, with this course being one of several approaches. The hypothesis being tested is that original, interesting research experiences for entering college students will increase numbers of scientists being trained.

**Methods:** Our students were self-selected from any major, and the course did not substitute for any other in their curriculum. We used was "just-in-time" teaching of phage biology and laboratory procedures. Students were required to manage their own phage and keep a notebook, and they were graded on "participation". Quizzes were given on basic information, and occasionally readings were required. In the bioinformatics semester, students worked in pairs and submitted assignments, for which they were given credit. This grading scheme resulted in a grade of "A" for almost every student, except those with poor attendance or failing to submit assignments.

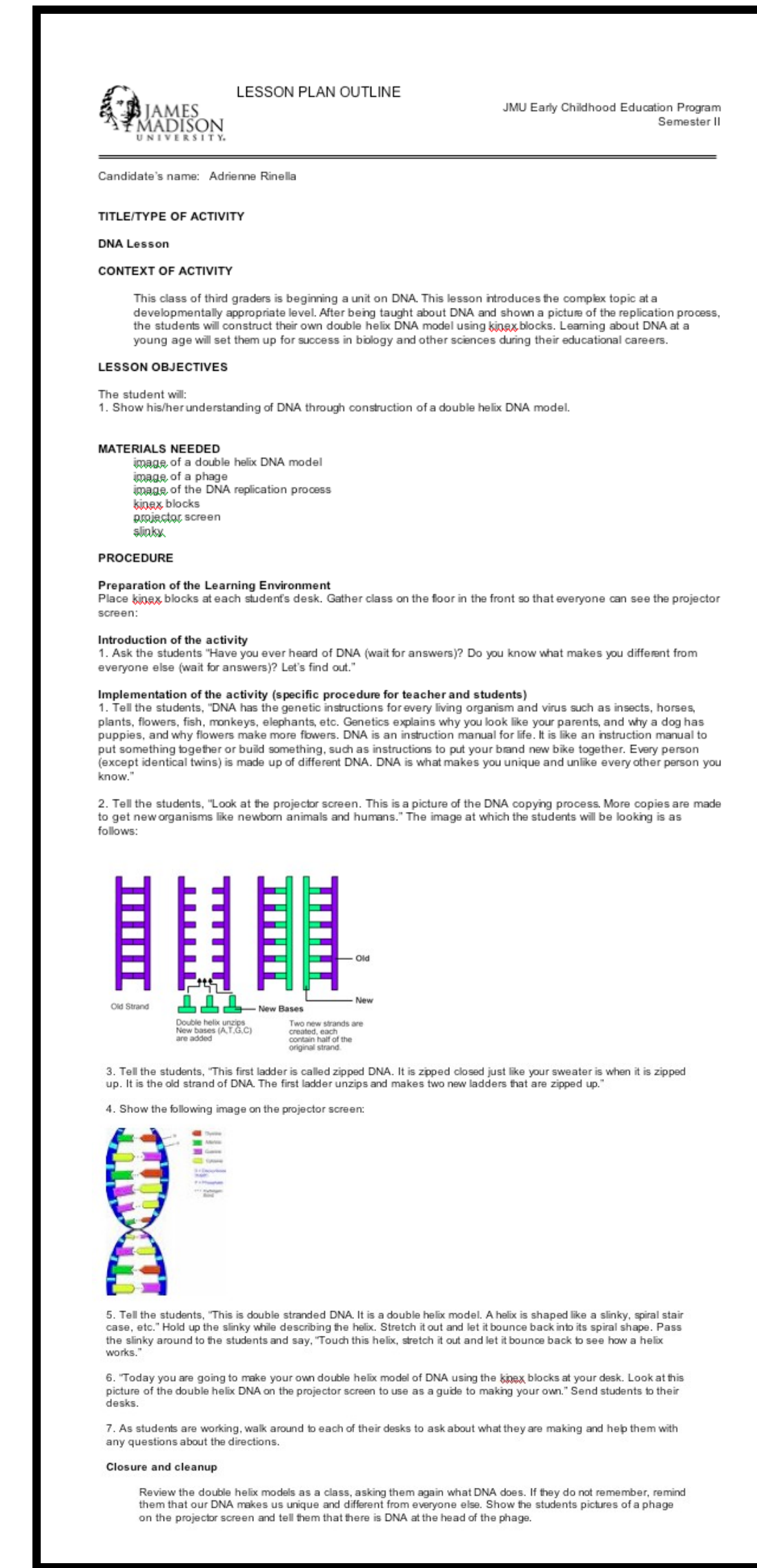
A unique feature of our course was a collaboration with software engineering students. In groups of 4, they were assigned to interact with a real-world problem in software usage. Each of the groups took on a problem related to our work and produced a report about how the problem could be addressed.

**Results and Conclusions:** Our retention rate between semesters one and two was 82%, compared to 53% in a control group of students advancing between two semesters of the traditional biology curriculum. Anecdotal evidence indicates that there was a high level of satisfaction with the course, and the number of students interested in continuing to work during the summer (8/26) is impressive, considering there is no compensation offered. We know of at least 4 more who are continuing in research in the fall.



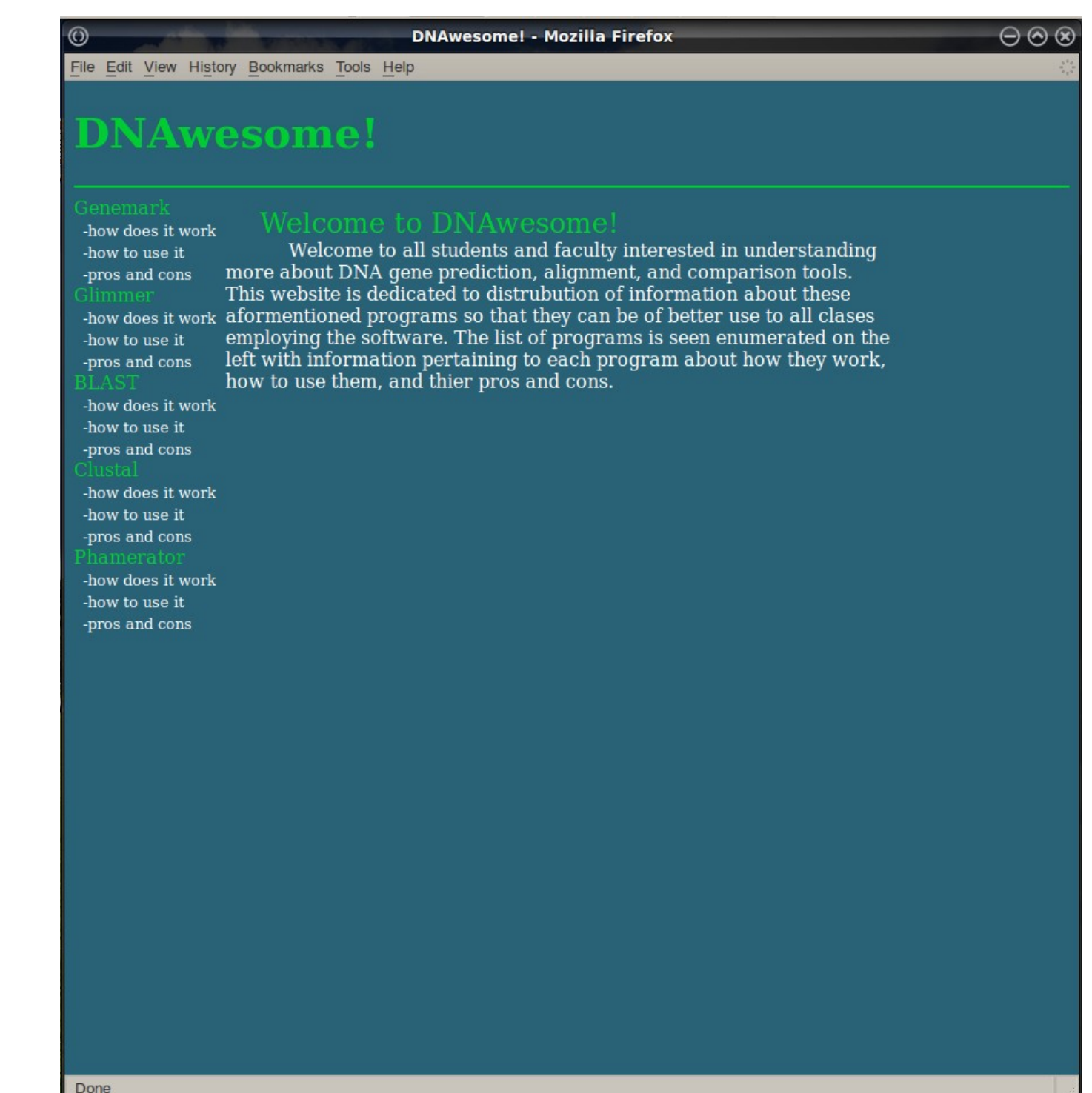
## EDUCATION STUDENT PARTICIPATION

Our K-8 education program requires majors to take a laboratory science course that is designed specifically for them. We worked with education faculty to enroll two students in this course on a trial basis, and we had two students in the fall and one in the spring. The student who complete the entire year prepared a lesson plan on genetics for a third-grade level class as an exercise to think about what concepts could be taught at that level and what sort of activities could be used to teach those concepts. We will continue to enroll a few students, because they observed that the students were enthusiastic about this "experience"-oriented class.



## COMPUTER SCIENCE COLLABORATION

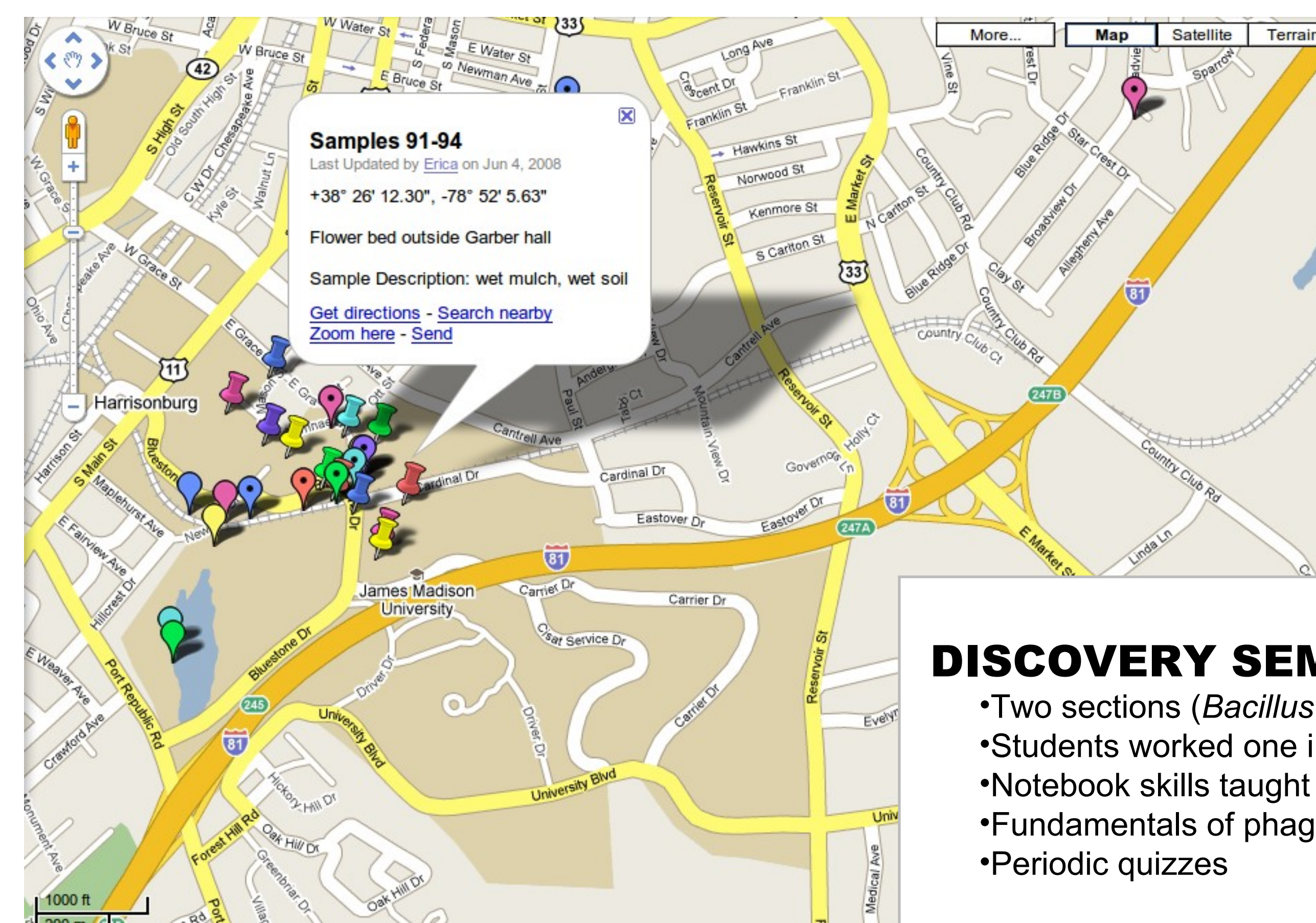
A unique feature of our course was the collaboration with students in a software engineering course taught by a computer science (CS) professor. A portion of that course required groups of 4 students to interact with a real-world problem in software usage. The CS students met with our students periodically throughout the semester and learned the challenges faced in use of multiple analysis packages, such as Sequencher, Consed, and Phamerator. Each of the groups took on a problem and produced a report about how the problem could be addressed. We expect to work with future classes in a similar way, and improvements to software and/or interfaces could result.



## DISCOVERY SEMESTER

- Two sections (*Bacillus* group and *Mycophage* group)
- Students worked one individual samples
- Notebook skills taught
- Fundamentals of phage biology taught
- Periodic quizzes

## BIOINFORMATICS SEMESTER



## STUDENT RECRUITING & SELECTION

### Viral Discovery and Genomics

Want to discover a new virus and sequence its genome? Apply for this unique research experience for freshmen-sophomores in JMU in Fall 2008!

Agar plate of bacteria infected with viruses from soil; spots are location of cells killed by the virus

Map representing genome organization of phage D29

- Open to all majors
- Innovative, hands-on research

•Fall: viral discovery  
•Spring: genome analysis and bioinformatics  
[phage.cisat.jmu.edu](http://phage.cisat.jmu.edu)

Louise Temple [templein@jmu.edu](mailto:templein@jmu.edu)  
Steve Cresawn [cresawsg@jmu.edu](mailto:cresawsg@jmu.edu)

### Viral Discovery and Genomics Course Application

Name \_\_\_\_\_  
Email address \_\_\_\_\_  
Home address \_\_\_\_\_

Please answer these questions candidly. We are looking for students interested in getting involved in research during their very first college year. No particular background in science is required, as we will teach you all that you need to know to understand and perform the work. Students with an interest in computer science are encouraged to apply. Use additional pages if needed. Please mail completed applications by June 15, 2009 to the following address:

1. Why are you interested in this course?
2. What do you think you will gain from participation?
3. Are you interested in teaching elementary, middle, or high school as a career?
4. What science courses have you taken in high school? Comment on what you enjoyed and did not enjoy in these courses.
5. What experiences have you had that are science-related, but not formal courses, that have influenced your interest in science?
6. What lab techniques and experiences have you had?
7. Please add any relevant interests or experiences that have not been mentioned above.