

NGRI Phage Course, Fall Semester, at Washington University in St. Louis: A Phantastic Phirst Experience

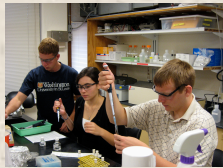


Kathleen A. Weston Hafer, Christopher D. Shaffer, and Sarah C.R. Elgin
Department of Biology, Washington University, St. Louis, MO 63130



What We Did

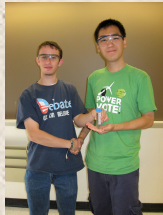
At Washington University (WU), we had 18 students in the fall semester. They were paired by the instructor according to biology background and schedule. Each pair isolated, purified and characterized a putative novel mycobacteriophage by the middle of November.



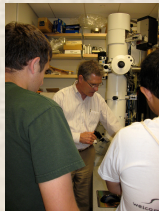
Just learning



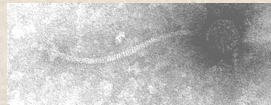
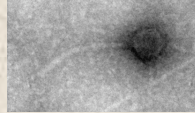
Plaques of BEEST (above)
And J-Gladiator (below)



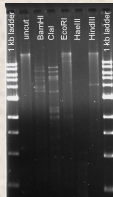
The day we isolated high-titer lysate (known as "the holy grail" at WUSTL)



EM work (left), and results: Buckbeak (above) and Uncle Howie (below)



First time gel loading (left and center), and J-Gladiator gel (right)



When We Did It

Our class met 5 hours a week on Tuesday and Thursday afternoons. During phage purification, students were expected to work briefly on Wednesdays and Fridays.

class	Tuesday (1-4 PM)	Thursday (1-3 PM)	Reading
1		• Intro to neutral experiment (KH) • Intro to "how class works" (KH) • "getting to know you" and surveys	• All the Wrenn's Phage- discussion 9/2/08 • Manual: Capture A1-A6 for 9/2/08 • Manual: Capture 13-14 for 9/4/08
2	• Intro to phage and bacteria growth (KH) • HHMI lab safety video (30') • discuss lab notebooks (KH) • Demo/Lab: aseptic technique (KH) • Lab: learn pipetting/micropipetting		
3		• phage/bacteria growth, continued (KT) • how to collect soil (KH) Note: collection outside of scheduled lab time • Lab: process soil samples	• Sadava pages and Hershey chapter: discussion and RR due 9/9/08 • Enrichment handout for 9/9/08
4	• Discuss/review central dogma, including Hershey/Chase reading (KH) • Lab: process soil samples • Wednesday: Start enrichment		• Manual: Tame A1-A15 for 9/11/08
5		• Lab: Examine plates; proceed (spot test) • Lab: continue enrichment procedure • Wed and Fri purification as needed	• Kornberg article: discussion and reading response due 9/16/08 • Manual: Tame B1-B9 for 9/16/08
6	• Central Dogma and discussion of Kornberg reading (KH and SE) • Lab: purify plaques • Lab: calculate/test phage for web plate • Lab: plate lysate from enrichment		
7		• Lab: purify plaques • Lab: examine/purify plaques from enrichments • Wed and Fri purification as needed	• Maniatis and Fritschy article: discussion and reading response due 9/23/08 • Manual: Dissect C1-C6 for 9/23/08
8	• Lecture: Intro to phage life cycle and reading discussion (PL) • Lab: plate for food/web plates • Wednesday: flood plates		
9		• Lab: Harvest phage lysate • Quiz 1	• Manual: Dissect B1-C8 for 9/30/08
10	• Lecture: Restriction enzymes (KT) • Lab: titer phage lysate		
11		• Catch-up day! • plan digests	
12	• Lecture: Gel electrophoresis (KH) • Lab: purify phage DNA		

13	• Lab: pour gels • Lab: set up DNA digests		• Manual: Dissect D1-D4 for 10/16/08
14	• Lab: run gel electrophoresis • Lab: photograph/analyze gel results • talk with Dr. Baker from HHMI		
15		• Discuss each phage results: compare/contrast size, etc.	• Manual Dissect A1-A3 for 10/21/08 • microscopy reading assignment
16	• Lecture: microscopy (KT) • Lab: run required JGI gel on selected samples		
17		• Prepare for EM • Quiz 2	
18	• Lab: Electron microscopy • OB discussion of reading responses (with Kelsey and Ryan)		
19		• Lab: Electron microscopy • OR discussion of reading responses (with Kelsey and Ryan)	
20	• Lab: share/discuss EM results and phage choice • run gels as needed		
22		• Finalize phage choice • run gels as needed	• Medavilla, et al article: discussion and reading response due 11/13 (Note this article replaces Pedulla, et al)
23	• Celebrate success! • Discuss reports • Intro to in silico big ideas (CS)		
24		• discussion of Medavilla article • reading response due • report work	• Hugenholz and Tyson article and Turbinoglu et. al.: discussion and reading response due 11/18/08
25	• Jeff Gordon talk and paper discussion • intro to BLAST (CS)		
26		• Computer lab: practice with BLAST	
27	• Report work day • individual consultations • Final Presentations • Final Reports due		
28		• Archiving • Surveys	

Acknowledgements: Thanks to our great TA's Kelsey Tinkum, Ryan Lee, Anthony Tubbs and Matt Dothager. Thanks to guest lecturers Petra Levin, Jeffrey Gordon, Douglas Berg, Swaine Chen and Roger Beachy. We could not have done the EM work without the the excellent guidance of R. Howard Berg at the Danforth Plant Science Center. Thanks to the SEA staff, and to Deborah Jacobs-Sera for excellent M. smeg hints.

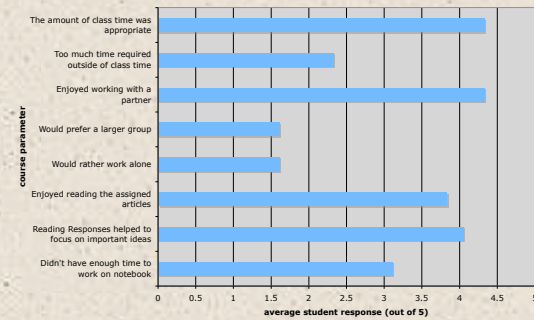
How it Worked

Students were surveyed at the end of the semester.

Selected Student Survey Comments:

- I think the time commitment for the class was great. It was enough to make sure people were dedicated, but not too much to turn us away from research.
- I thought the time commitments were very reasonable, and the way partners were paired based on their schedules worked out really well.
- I liked having a partner, and the fact that we didn't pick our own. Coming in as a freshman, I didn't know anyone in the class.
- I like having partners as we can discuss problems and share ideas.
- I really like how the readings all coalesced by the end of the semester to give us a broad background of the importance of phages and how our work in the lab fits into the broader picture.
- This was a terrific class! The only thing I regret is not getting to do more experiments like observing plaque morphology over time, testing temperate phages, calculating burst size, or trying to find the phage receptor
- I have very much enjoyed this semester and am eager for the next...I'm sure it will be a "BLAST". Sorry for the pun.

Student Satisfaction with Fall Semester NGRI Phage Course at Washington University



Lessons Learned:

- Pairing partners by schedule worked well. With one exception the groups worked well together, and contributed equally to the work.
- We need to take better quality plaque photos, and be more organized in storing and sharing photos.
- Working more than two days a week is necessary to get DNA ready for the JGI deadline.
- The DNA isolation protocol needs to be improved. We felt we lost a lot of yield.
- Students need more in-class time to work on notebooks, or notebooks need to be allowed out of the lab.
- We need to give better instructions for what is expected on writing assignments.
- Always have a back-up M. smeg culture ready!
- This class was a great experience for students, TA's and instructors. The more help the better!