

## Figure S1. SEA-CURE post-Survey

Welcome (or Welcome back) to the SEA-CURE survey site. This project is a collaborative effort involving students and faculty from colleges and universities across the country. This project is expected to impact students, faculty, and undergraduate institutions participating in the Science Education Alliance (SEA). As a collaborative network of investigators, we are learning more about the success of our science courses in empowering student learning. To accomplish this task, we have developed a pre-course and post-course research design to measure the learning gains and other outcomes of courses that includes our national genomics initiative, the NGRI. This research is funded by the Howard Hughes Medical Institute. It has been approved by the institutional review board at your undergraduate institution.

At the beginning of the NGRI course, your instructor asked you to fill out the SEA-CURE pre-course survey about your general attitudes towards science. Now, we are asking you to fill out the post-course survey. If you didn't complete the pre-course survey, you can still participate in the post-course survey. Because of the complexity of tracking the data from many courses at many institutions, we ask you to provide a personal identification code, identify your college or university, and identify your course. [Please make sure to use the same identification code you used in the pre-course survey]. The reason for the identification code is to enable us to match your pre-course responses with a post-course evaluation you are about to complete. This alignment of your pre-course responses with your post-course responses permits a sensitive measure of change. Your individual data will not be revealed to your course instructor. The lead analyst for the project, Prof. David Lopatto of Grinnell College, will keep all individual data confidential. Only aggregate pre-course-post-course data will be reported back to your institution and to the SEA as a whole. Your individual responses will not be reported or used by instructors to determine your grade in the course.

As with any research, you are not compelled to participate. You may elect to not answer individual questions. A "not applicable" or "N.A." option is available for the questions as an alternative. Consequently, use this if the question is irrelevant or if you choose not to answer. If you change your mind about completing the survey, just leave the site. It is assumed that the submission of a completed survey is your consent for participation. If you have any questions or comments regarding the survey, please send an email to Prof. Lopatto (lopatto@grinnell.edu). All such communications will be considered confidential.

In a final box, we offer you an opportunity to be entered into a raffle for a \$50 gift certificate from Amazon.com, as a "thank you" for your participation. Proceed to the survey

### Part I: General information about you and your institution.

1. Please provide your personal identification number to assist us with tracking. Or, if you prefer not to answer, leave blank. [Please use the same identification number you used you in your pre-course survey].

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3. My institution's name:

4. I am classified as a  
Freshman

Sophomore

Junior

Senior

Other

6. Please provide us with a sense of your level of engagement in each of the following science-related activities.

	Often	Sometimes	Rarely	Never	N/A or I prefer not to answer
I participate in the activities of a science-focused campus club.					
I participate in science-focused outreach activities.					
I subscribe to a science-focused magazine or journal.					
I read science-focused articles outside of class.					
I attend science-focused seminars as part of my courses.					
I attend science-focused seminars beyond what's required for my courses.					
I have actively participated in an online community focused on some aspect of science.					
I tutored students in science and/or math courses while I was in high school.					
I tutor other college students in science and/or math courses.					
I have assisted a college professor in a science or math course.					

7. Have you declared a major or concentration yet?

Yes

No

8. If you have declared a major or concentration, please write it here (include double majors, concentrations, etc.)

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9. If you have not declared a major or concentration, once again indicate if you are considering a major/concentration in the sciences.

Definitely yes

It is likely

I am not sure

It is unlikely

Definitely not

I prefer not to answer

10. This question is about your goals beyond your undergraduate degree. It is difficult to list all the goals people may have. The purpose of this question is to learn how many students plan to on in science, medicine, or other fields, as well as to learn how many students do not plan to go to post-graduate education in their near future. Please choose one.

My goal is to go to graduate school for a Ph.D. degree in a biology-related field.

My goal is to go to graduate school for a Ph.D. degree in the physical sciences (including engineering, math, and computer science).

My goal is to go to graduate school for a Masters Degree in the life sciences.

My goal is to go to graduate school for a Masters Degree in the physical sciences (including engineering, math, and computer science).

My goal is to go to graduate school for a Masters or a Ph.D. degree in a social science (including psychology, sociology, anthropology, economics, and political science)

My goal is to go to graduate school for a Masters or a Ph.D. in humanities or fine arts.

My goal is to earn a certification or degree that will qualify me for teaching

My goal is to go to school for a medical degree (M.D.)

My goal is to go to school for an M.D./Ph.D.

My goal is to go to school for other health professions.

My goal is to go to a type of graduate education not mentioned above, such as law school.

My goal does not include graduate education for at least the near future.

Not applicable/Prefer not to answer.

**Part II: Elements**

11. Please look over this inventory of elements that might have been included in a course. For each element, give an estimate of your current level of ability after having completed the course. Please use this scale: mark a "1" if you have no experience or you feel inexperienced, mark a "2" if you have some experience, or mark a "3" if you have much experience or feel you have mastered this element. If students are expected to do the following course elements, I have \_\_\_\_\_.

	1-no experience or feel inexperienced	2-some experience	3-much experience or mastered this element	Not applicable
a scripted lab or project in which the students know the expected outcome				
a lab or project in which only the instructor knows the outcome				
a lab or project where no one knows the outcome				
at least one project that is assigned and structured by the instructor				
a project in which students have some input into the research process and/or what is being studied				
a project entirely of student design				
work individually				
work as a whole class				
work in small groups				
become responsible for a part of the project				
read primary scientific literature				
write a research proposal				
collect data				
analyze data				
present results orally				

present results in written papers or reports				
present posters				
critique the work of others students				
listen to lectures				
read a textbook				
work on problem sets				
take tests in class				
discuss reading materials in class				
maintain lab notebook				
computer modeling				

12. In which of the following experiences of research, activities, or endeavors do you plan to engage?

	Definitely	Very likely	Probably / Maybe	Doubtful	No way	N/A
I plan to participate in scientific research this summer at my college or university.						
I plan to make a scientific poster presentation at a conference or meeting this year.						
I plan to make an oral presentation on data I've generated in my research at a scientific conference or meeting this year.						
I plan to apply / have applied to summer research programs this year.						
I plan to apply for a science- or mathematics- focused scholarship or fellowship as an undergraduate.						
I plan to apply / have applied to summer research programs this year.						
I plan to apply for a science- or mathematics- focused scholarship or						

fellowship as an undergraduate.						
I plan to pursue a career in a STEM-related field.						
I plan to pursue a career that has a laboratory research component.						

**Part III: Benefits**

13. Below are some possible gains you may have made as a result of taking this course. The scale measuring your gain is from 1 (no or very small gain) to 5 (very large gain). Select the number that reflects your experience in this course. If the item is not relevant or your prefer not to answer, please chose the "N/A" option.

	1- no gain or very small gain	2- small gain	3- moderate gain	4- large gain	5 – very large gain	6 – N/A
Understanding of the research process in this field						
Understanding how knowledge is constructed in the field						
Readiness for more demanding research						
Tolerance for obstacles faced in the research process						
Skill in interpretation of results						
Clarification of my career path						
Ability to integrate theory and practice						
Understanding how scientists work on real problems						
Understanding that scientific assertions require supporting evidence						
Ability to analyze data and other information						
Ability to read and understand primary literature						

Understanding science						
Learning ethical conduct in this field						
Learning laboratory skills						
Learning computer skills						
Skill in how to give an effective oral presentation						
Skill in reasoning from data						
Self-confidence in discussing science with peers						
Self-confidence in discussing science with mentors/instructors						
Skill in scientific writing						
Understanding how scientists think						
Learning to work independently						
Learning to work as part of a team						
Becoming part of a learning community						
Interest in taking other courses in this area						
Interest in taking additional courses in math and computer science						
Confidence in my potential to be a teacher of science						

14. Below is a list of specific teaching tools or activities that may have been part of your course. Please rate each component, indicating to what degree this component contributed to your learning experience in the course (1 – very little learning; 5 – very beneficial to learning). If that component was not used in your course, check N/A.

	1- very little learning	2	3	4	5 – very beneficial to learning	N/A
Growing bacteria						
Identifying plaques						

Titering phage						
Purifying phage						
Purifying genomic DNA						
Restricting DNA						
Electrophoresing DNA						
Staining phage for microscopy						
Defending my ideas						
Preparing your written report about your phage's characteristics						
Preparing your oral report about your phage's characteristics						
Whole genome shotgun sequencing of DNA						
Annotating my segment of the genome						
Annotating the entire phage genome						
Analyzing genes						
Determining the end of the phage chromosome						
Preparing your written report about your class' phage annotation						
Preparing your oral report about your class' phage annotation						
Defending my conclusions						

**Part IV. Overall Evaluation**

15. For each item below please rate your own agreement with the item (5-point scale: strongly agree, agree, neutral, strongly disagree N/A).

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	N/A
This course was a good way of learning						



about a variety of subject matters.						
This course was a good way of learning about the process of scientific research.						
This course had a positive effect on my interest in science.						
I was able to ask questions in this class and get helpful responses.						
I would take another research-oriented lab course if given the opportunity						
Phage biology is awesome! I love the power of micro organisms!						
Genomics is awesome! I love the power of databases!						
Taking this course helped me to become a more active learner.						
Taking this course has helped me to learn to think independently.						
Taking this course has increased my motivation to learn.						
I would recommend this course to a friend.						
This course gave me a wholly new perspective on what it means to be a scientist.						
Taking this course was not very beneficial for me.						

**Part V. Your Opinions about Science**

16. In the pre-test you responded to questions about science. We are posing the questions again. Your answers will help us decide between two hypotheses: that such opinions are constant over time or that opinions change as a result of experience. For each of the following items, please rate your agreement with the item (response choices: strongly agree, agree, neutral, disagree, strongly disagree, N/A).

	Strongly	Agree	Neutral	Disagree	Strongly	N/A
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	agree				disagree	
Even if I forget the facts, I'll still be able to use the thinking skills I learn in science.						
You can rely on scientific results to be true and correct.						
The process of writing in science is helpful for understanding scientific ideas.						
When scientific results conflict with my personal experience, I follow my experience in making choices.						
Students who do not major/concentrate in science should not have to take science courses.						
I wish science instructors would just tell us what we need to know so we can learn it.						
Creativity does not play a role in science.						
Science is not connected to non-science fields such as history, literature, economics, or art.						
When experts disagree on a science question, it's because they don't know all the facts yet.						
I get personal satisfaction when I solve a scientific problem by figuring it out myself.						
Since nothing in science is known for certain, all theories are equally valid.						
Science is essentially an accumulation of facts, rules, and formulas.						
I can do well in science courses.						
Real scientists don't follow the scientific method in a straight line.						

There is too much emphasis in science classes on figuring things out for yourself.						
Only scientific experts are qualified to make judgments on scientific issues.						
Scientists know what the results of their experiments will be before they start.						
Explaining science ideas to others has helped me understand the ideas better.						
The main job of the instructor is to structure the work so that we can learn it ourselves.						
Scientists play with statistics to support their own ideas.						
Lab experiments are used to confirm information studied in science class.						
If an experiment shows that something doesn't work, the experiment was a failure.						

17. Please comment on how this laboratory course rates against the others you have taken. How good was the integration of teaching and research? What were the strengths and weaknesses? What was of special value to you? Should this effort be continued?

Thank you!