

Active Learning Pedagogies to Design a New Advanced Genetics Course: Using students' feedback to create a tailored STEM class for SSU

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ABSTRACT

The STEM field is constantly evolving where graduate schools, medical schools, and the science job market are becoming more competitive. It is important for the students of Salem State University (SSU) that their curriculum is consistently being adapted to fit these new needs. A large percentage of the SSU biology community aims to enter the medical field, biotechnology field, or go on to pursue post graduate education. These are paths that require students to have an advanced level of knowledge pertaining to genetics and this is an area Salem State is starting to fall behind in compared to options offered at various local universities. We currently only offer two introductory genetics courses, this requires students to learn everything they will need to know about genetics for their future careers in one semester. If we were to offer an advance genetics course students would graduate with advance knowledge in this field and have a better chance getting into post graduate schools or landing job opportunities. Using the feedback of students in the SSU science community we have found a way to both fill this new need and satisfy their interest and concerns via a new Advanced Genetics of Disease course.

OBJECTIVES

- To create a new advanced Genetics course tailored to the needs of our SSU STEM students
- To determine current professional fields of SSU science Alumni and find out what fields our current SSU Biology students intend to enter post graduation
- To research what other universities are offering as Genetics courses and what genetic tools the job market and graduate/medical schools are requiring now

MATERIALS AND METHODS

- Researched biology curriculum from ten competitive schools focusing on course catalog for Genetics courses
- Conducted an optional survey to various Biology introductory classes which included their career plans
- Analyzed information on LinkedIn stats to see what fields SSU Alumni entered after receiving a Bachelor of Science from SSU

RESULTS

Table 1. Genetics Courses Offered at Other Local Universities. This table is a comparison of current genetics courses offered at SSU and the genetics courses offered at other local Universities throughout Massachusetts.

University	Intro / general genetics	Lab	Genomics	Cancer Genetics	Extra Elective Genetics
Salem State	✓	X	X	X	None
Umass Amherst	✓	✓	✓	✓	5+ courses
Umass Lowell	✓	✓	✓	✓	2+ courses
Boston University	✓	✓	✓	✓	5+ courses
Gordon College	✓	✓	X	✓	2+ courses
Boston College	✓	✓	✓	✓	4+ courses
Framingham	✓	✓	X	✓	1+ course
Brandeis	✓	✓	✓	✓	6+ courses
Merrimack	✓	✓	X	✓	2+ courses
Suffolk	✓	✓	✓	✓	None
Endicott	✓	✓	X	X	None

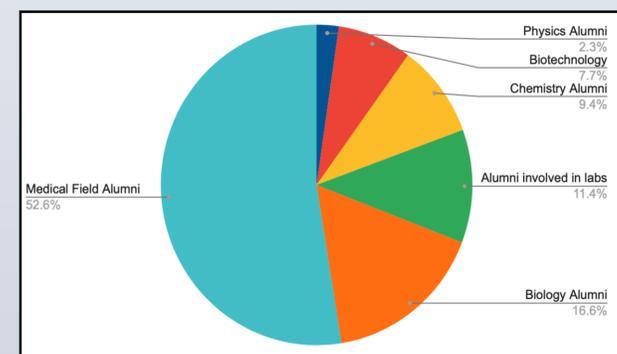


Figure 1. SSU Science Alumni Fields of Interest. This chart shows what fields SSU STEM Alumni members are part of or currently looking for a job in. This data was collected from the University's 14,783 science alumni registered on LinkedIn

- SSU has significantly less genetics courses to offer compared to other local universities (Table 1), despite having a very large amount of students who enter, or plan to enter, the medical field, biology research, or other biotechnology careers (Fig 1 and 2).
- From the students we surveyed (from different courses ranging from intro biology to anatomy) it was clear the majority of students were most interested in taking a course relating to the genetics of disease (Fig 3).

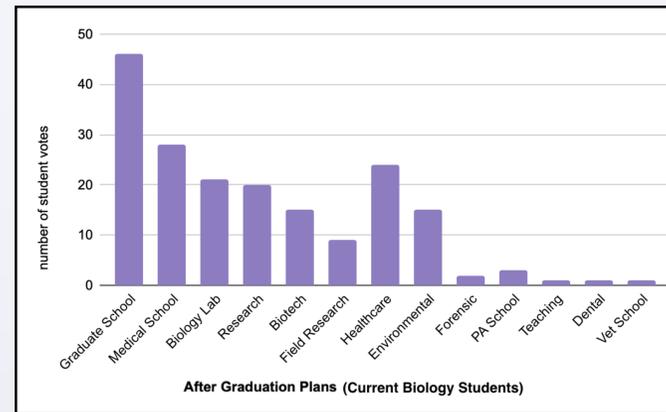


Figure 2. Fields Current SSU Students Intend to Enter. Out of all the Biology classes surveyed this is how many current SSU students said they would be going into each field

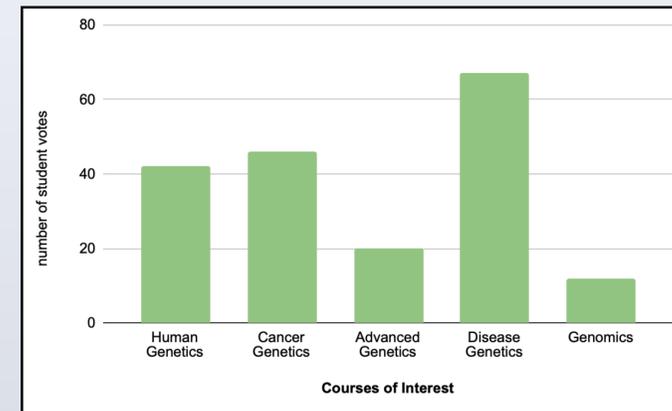


Figure 3. Genetics Courses Current SSU Students are Interested in Taking. This figure is showing what genetics courses current students said they would be most interested in taking.

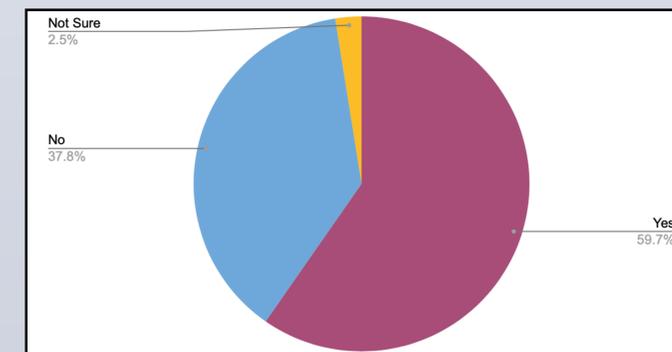


Figure 4. Should Advanced Genetics Have a Lab? Representation of how many students felt an advanced genetics course should or should not have a lab.

- The majority of students (59.7%) want an advanced genetics course to have a lab (Fig 4). In the survey "additional comments" section students expressed the interest in having a genetics lab to further solidify learning.

CONCLUSION

- The results showed Salem State was significantly behind other schools in terms of genetic course options. The results also showed this needs to be changed due to the large amount of SSU students that plan on going to graduate school, medical school, or into the health field.
- All of these fields require students to enter them with a solid grasp of the concepts learned from multiple genetics courses and the fields are only getting more and more competitive.
- The best way to fill this need and give SSU students an advantage based on student opinion / interest is via a course that focuses on Genetic Disease.
- Students request for a laboratory shows the interest in learning hands on new genetic techniques.
- A course discussing genetic disease will reinforce learning on important core biology topics whilst also offering students a new more complex grasp on human genetics, another upper level biology elective when applying to higher education, and another option when trying to fill degree requirements.

REFERENCES

- "Biological Sciences Course Listing: Biological Sciences: Catalog." *Biological Sciences | Catalog | UMass Lowell*, www.uml.edu/catalog/undergraduate/sciences/departments/biology/course-listing.aspx.
- "Biology and Biotechnology Major (Bachelor of Science)." *Program: Biology and Biotechnology Major (Bachelor of Science) - Endicott College - Acalog ACMS™*, catalog.endicott.edu/preview_program.php?catoid=14&poiid=566&returnto=373.
- "Biology Courses." *Academics RSS*, www.bu.edu/academics/cas/courses/biology/.
- "Biology Courses." *Biology Courses - University Catalog - Boston College*, www.bc.edu/bc-web/academics/sites/university-catalog/courses/arts-sciences/biology.html.
- "Biology Department University of Massachusetts Amherst." *UMass Amherst: Biology Department: Biology Courses*, www.bio.umass.edu/biology/undergraduate/biology-courses/course-catalog.
- "Biological Sciences Course Listing: Biological Sciences: Catalog." *Biological Sciences | Catalog | UMass Lowell*, www.uml.edu/catalog/undergraduate/sciences/departments/biology/course-listing.aspx.
- "Biology Major." *Framingham State University*, www.framingham.edu/academics/colleges/science-technology-engineering-and-mathematics/biology/programs/majors/biology-major.
- "Biology, B.S." *Program: Biology, B.S. - Merrimack College - Acalog ACMS™*, catalog.merrimack.edu/preview_program.php?catoid=2&poiid=145.
- "College of Arts & Sciences Courses." *Suffolk University Boston*, www.suffolk.edu/academics/academic-catalogs/undergraduate-a-z-course-lists/a-z-cas-undergraduate-course-list.
- "Department of Biology." *Biology | Subject Area Listings | Provisional University Bulletin (2020-2021) | Brandeis University*, www.brandeis.edu/registrar/bulletin/provisional/courses/subjects/700.html.
- "Professional Biology Courses." *Professional Biology Courses and Requirements - Gordon College*, www.gordon.edu/professionalstudies/courses.

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