Bridging Research and Education with Model ORganisms (BREWMOR)

2023 bigBREW

Integrating Primary Literature into the Classroom

A Virtual Workshop hosted by BREWMOR and GSA

July 26, 2023, Wednesday; 2:00 pm – 5:15 pm US EST

July 28, 2023, Friday; 12:00 pm – 2:00 pm US EST
(Optional Workshop component)

SCHEDULE – DAY 1

1:45 – 2:00 pm, *Eastern* — **CONFERENCE LOGIN**

2:05 – 2:10 pm — **WELCOME AND INTRODUCTIONS**

2:10 – 2:50 pm — **INTRODUCTION OF COMMUNITY TALK SPEAKERS**

PRESENTATION (30 minutes)
Science Podcast Annotation as a Collaborative Learning Experience and Tool to Build OER
Rebecca Seipelt-Thiemann, Professor of Biology, Middle Tennessee State University

Q & A

- Moderator: BREWMOR Steering Committee Member

2:55 – 3:00 pm — **BREAK**

3:00 pm – 4:30 pm — **SESSION (15-minute talks + 5 minutes Q & A)**

INTRODUCTION OF SPEAKERS

- BREWMOR Steering Committee Member

3:00 pm – 3:20 pm; Using The Case It Molecular Biology Laboratory Simulation Software Package To Actively Analyze Primary Literature By Replicating Published Experiments In Silico. Ken Saville (Albion College, Albion, Mi.) and Mark Bergland (University of Wisconsin, River Falls, Wi.)

3:20 pm – 3:40 pm; Diversity of Discovery: Using primary literature to learn about discoveries made by scientists from underrepresented and minoritized backgrounds. Josephine Mitchell, Assistant Professor, Department of Chemistry and Biochemistry, Kalamazoo College

3:40 pm – 4:00 pm; How to Run a Journal Club with More than 100 Students. Mitch McVey, Professor of Biology, Tufts University, and Jessica Silva-Fisher, Assistant Professor, Washington University School of Medicine

4:00 pm – 4:20 pm; An active approach to primary literature and the scientific process in undergraduate classes. Traci Stevens, Professor of Biology, Randolph-Macon College

4:20 pm – 4:40 pm; Breaking down the complexity of primary literature with participation from *all* students. Yee Mon Thu, Assistant Professor, Colby College

4:40 pm – 4:45 pm **Group Share and Closing**

Networking and Discussion

- With speakers in breakout rooms

4:45 pm – 5:15 pm **REFLECTIONS**

SCHEDULE – DAY 2 Workshop

July 28, 2023

12:00 pm - 12:10 pm **Welcome to bigBREW – Workshop Day 2**

Summary from Day 1

12:10 pm -1:30 pm **BREAKOUT GROUPS**

Moderator: BREWMOR Steering Committee Member

1:30 pm – 2:00 pm

CLOSING THOUGHTS AND NETWORKING

BREWMOR Steering Committee 2022-2023

The mission of BREWMOR is to build a network of teaching and research faculty dedicated to increasing experiential learning for biology students, primarily at the undergraduate level.

Visit the website for more information: https://brewmor.org/

Abstracts of Selected Presentations

July 26, 2023, Wednesday

Science Podcast Annotation as a Collaborative Learning Experience and Tool to Build OER

Rebecca Seipelt-Thiemann, Professor of Biology, Middle Tennessee State University

The ability to understand science and think in a critical way is important to modern citizens. However, students struggle with learning how to read and write about science. Students also leave science because they feel unconnected and uninspired by traditional teaching methods. On the other hand, teachers struggle to find teaching resources that are effective, innovative, and reliable. The extreme academic and social disruption caused by COVID-19 in the spring and summer of 2020 led to the loss of many student internships and directly led to the development of this science literacy project which has two components. First, student teams engaged in collaborative science podcast annotation (This Week in Microbiology, TWiM) while learning primary literature concepts. Students also mapped concepts to the American Society for Microbiology learning guidelines and chose figures from the primary literature articles that were the focus of the podcast. Second, faculty mentors reviewed and revised the annotation and added short figure-based exercises. Following the experience, students reported more confidence in data interpretation, better communication skills, and an increase in the ability to collaborate with others. Thus, these teams not only had improved science literacy skills, but also created accessible and free primary literature -based learning materials. These materials are currently being organized into an Open Education Resource Pressbook with accessible, inclusive, and complete activities for teachers to use. In addition to TWiM, many other professional, primary literature-based podcasts are being produced and are candidates for annotation. Our team is currently continuing this project and would like to invite faculty to join our group to learn to build their own annotation teams, generate OER for primary literature-based science podcasts, and investigate the impact of these trainings and materials on student science literacy, identity, and motivation.

How to Run a Journal Club with More than 100 Students

Mitch McVey, Professor of Biology, Tufts University
Jessica Silva-Fisher, Assistant Professor, Washington University School of Medicine

Journal clubs are a time-honored tradition in scientific laboratories, providing opportunities to discuss and analyze research papers. Conducting journal clubs in small, discussion-based classes is straightforward. But what do you do when you want to include primary literature discussion in a lecture class of more than 100 students? Here, we describe an adaptation of the journal club format to a mixed-level (undergraduate and graduate student) molecular biology course that enrolls 120 students.

Each semester, the students read three papers that are carefully selected to augment the course curriculum. Prior to each journal club, they engage in asynchronous discussions using an online annotation platform called Persuall, working in groups of ~10 students to pose questions and answer their colleagues' inquiries. Subsequently, they participate in a 75-minute, in-person journal club, during which they work in small groups to analyze assigned figures and present them to the class. We employ numerous strategies to maximize student participation and promote inclusivity during the in-person discussions. These include assigning roles to each group member, randomly choosing presenters from each group, and providing ample time for presenters to prepare, with real-time check-ins from the instructors.

For the third journal club, students work in groups to prepare posters describing 'what next' experiments that could be used to extend the research. The final class meeting is a Zoom conversation with the authors of the paper, who describe future research plans, answer questions about their scientific careers, and interact directly with students. We have found that these conversations help students to engage more fully in the scientific process and encourage them to self-identify as scientists themselves, while providing networking opportunities with scientists from diverse backgrounds.

Diversity of Discovery: Using primary literature to learn about discoveries made by scientists from underrepresented and minoritized backgrounds.

Josephine Mitchell, Assistant Professor, Department of Chemistry and Biochemistry, Kalamazoo College

A major contributor to persistence of students from minoritized backgrounds in STEM fields is their sense of belonging and identity within the scientific community (Estrada, et al. 2011). One strategy aimed at increasing students' likelihood to identify as scientists and pursue careers in the STEM workforce is to see and experience other scientists with similar identities. To work towards accomplishing this goal, I used primary literature published by scientists from underrepresented and minoritized (URM) backgrounds in STEM in a journal club-style seminar for undergraduate students. Senior biochemistry majors participated in a capstone laboratory course that included a weekly seminar. Before and during each seminar, students read and critically analyzed primary literature written by scientists from URM backgrounds. Each week, one student would present the paper that the group read and we would discuss the authors, the major findings, and the broad contributions to the field. In presenting the work of the scientists, an emphasis was put on delving deeper into the life of the scientist and researching their career trajectory and life. Primary literature was chosen based on the broad topic of representation in science and included female and male researchers in both modern and historical contexts. Students could choose from a list of articles that were pre-selected. In future iterations of the course, I would like to help students choose their own papers and guide them in learning how to find these references. Learning objectives for the seminar included learning how to communicate scientific findings, critically analyze primary literature, and value the contributions of scientists from URM backgrounds. Students reported feeling confident in recognizing the contributions made by scientists from URM backgrounds and one student mentioned that, "The focus on the scientist themselves added relevancy and context to the discovery which pushed me to learn more about the research." Overall, this broad topic of highlighting discoveries made by diverse scientists was an effective way to integrate primary literature into a senior biochemistry capstone lab course.

Breaking down the complexity of primary literature with participation from *all* students.

Yee Mon Thu, Assistant Professor, Colby College

Constructing meaningful and engaging primary literature discussion experience for almost all students in a classroom is a challenging task. Even in an advanced level class, students come in with varying levels of preparation in skills and knowledge required to tackle a primary research article. To make it equitable and engaging for most students, I use multiple strategies to break down complexity of the paper and associated figures. First, one class period before the paper discussion, students engage in a small group discussion to interpret hypothetical data. These data summarize a few main concepts I want students to take away from the paper that we will read. Second, students are provided with a general guideline on how to analyze a figure as well as a short video (~10mins) that I recorded to provide the context and big picture ideas of the paper. Third, students submit their answers for the guiding questions specifically written for the paper. These questions help students to be selective about which aspects to focus on. Students are encouraged to work with peers to answer these guiding questions and they get full credits as long as they demonstrate honest efforts. Finally, on the day of paper discussion, students engage in small group discussion. Each group of 3-4 students is responsible for a figure. I use the "jigsaw" approach in which students explain their understanding from small group discussion to another student. These approaches are well received. As a teacher, the most rewarding experience for me is to witness students, who started out with varying levels of preparation, asking insightful questions and being able to propose experiments to test a hypothesis.

An active approach to primary literature and the scientific process in undergraduate classes

Traci Stevens, Professor of Biology, Randolph-Macon College

Teaching students how and why science is done is one of the biggest challenges in undergraduate education. Therefore, I designed an in-class, student-centered activity, using the primary literature, to immerse students in the scientific process. This approach emphasizes scientific thinking and experimental design, rather than the reading of the text of the paper, which often is written at an expert level and contains discipline-specific jargon, both of which impede the ability of undergraduate readers to understand primary literature. Therefore, instead of assigning a research paper as pre-class reading, the first step of this approach is to assign background readings that are at the appropriate level to be read before class. More details on the background relevant to the research paper are then introduced in class, along with the overall objective of the research paper. Then, still without having read the scientific paper, students develop a plan to address the research objective, first working in small groups, followed by whole class discussion. Expectations for the proposed research plan can be adapted, depending on the experience level and prior knowledge of the class, and can include research questions to be addressed, the experiments and controls to be done, and/or expected results. An overall research plan is then constructed during a whole class discussion, after which data from the research paper are revealed, one figure/experiment at a time. Students interpret the data, without the aid of the authors' interpretation found within the text or figure legends from the paper, which allows the instructor to identify and address misconceptions and gaps in knowledge. Lastly, to assess individual understanding, students write an abstract based on their analyses of the data and interpretation, including big picture conclusions. In my experience, this

Using The Case It Molecular Biology Laboratory Simulation Software Package To Actively Analyze Primary Literature By Replicating Published Experiments In Silico.

Ken Saville (Albion College, Albion, Mi.) and Mark Bergland (University of Wisconsin, River Falls, Wi.)

Case It (caseitproject.org) is a free, downloadable software package which can be used to carry out simulated molecular biology experiments, developed with support from the National Science Foundation. Case it can be used to perform a variety of common laboratory procedures on any DNA or protein sequence. Techniques include: restriction enzyme digestion, PCR, gel electrophoresis, Southern, Western and dot blotting, as well as qPCR experiments, SNP analysis and DNA and expression microarrays. The above techniques can be applied to case-based scenarios using DNA and protein sequences included with the download package. Case it has also been used to recapitulate experiments underlying two groundbreaking discoveries. The first set of experiments is the Nobel prize winning work describing the development of the CRISPR / cas9 system as a programmable RNA-guided DNA endonuclease (Jinek et al, 2012), along with the first successful use of CRISPR / cas9 in the in vivo treatment of a genetic condition (Gillmore, 2021). The second set of experiments replicates flow cytometry and cytokine ELISA results based on Kariko et al. (2005), the publication that set the stage for development of COVID vaccines from Moderna and Pfizer. In addition to simulated wet lab experiments, Case it integrates sequence search capabilities, useful for introducing undergraduate students to basic bioinformatics analyses. We have used Case It in a seminar-style course in which students actively simulate the performance and analysis of real experiments, then present the scientific background, experimental results, and discussion of the scientific significance to the class. This approach seems to closely mimic the scientific process and is an excellent method for integrating primary literature into undergraduate coursework, going beyond traditional reading and discussing primary literature, to actively replicating the critical experiments involved.

Thank you for attending BigBREW!

The Steering Committee is interested in your feedback. We will provide a link for a survey during the workshop. Your feedback is important for future programming!