JMBE Journal of Microbiology & Biology Education

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Journal of Microbiology & Biology Education Curriculum Section Author Guidelines

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JMBE Author Guidelines

FOCUS AND SCOPE

The *Journal of Microbiology & Biology Education* (*JMBE*) publishes original, previously unpublished, peer-reviewed articles that foster scholarly teaching, and provide readily adoptable resources in biology education. *JMBE* welcomes thoughtful and supported submissions pertaining to scholarly teaching in undergraduate, graduate and professional (e.g., medical school) education, K-12 outreach, and informal education.

The scope of the journal is rooted in the biological sciences and its branches to other disciplines. Examples of articles *JMBE* accepts include those addressing good pedagogy and design, student interest and motivation, recruitment and retention, citizen science, faculty development, and institutional transformation.

A unique feature of the *JMBE* editorial process is to provide extensive feedback, guidance, and support for authors from submission through publication.

JMBE is sponsored by the American Society for Microbiology (ASM; www.asm.org), the oldest and largest single life science membership organization in the world, and is indexed in PubMed Central, CrossRef, and DOAJ. The *JMBE* Editorial Board is committed to providing open access content.

The journal features seven sections:

- **Letters to the Editor** directly address articles published in this or other biology education journals.
- **Research** is for hypothesis-driven research in student learning. Documentation of sound assessment strategies that support research conclusions is required. Articles that address social science or qualitative work are also welcome.
- **Perspectives** place a particular, current topic of science education into perspective. Articles focus on a specific topic, problem, or approach of broad, general interest to science educators, but do not primarily discuss the author's own work.
- **Curriculum** includes field-tested activities that foster active learning and other best practices in education. Activities may be used in the classroom, laboratory, and/or field or online in blended and distance-learning experiences. Manuscripts in this category must include evaluations of the activities, and these evaluations must demonstrate effective learning.
- **Tips and Tools** promote practical tips, suggestions, and advice for improving biology education.
- **Reviews** include reviews of books and media, Journal Watch, and Web Watch.
- **ASMCUE Abstracts** include accepted abstracts for the annual ASM Conference for Undergraduate Educators.

PUBLICATION FREQUENCY

JMBE operates under a continuous publication model, where manuscripts are made available online as soon as they become ready. When a manuscript appears online, it will be catalogued in one of three issues: Spring (April), Back to School (August), or Winter (December). These three issues make up the year's volume.

Beginning in 2010, each May issue of *JMBE* will feature abstracts for that year's ASM Conference for Undergraduate Educators (ASMCUE; www.asmcue.org).

In addition, *JMBE* publishes a printed *JMBE* Spotlight issue for distribution at ASMCUE and other related educator meetings. The Spotlight issue is a compilation of articles from each section, hand-picked by *JMBE* Editors from the previous year's volume, as well as the accepted abstracts for that year's ASMCUE meeting.

ETHICAL GUIDELINES

In recent years, editors of scientific journals increasingly have reported problems relating to the integrity of the research in submitted and published papers. Scientific errors and incorrect interpretations inevitably occur in the published literature, but authors who knowingly commit fraud or other scientific misconduct seriously compromise the integrity of the scientific record and the success of future scientific research.

Authorship. Regarding authenticity of authorship, only those individuals who contributed directly to the intellectual content of the paper should be listed as such, with the implication that all of the following criteria have been met by the author(s) listed: (a) conceived and planned the work that led to the report; (b) wrote the paper, or reviewed successive versions and took part in the revision process; and (c) approved the final version. Holding positions of administrative leadership, contributing clients, and collecting and assembling data, are not, by themselves, criteria for authorship. Other persons who have made substantial, direct contributions to the work but cannot be considered authors should be acknowledged with their permission.

Previous or Duplicate Publication. In "Comments to the Editor," give full details on any possible previous or duplicate publication of any content of the paper. Previous publication of a small fraction of the content of a paper does not necessarily preclude its being published, but members of the Editorial Board need information about previous publication when deciding how to use space in the journal efficiently; they regard failure of full disclosure by authors of possible prior publication as a breach of scientific ethics. Please send a copy of any document that might be considered a previous publication via email to the Executive Editor, or provide this document during the submission process as a Supplementary file.

Preprint Policy. *JMBE* Editors will consider manuscripts for publication that have been posted in a recognized, not-for-profit preprint archive (such as bioRxiv), provided that upon acceptance of the manuscript for publication, the author is still able to grant ASM copyright or agree to the terms of an Open Access license. It is the responsibility of authors to inform the journal at the time of submission if and where their article has been previously posted. If the manuscript is accepted for publication in *JMBE*, authors are required to update the preprint with a citation to the final published article that includes the DOI along with a link.

Conflict of Interest Notification. Conflict of interest exists when an author, reviewer, or editor has financial or personal relationships that could inappropriately bias or compromise his or her actions (such relationships are also known as dual commitments, competing interests, or competing loyalties). More specifically, the following considerations are illustrative and would need to be addressed: (a) Authors should identify individuals who provide writing or other assistance and disclose the funding source for this assistance. (b) Investigators must disclose potential conflicts to study participants and should state in the manuscript whether they have done so. (c) Authors should describe the role of the study sponsor(s), if any, in the study design; in the collection, analysis, and interpretation of the data; in the writing of the report; and in the decision to submit the report for publication. If the supporting source had no such involvement, the authors should so state. (d) Editors may request that authors of a study funded by an agency with a proprietary or financial interest in the outcome sign a statement such as, "I had full access to all of the data in this study and I take complete responsibility for the integrity of the data and the accuracy of the data analysis."

Such perceived conflicts--or their absence in a study-- must be disclosed by the author via the "Comments to the Editor" route when the manuscript is submitted. Additionally, either the presence or

absence of perceived conflicts must be addressed on a Conflict of Interest Notification Page that follows the manuscript's title page.

Project Funding. Sources of outside support for research, including funding, equipment, and drugs, must be named in the contributed manuscript. The role(s) of the funding organization, if any, in the collection of data, its analysis and interpretation, and in the right to approve or disapprove publication of the finished manuscript must be described in the Methods section of the text.

Informed Consent. The use of human subjects or other animals for research purposes is regulated by the federal government and individual institutions. Manuscripts containing information related to human or animal use should clearly state that the research has complied with all relevant federal guidelines and institutional policies.

Warranties and Exclusions. Articles published in this journal represent the opinions of the authors and do not necessarily represent the opinions of ASM. ASM does not warrant the fitness or suitability, for any purpose, of any methodology, kit, product, or device described or identified in an article. The use of trade names is for identification purposes only and does not constitute endorsement by ASM.

COPYRIGHT NOTICE

All individuals submitting materials for the *Journal of Microbiology & Biology Education* must attest that they own the copyright and the materials are original; this includes text, figures, tables, artwork, abstracts, cover images, summaries, and supplemental materials included in the submission. Furthermore, corresponding authors must grant the American Society for Microbiology (ASM) an irrevocable nonexclusive license to publish their work if it is accepted. Upon publication, the work becomes freely available on ASM's *Journal of Microbiology & Biology Education* website and PubMed Central's Open Access subset for the public to copy, distribute, or display under a Creative Commons Attribution-Noncommercial-NoDerivatives 4.0 International license (License: https://creativecommons.org/licenses/by-nc-nd/4.0/; Legal Code: https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode).

Individuals authoring materials for *Journal of Microbiology & Biology Education* must grant an irrevocable nonexclusive copyright license to the American Society for Microbiology (ASM). Please complete the *Journal of Microbiology & Biology Education* Author Agreement Form (PDF) which can be found at the end of this document.

PEER REVIEW PROCESS

Peer-Review. All manuscripts are considered to be confidential and are reviewed by the editors, members of the editorial board, or qualified ad hoc reviewers. When a manuscript is submitted, it is given a number and sent to the editor. Corresponding authors are notified of this number. Always refer to this number in communications with the editor(s) and *JMBE* production staff. It is the responsibility of the corresponding author to inform the coauthors of the manuscript's status throughout the review and publication processes.

The reviewers operate under strict guidelines set forth in "Guidelines for Reviewers" and are expected to complete their reviews within two weeks after receiving the manuscript. The corresponding author is notified, about six weeks after the submission deadline for the volume, of the editor's decision to accept, reject, or require modification. When a manuscript is returned to the corresponding author for modification, it should be returned to the editor within one month; otherwise it may be considered withdrawn. A point-for-point response to the reviews must be included with the revised manuscript; an extra copy of the revised manuscript should have the changes highlighted.

Any manuscript with a laboratory component will undergo review by *JMBE*'s Laboratory Safety Review Committee, prior to regular review. As a result, authors may be asked to make safety-related changes to their manuscript before it goes out for regular review. This review has been established to ensure that all laboratory practices comply with ASM's Guidelines for Biosafety in Teaching Laboratories and to mitigate the risk to the students, faculty, and institutions who may be adopting the activity.

Manuscript Disposition. Manuscripts may be rejected upon receipt by the Editor-in-Chief and/or Editor if they do not fit the scope of the journal or section. In this case, the manuscript will not enter the review process, is considered rejected, and the Author will be asked to review the "Instructions to Authors" more thoroughly before resubmitting.

Once a manuscript is deemed appropriate for review, there are four possible final outcomes:

1. Editor enters a decision of "Decline Submission." This indicates that the paper is not appropriate for publication and the Author will not be requested to resubmit. The manuscript will exit the system, marked as "Archived."

2. Editor enters a decision of "Resubmit for Review." This indicates that while the manuscript topic is engaging, there are major issues with formatting, inadequate data, or lack of assessment, among others. The manuscript will exit the system, marked as "Archived," and the Author is requested to make extensive revisions based on Editor comments. The Author may submit a new manuscript when all reviewers' concerns have been addressed. A new manuscript number will be assigned upon receipt of the new submission.

3. Editor enters a decision of "Revisions Required." This indicates that the paper is acceptable, but minor revisions are necessary. The manuscript remains "Active" in the system. The author will upload a revised manuscript*, along with a cover letter indicating the changes made. The revised manuscript will be reconsidered by the Reviewers, and a final decision will be made.

4. Editor enters a decision of "Accept Submission." The manuscript matches the focus and scope of the journal and is accepted for publication. It will move forward in the production process.

***Note**: When preparing revised manuscripts, it is essential to carefully follow the instructions given in the Editor's letter. In particular, provide an annotated copy of the manuscript as well as a cover letter that addresses, point-by-point, the concerns of the Reviewers. Failure to do so will cause a delay in the review of the revised manuscript and may result in its return. Revised manuscripts must be uploaded under the "Editor Decision" section, located at the bottom on the manuscript's Review page. Revisions received more than three months after requested may be held for another review cycle, at the Editor's discretion. If a revision is not received within six months after requested, the file may be closed and archived.

ONLINE SUBMISSION PROCEDURES

Creating an Author Account. Before submitting a manuscript, authors must create a user account and check the "Author" box in their user profile. Once this box is checked, select the "Submit a Manuscript" button to the right and follow the prompts for submission. Create a *JMBE* account.

Author Tip. Authors should review journal articles in the section to which they plan to submit and make sure their manuscripts follow the formatting of those articles published in 2012 and beyond.

Submission Process. Authors can find additional guidance and step-by-step instructions for the submission process, as well as instructions for uploading revised manuscripts, in the "Online Submissions" section of the Author Guidelines page. Be sure to download and follow the PDF documents "How to Submit a Manuscript to *JMBE*" and "How to Submit a Revised Manuscript to *JMBE*."

Step 1: Start Submission. Under "Journal Section," a drop down menu allows the selection of type of article. The author should complete the submission checklist indicating the article is prepared in the proper format and has not been previously published. Use the optional "Comments to the Editor" section to report any previous or duplicate publication and/or conflict of interest (see General Guidelines). Select Save/Continue to proceed to the next section.

Step 2: Submission Metadata. The first, middle, and last name of each author, affiliation, and email address are required for each author. An optional biographical statement may be added for each author. Spaces are provided for the Submission Title and Submission Abstract. A space is provided for the author to name Agencies that provided support for the work presented in the submission.

Step 3: Submission Upload. Four steps are required to submit the manuscript, which must be saved on the hard drive of the Author's computer. 1. Click Browse to open a Choose File window for locating the manuscript on the hard drive. 2. Locate the submission file and highlight it. 3. Click Open on the window, which places the address in the box on this page. 4. Click Upload on this page, which uploads the file from the Author's computer to the journal's website and renames it following the journal's system. The file can be viewed by clicking on the file name. A new or revised file can be uploaded, deleting the one that currently appears. After clicking Upload, the upload window clears; click Save/Continue to move to the next step.

Step 4: Supplemental Files. An important feature of this publishing system is the ability to upload separate graphics files. Having graphics files separate from text files facilitates the HTML markup of the article for online viewing. An additional advantage is its ability to post and index any number of supplemental files for each published investigation. These might include samples of student work, teacher versions for exercises, teacher research instruments, data sets, information sources, etc. In addition, special permission to use figures, copyright release statements, may be included.

Step 5: Confirmation. This step allows the author to review the submission for completeness, note the file(s) name change in the system, note the submission file size, and upload date. **The author should click Finish Submission to confirm the upload.**

ONLINE SUBMISSION CHECKLIST

As part of the submission process, authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to these guidelines.

1. **ONLINE SELF-DIAGNOSIS TOOL:** The Author has used this tool to determine if their manuscript is ready for submission. Structured similarly to popular online quizzes, this tool helps authors understand the scope and level of assessment required by each section. **Diagnose Your Manuscript.**
2. **GUIDELINES FOR MANUSCRIPT TITLES:** The Author has used the following guidelines to help increase their manuscript's "discoverability" online, thus leading to a wider audience and increased citations. **Improve Your Manuscript Title**.
3. ***JMBE* How-To Series: Steps for Submitting a Manuscript to the Journal:** The Author has watched the 10-15 minute video tutorial that provides an overview of *JMBE* and its five sections, a walk-through of the submission process, and tips for a successful submission.
4. **CONTENT ADHERES TO AUTHOR GUIDELINES:** The text meets the journal's formatting requirements as outlined in the General Guidelines and specific Section Guidelines for the section to which the paper has been submitted.
5. **LABORATORY BIOSAFETY GUIDELINES:** The author has confirmed that any laboratory procedures and/or practices outlined in the submission adhere to the **ASM Guidelines for Biosafety in Teaching Laboratories**. Furthermore, the author has indicated in the submission how those procedures and/or practices adhere to the ASM Guidelines for Biosafety in Teaching Laboratories.
6. **PREVIOUS OR DUPLICATE PUBLICATION:** The submission has not been previously published, nor is it before another journal for consideration; or an explanation has been provided in "Comments to the Editor."
7. **FILE FORMAT:** The submission file is in Microsoft Word or RTF document file format.
8. **DOCUMENT FORMAT:** The text is double-spaced; uses a 10-point Times New Roman font or equivalent; employs italics, rather than underlining (except for URL addresses); with figures and tables placed at the end of the text, rather than embedded within.
9. **WEBSITE LINKING:** All URL addresses in the text are activated and ready to click.
10. **FIGURES AND TABLES:** Figures and tables are placed at the end of the text, rather than embedded within. They are numbered and include a heading followed by a period. **Permissions are required to reproduce or modify figures and tables within the submitted manuscript and any associated supplemental materials**.
11. **IMAGES:** All images are uploaded as Supplemental Files in JPG or GIF with 300 dpi (color or grayscale). Monochrome images have been saved in grayscale mode; color images are in RGB. No BMP, RTF, or TIF images are included. Images are at least 3 inches and no greater than 5 inches in the greatest dimension. **Permissions are required to reproduce or modify images within the submitted manuscript and any associated supplemental materials**.
12. **SUPPLEMENTAL MATERIALS:** Supplemental materials are loaded as one Word doc file. All materials are designated as Appendix 1, Appendix 2, etc., within the manuscript text and listed at the end of the manuscript as well. **Permissions are required to reproduce or modify images, figures (including maps), and tables within the supplemental materials**. A formatted and linked Table of Contents will be provided for supplemental materials once the manuscript and associated supplemental materials have been accepted for publication in *JMBE*.
13. **REFERENCES:** References are listed in the order in which they are cited in the manuscript (citation-sequence reference system) and formatted according to **ASM Style**.
14. **INFORMED CONSENT:** The use of human subjects or other animals for research purposes is regulated by the federal government and individual institutions. Manuscripts containing information related to human or animal use should clearly state that the research has complied with all relevant federal guidelines and institutional policies.

Preparing a Curriculum Section Manuscript

GENERAL GUIDELINES

Curriculum articles describe innovative classroom and laboratory activities ready for adoption by instructors teaching biology. Detailed instructions for student and directions for instructor preparation and use are important components of all curriculum articles. To facilitate ready use of the activity all institution specific references (e.g., course numbers, facilities) should be absent. Curriculum articles also:

- List learning objectives
- Use high-impact pedagogical practices that engage students in thinking beyond knowledge and comprehension (e.g., about application, analysis, synthesis, and evaluation)
- Describe previous use of the activity in the classroom or laboratory
- Include examples of student data and/or outcomes expected from the activity
- Provide suggestions for determining student learning
- Provide adequate support materials (e.g., references to background information, student worksheets, answer keys, sources of materials, etc.)
- Present results of assessment of student achievement of learning objectives
- Suggest possible modifications and/or extensions

Manuscript length: 1,000 to 4,000 words in length, including the abstract. Word limit does not include supplemental materials (e.g., student instruction handouts, directions for preparation, and student learning assessment materials) or references.

Manuscript Review Criteria. Reviewers are provided a rubric to guide their assessment of a manuscript. Authors are highly encouraged to review the rubric prior to submission. See pages 14-17 for the Curriculum Section Review Criteria.

Editorial Style. The editorial style of ASM journals conforms to the ASM Style Manual for Journals (American Society for Microbiology, 2011, in-house document) and How To Write and Publish a Scientific Paper, 6th ed. (Greenwood Press, Westport, CT, 2006), as interpreted and modified by the editors and the *JMBE* production staff. The ASM copyeditors and the *JMBE* production staff reserve the privilege of editing manuscripts to conform to the stylistic conventions set forth in the aforesaid publications and in these Author Guidelines. On receipt at ASM, an accepted manuscript undergoes an automated pre-editing, cleanup, and tagging process specific to the particular article type. To optimize this process, manuscripts must be supplied in the correct format and with the appropriate sections and headings. Authors who are unsure of proper English usage should have their manuscripts checked by someone proficient in the English language. Manuscripts may be editorially rejected, without review, on the basis of poor English or lack of conformity to the standards set forth in these Author Guidelines.

Copyediting. After final acceptance, a manuscript will be copyedited to conform to the editorial style of the ASM Style Manual for Journals (American Society for Microbiology, 2011, in-house document) and How To Write and Publish a Scientific Paper, 6th ed. (Greenwood Press, Westport, CT, 2006), as interpreted and modified by the editors and the *JMBE* production staff. It is the responsibility of the corresponding author to read the copyedited manuscript he or she will receive, and to answer all queries fully.

MANUSCRIPT COMPOSITION AND FORMATTING

File Format. The submission file should be in Microsoft Word or an RTF document file format.

Document Format. The text should be double-spaced; using a 10-point Times New Roman font or equivalent; employing italics, rather than underlining (except for URL addresses); with figures and tables placed at the end of the text, rather than embedded within.

Website Linking. All URL addresses in the text should be activated and ready to click.

Figures and Tables. Figures and tables are placed at the end of the text, rather than embedded within. They are numbered and include a heading followed by a period. **Permissions are required to reproduce or modify figures and tables within the submitted manuscript and any associated supplemental materials**.

Images. All images are uploaded as Supplemental Files in JPG or GIF with 300 dpi (color or grayscale). Monochrome images have been saved in grayscale mode; color images are in RGB. No BMP, RTF, or TIF images are included. Images are at least 3 inches and no greater than 5 inches in the greatest dimension. **Permissions are required to reproduce or modify images within the submitted manuscript and any associated supplemental materials**.

Cover Pages. The following information should be included as part of the manuscript submission:

> ***Title Page.*** Inclusive of the following: information in the title that facilitates appropriate electronic article retrieval; authors' names, highest academic/professional degree(s), and institutional affiliation; appropriate contact information for the corresponding author(s); source(s) of support for the work presented in the article; running head or foot line of approximately 40 characters; and number of figures, tables, and supplemental materials.
>
> ***Conflict of Interest Notification Page.*** As outlined in the "General Guidelines" section, a Conflict of Interest Notification Page must immediately follow the manuscript's title page. To prevent ambiguity, authors must state explicitly whether potential conflicts do or do not exist.
>
> ***Abstract and Key Word Page.*** Limit the abstract to 250 words or less and concisely summarize the basic content of the paper without presenting extensive details. Avoid abbreviations and references and do not include diagrams. When it is essential to include a reference, use the same format as for the References section but omit the article title. The abstract must be complete and understandable without reference to the text. In addition to the abstract, include 3 to 10 key words or short phrases that describe the manuscript contents. Include "classroom exercise" or "laboratory exercise" as appropriate**.**

MANUSCRIPT TITLE GUIDELINES

Creating a title that conveys the purpose of your work can be one of the most difficult parts of scientific writing. Before digital archiving, "eye-catching" titles were preferred because they could draw a reader to the abstract. In today's research environment, keywords in titles and abstracts are the most important indicator that a paper will be read. Remember: if it can't be found (and quickly!), it won't be utilized. Below are some guidelines and an activity to help you craft a title that will be attractive for today's online searching methods.

The *JMBE* Editorial Board recommends that you consider these questions as you develop a title for your submission:

- **What organism/research method/activity style/key concept is central to your paper?** Make sure this appears in your title.

- **What action is your manuscript calling for?** What do you want the reader to do after reading your manuscript (i.e. revise policy, use it in their classroom, etc.)? Make sure that similar action verbs are reflected in your title or abstract.

- **What keywords would you use to search for your article?** Make a list of the top five keywords and then use them in a search. Are the papers that you find in a similar vein to yours? If yes, make sure to incorporate these keywords appropriately in your title.

- **Is your title ambiguous or misleading?** Ask someone who is not familiar with your paper to read just the title of your manuscript and have them tell you what they think it is about. If they misinterpret your title, have them clarify which words were confusing. Remember: someone searching for your paper may not have your expertise.

- **Don't get too carried away.** While you want your title to describe your paper accurately, it might not be attractive to today's reader if it is more than one line long. Remember that there is an abundance of resources available to today's reader, and if they don't find your title and understand the content quickly, they will not read it!

Now take the test!

Consider the following fictitious titles, which are based upon published submissions. Which one do you think would attract the most search hits? What makes the other titles ineffective?

Giving the Undergraduate Laboratory Meaning and Purpose
Exploding Cells and Dynamic Colors: Creating Engaging Laboratories in the Science Classroom
Laboratory Exercises that Promote Student Engagement and Learning about Osmosis

Answer:

While not particularly "original," the third title is the best in terms of keywords that will guide a reader to the manuscript. It states the topic of the laboratory, and indicates what the reader can gain from reading the manuscript (ways to engage and promote student learning).

Giving the Undergraduate Laboratory Meaning and Purpose
> Is this a discussion of HOW to give a lab meaning and purpose or WHY it is important? Both? What is covered in this laboratory? This is the vaguest title, and is likely to be passed over because it is not specific or clear enough to draw in a reader.

Exploding Cells and Dynamic Colors: Creating Engaging Laboratories in the Science Classroom
> While "eye-catching," it isn't clear whether this is a "how to" article or an overview of the author's experience. It also remains vague on what students actually learn in the laboratories.

MANUSCRIPT HEADINGS AND SUBHEADINGS

INTRODUCTION — The introduction should provide sufficient background information to allow the reader to evaluate the applicability of the curriculum activity to their needs. The introduction should provide the rationale for design of the curriculum activity, sufficient background information to allow the reader to evaluate the activity without referring to previous publications, and indicate whether the exercise is a classroom or laboratory activity. In addition to this background information, introductions are expected to

contain the following subsections: intended audience, learning time, prerequisite student knowledge, and learning objectives.

Intended audience. Indicate the intended audience for the activity. For example: Microbiology/Biology majors, Allied health majors, Biotechnology majors, Science education majors, or Non-majors.

Learning time. Indicate the approximate class or lab time required and/or any follow-up in one or more subsequent periods. If the activity is a longer exercise, consider alternate arrangements of activity units to allow the exercise to be completed in one long period or spread over several periods. Alternate activity timelines may also be described in the modifications section.

Prerequisite student knowledge. Indicate prerequisite knowledge and skills that students should have before using this activity. Prerequisite knowledge includes both laboratory skills and background knowledge needed.

Learning objectives. Provide a list of clearly stated learning outcomes. Learning objectives must describe student behaviors that are observable, measurable, and testable. They may start with the phrase "Upon completion of this activity, students will…." Well-written submissions will include assessment examples that directly test these stated learning objectives.

PROCEDURE — The procedure section includes all information needed to allow adopting instructors to repeat the activity with their classes. The procedure section includes the following subsections: materials, student instructions, faculty instructions, suggestions for determining student learning, sample data, and safety issues.

Materials. Provide a clear and complete list of materials, indicating whether they are readily available or need special ordering. Materials should be organized in terms of "items per student," "items per group," and "items per lab." Multi-unit activities should indicate the materials needed for each unit. Include recipes or references for all media and solutions. Materials may be provided as a supplemental file (please indicate this availability in the text of the main document).

Student instructions. Provide a clear and complete set of instructions for students to perform this activity. Most activities include handout-ready student instructions as a supplemental file (please indicate this availability in the text of the main document). Instructions should not contain information that would be relevant only to your class (e.g., class number, date, etc.).

Faculty instructions. Summarize the steps of the procedure for the faculty member's benefit and include any explanations that are needed to help the faculty make the activity work smoothly. Include all preparation steps and any special clean-up or follow through required. Include any hints, tricks, or pitfalls to avoid. Also appreciated are suggestions for acquiring hard-to-get materials or special items. Please try to include those things that you do automatically, which someone else may not know but contribute to the success of the activity. These instructions will not be handed out to students. Please keep in mind that not all instructors have the same background as you - many *JMBE* readers are looking for activities outside their own area of expertise and rely on detailed faculty instructions to ensure the success of the activity. Faculty instructions may be provided as a supplemental file (please indicate this availability in the main text of the document).

Suggestions for determining student learning. Please share the assessment methods that you have used to determine if students have achieved your stated learning objectives and the methods you use to assign grades. Examples of questions, assignments, and/or rubrics should be provided (please indicate this availability in the main text of the document if these items are included as supplemental files).

Sample data. Provide examples of student work and/or expected student outcomes to help provide faculty with a fuller sense of the range of outcomes for the activity. Possibilities include text submitted by students, data gathered, photographs or short movie clips, etc. Remove any identifying names. Sample data may be provided as a supplemental file (please indicate this availability in the main text of the document).

Safety issues. Address all safety issues faculty and students need to know when attempting this activity. Safety concerns may include (but are not limited to): biosafety level of strains used; chemical considerations; UV; environmental unknowns; etc. If there are no safety issues, state "None."

DISCUSSION — The discussion section should highlight the activity's effectiveness in achieving the stated learning objectives, and provide evidence of student learning. The discussion may elaborate on how the activity may be adapted to different course situations or different student audiences. The discussion should include the following subsections: field testing, evidence of student learning, and potential modifications.

Field testing. Please indicate course conditions in which you have used this activity (size of class, audience, etc.). Include student and faculty feedback so other faculty can better judge how this activity might work for them. If appropriate, include the results from any informal assessments or surveys of this activity as an indication of student and faculty responses to the activity.

Evidence of student learning. Tell us how you know that this exercise is effective. Provide results from assessments that demonstrate student learning across stated learning objectives. Appropriate examples of evidence include pre-/post-testing, normalized learning gains, and/or post activity assignments /questions with statistics of student performance toward different objectives. Perceived learning as measured by student attitude surveys, while effective in demonstrating student interest, are not appropriate as evidence of student learning.

Possible modifications **(optional).** Outline ways your activity can be modified or extended to broaden its appeal for faculty in other settings or facing alternate curriculum goals. For longer activities, elaborate on alternate timelines to adapt the activity to different course schedules.

ACKNOWLEDGMENTS — The source of any financial support received for the work being published must be indicated in the Acknowledgments section. It will be assumed that the absence of such an acknowledgment is a statement by the authors that no support was received.

REFERENCES — List references that would be especially suitable as background for faculty or supplemental material for students. References should be listed in the order in which they appear in the manuscript (citation-sequence reference system). This part of the report immediately following the manuscript's main body provides the bibliographic information for each and every source cited. Arabic numerals in parentheses serve to identify references in text, tables, and legends. Please review the ASM Style Guide for References provided, and refer to journal articles published in 2012 and beyond. *JMBE* strongly encourages authors to use professional literature citations from recognized genres of scholarly publications such as peer-reviewed journal articles and authored or edited books. In so doing, the reliance on reputable primary rather than secondary sources is obviously preferred. The appeal to electronic encyclopedias and/or online knowledge-sharing tools should be made only in those circumstances where more generally recognized scholarly sources are unavailable and/or incompatible with the author's intent. When such is the case, these citations must be embedded parenthetically in the manuscript's narrative as opposed to being included as entries in the References section.

SUPPLEMENTAL MATERIALS (If applicable) — Append any useful or needed information that does not fit easily into the categories above as appendices. Supplemental materials are loaded as one Word doc file. All materials are designated as Appendix 1, Appendix 2, etc., within the manuscript text and

listed at the end of the manuscript as well. **Permissions are required to reproduce or modify images, figures (including maps), and tables within the supplemental materials**. A formatted and linked Table of Contents will be provided for supplemental materials once the manuscript and associated supplemental materials have been accepted for publication in *JMBE*.

Curriculum Section Review Criteria

Criteria	Acceptable as submitted; no change or simple corrections (1)	Needs modifications or improvements (2)	Fundamental revisions or additions required (3)
Worthwhileness			
Impact	The activity is innovative and includes at least one high impact practice, e.g. peer collaboration, oral and/or written communication, problem solving, active learning, etc.	Activity includes some new methods and approaches and marginal active engagement of students.	Activity does not include any novel methods or approaches and students are not actively engaged.
Depth	The activity actively engages students in thinking beyond knowledge and comprehension such as application, critical thinking, synthesis, analysis, or evaluation.	The activity requires students to understand core concepts; it encourages students to apply skills to new situations.	The activity fosters basic understanding but does not involve applications of knowledge to new situations.
Outcomes	The learning objectives describe measurable behaviors and outcomes. The activity as conceived and presented is designed to support the learning outcomes.	The learning objectives as stated are difficult to measure. The activity as conceived and presented could include additional outcomes and/or does not support the stated learning outcomes.	Learning outcomes are absent or not measurable and not represented by the activity as it is conceived and presented.
Coherence			
Time Management & Student Prerequisites	Intended audience provided and not institution specific. Activity preparation times and student meeting times provided (number of minutes/hours or class periods). Prerequisites student knowledge provided.	Intended audience unclear or incomplete and/or institution specific. Activity preparation times and student meeting times are suggested but require clarification. Prerequisite student knowledge incomplete or requires clarification.	Intended audience not provided. Preparation times and student meeting times vague and/or unrealistic or not provided. Prerequisite student knowledge unrealistic or not provided.
Preparatory Support	Materials list is clear, complete, and well organized as amount required per student, per group, or per lab. Sources for materials are suggested and recipes	Materials list is essentially complete, but lacks important details. Sources for some key items not suggested. Recipes and storage instructions vague or	Materials list is incomplete and/or items are expensive, difficult to obtain, or pose safety hazards. Sources for items not suggested and recipes and storage

	and storage instructions are provided as necessary.	incomplete.	instructions absent.
Safety Guidelines	Safety issues (microorganisms, toxicity, flammables, corrosives, combustibles, etc.) are identified and described.	Safety issues absent for some materials (microorganisms, toxicity, flammables, corrosives, combustibles, etc.).	Safety information absent or incorrect.
Competence	**Acceptable as submitted (1)**	**Needs modifications (2)**	**Fundamental revisions required (3)**
Student Procedures	Instructions are provided in the form of a student handout. Procedures are clear, complete, well organized, and presented at the appropriate level. Institution specific references absent.	Instructions and procedures are essentially complete, but may be unclear or need minor modifications. Instructions are not in the form of a student handout. Contains institution specific references.	Instructions and procedures are incomplete or unclear. Procedures are provided at an inappropriate level. Student handout is clearly needed but not included.
Instructor Procedures	Instructions are organized, succinct, and include explanations or clarifications that allow the activity work smoothly. Institution specific references absent.	Instructions and procedures are essentially complete, but may be unclear or need minor modifications. Contains institution specific references.	Instructions and procedures are incomplete or unclear. Specific methods or steps require additional clarifications.
Student Evaluation	Suggestions for determining student learning are well described and methods are appropriate and effectively measure the stated learning outcomes. Sample grading rubrics provided if appropriate.	Assessment methods are suggested but require clarification and/or do not measure whether students have met the learning outcomes. Sample grading rubrics provided but require clarification or rubrics are absent.	Suggested assessment methods are inappropriate for the activity or not provided. Sample grading rubrics absent.
Support Materials	Adequate support materials (e.g. references, student worksheets, answer keys) are provided.	Support materials (e.g. references, student worksheets, answer keys) vague or incomplete.	Support materials (e.g. references, student worksheets, answer keys) of poor quality or not provided.

Ethics	Acceptable as submitted (1)	Needs modifications (2)	Fundamental revisions required (3)
Use of Human Subjects	The manuscript demonstrates appropriate data collection and/or the use of human subjects, such as informed consent and confidentiality.	The manuscript inadequately demonstrates appropriate data collection and/or the use of human subjects, such as informed consent and confidentiality.	The manuscript fails to demonstrate appropriate data collection and/or the use of human subjects, such as informed consent and confidentiality.
Acknowledgement	The authors have completely and properly cited the work of others from the primary literature.	The authors incompletely or improperly cite the work of others from the primary literature.	The authors have failed to cite the work of others from the primary literature.
Credibility			
Sample Data	Included are useful examples of actual student data and/or expected outcomes of the activity.	Included are examples of actual student data and/or expected outcomes of the activity that are incomplete or require clarification	Examples of actual student data and/or expected outcomes of the activity not provided.
Assessment	The activity has been field tested at least twice and revised accordingly. Assessment methods are appropriate (e.g. more than student perception of learning) and are well connected to the stated learning outcomes.	The activity has been field tested once and revised accordingly. Assessment methods are suggested but are inappropriate (e.g. only student perception of learning) and/or are not well connected to the stated learning outcomes.	No reported field-testing. Assessment methods are absent. Assessment methods are not well connected to the stated learning outcomes.
Claims and Conclusions	Claims and conclusions are believable. Assessment data demonstrate activity is highly effective in meeting the learning objectives.	Claims and conclusions exaggerated or understated. Assessment data demonstrates activity has marginal effectiveness in meeting the learning objectives.	Claims and conclusions are not believable or are misleading. Evidence from field tests does not demonstrate effectiveness of activity to meet the stated objectives.

Organization and Other Qualities	Acceptable as submitted (1)	Needs modifications (2)	Fundamental revisions required (3)
Organization	The manuscript is clear, concise and well organized.	The manuscript is not clear or concise, but is well organized, OR the manuscript is concise, but not clear or well organized.	The manuscript is not clear, not concise and not well organized.
Modifications and Extensions	Appropriate modifications and extensions are suggested that broaden the activity to other audiences, themes, or applications.	Appropriate modifications are suggested that broaden the usefulness of the activity, but require clarification.	No modification or extensions are listed, although the activity clearly would benefit by their inclusion.
Supplemental Materials	Supplemental materials represent useful material that enhances the submission. Institution specific references absent.	Additional supplemental material would be useful and/or supplemental materials require clarification. Contain institution specific references.	Necessary supplemental materials absent and/or included supplemental materials seemingly not relevant to the quality of the activity. Contain institution specific references.

Overall Common Problems that Require Major Revision:

1. Activity is not novel, or closely duplicates a previously published activity.
2. Abstract is not concise or comprehensive.
3. Expected outcomes are not provided.
4. Results of field testing are not included; evidence of student learning is not provided.
5. Safety issues are not addressed.
6. Activity does not allow active learning (i.e., it is a 'cookbook' exercise).

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