[Replace Text Here with Your Title]

[List authors by first name (optional middle initial or middle name) followed by last name. Separate multiple authors by commas. Use superscript numbers to link authors to specific affiliations, and symbols for author notes.]

First Middle Last1\*, First Last2†, and First M. Last1

**Affiliations:**

1Department Name, University/ Institution

2Precede each affiliation by a superscript number corresponding to the author list.

\*Correspondence to: Include the postal mail and email addresses of the corresponding author(s).

†Use symbols to indicate additional author notes (for example, equal author contributions, current addresses, etc.). Use in the following order (†, ‡, §).

**Type of Manuscript:** *CourseSource* Lesson Manuscript

**Funding and Conflict of Interest:** [Sources of outside support for the creation of the resource must be named in the contributed manuscript. Please indicate funding that relates to a potential conflict of interest. Conflict of interest exists when an author has financial, personal, or professional relationships that could inappropriately bias or compromise their actions. If no authors have conflicts of interest related to this manuscript, please indicate: “None of the authors have a financial, personal, or professional conflict of interest related to this work.”]

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**Title and Description of Primary Image:** [Provide a title and a short description to accompany your primary image. All submissions must include an image that represents the information in the article (*e.g.,* a picture of a dividing cell for a lesson about mitosis; a picture of a swinging pendulum for a physics lab). This image will be displayed with the title of your article on the *CourseSource* website (it will not be in the PDF). Ensure that this image is not copyrighted. If students are photographed, students must consent to having their image published.]

Please provide a 4 x 3 image at high resolution (*e.g.,* 800 pixels wide x 600 pixels high).

# Abstract

[The abstract should be a single paragraph of 250 words or less. Start with an opening sentence that sets the teaching challenge that you address in this manuscript, provide background information specific to this Lesson, briefly describe the Lesson, and end with a concluding sentence.]

## Scientific Teaching Context

### Learning Goal(s)

Students will:

[Provide clearly stated learning goals, which are broad statements of what the students will know once they have completed the Lesson. Learning goals are typically rather abstract and use words like “know,” “understand,” and “value.” (Appreciate should not be used as a synonym for “understand.” Avoid using “appreciate” unless you intend it to mean “value,” as in “Students will appreciate the role of science in society.”)

For example:

* Understand the steps of mitosis.
* Appreciate the importance of mitosis in the process of reproduction.

\*\*Additionally, list any society generated learning goals that align with your Lesson. This helps readers find your Lesson when searching by society generated learning goals. Briefly go through the Course Learning Frameworks, if available, for the Course(s) that you identified as the area(s) for this Lesson. These learning frameworks can be found on the [*CourseSource* website](https://qubeshub.org/community/groups/coursesource/courses), under the “Courses” tab. You are welcome to use learning goals from multiple Courses in your Lesson.

For example, the above Lesson Learning Goals, could align with the following society-generated learning goals:

* From Genetics Learning Framework:
	+ “What are the molecular components and mechanisms necessary to preserve and duplicate an organism’s genome?”
	+ “What are the mechanisms by which an organism’s genome is passed on to the next generation?”
* From Cell Biology Learning Framework:
	+ “How do cells conduct, coordinate, and regulate nuclear and cell division?”]

### Learning Objective(s)

Students will be able to:

[Define what students who have successfully accomplished the learning goal can actually do. Learning objectives describe student behaviors that are observable, measurable, and testable. Learning objectives should test students’ mastery of the material and use words like “define,” “predict,” “design,” and “evaluate.”

For example:

* Compare and contrast mitosis and meiosis.
* Predict consequences of abnormal meiosis.]

## Introduction

[The introduction should provide the origin and rationale for the design of the Lesson and provide enough background information to allow the reader to evaluate the Lesson. **Citations should be present throughout this section**.]

Place your work in the context of the published work of others. Provide citations to similar lessons or approaches, if they exist. How does your Lesson build on the activities, assessments, etc. of others?

For complex topics, you may submit a “Science Behind the Lesson” article with the Lesson, to provide potential instructors with sufficient information to implement the Lesson.

### Intended Audience

[Describe the student population(s) who were engaged in the Lesson, including their level and major affiliation. For example: first-year students at a large research university; science majors at a community college; non-science majors in a summer research program; advanced biology students at a liberal arts college, etc.]

### Required Learning Time

[Provide a description of the time needed to complete the Lesson, keeping in mind potential alternate Lesson timelines that may be described in the discussion section.]

### Prerequisite Student Knowledge

[Provide a description of the knowledge and skills that students should have before completing this Lesson. Prerequisite knowledge may include both skills and background content knowledge.]

### Prerequisite Teacher Knowledge

[Provide a description of the prerequisite knowledge that an instructor needs to teach this Lesson. Prerequisite knowledge may include both skills and background content knowledge.]

## Scientific Teaching Themes

### Active Learning

[Describe how students were actively engaged in learning the concepts. List and/or explain the active learning strategies used in the Lesson. For example, activities could include think-pair-share, clicker questions, group discussion, debate, etc. Include both in-class and out-of-class activities. Reference literature that aligns with techniques used in the Lesson.]

### Assessment

[Describe how the instructors measured learning. How did students self-evaluate their learning? List and/or explain the kinds of assessment tools used to measure how well students achieved the learning objectives. For example, assessments might be clicker questions, forced choice questions, exams, posters, etc. Reference literature that aligns with the assessment strategies used in the Lesson.]

### Inclusive Teaching

[Describe how your Lesson includes all participants and acknowledges the value of diversity in science. List and/or explain how the Lesson is inclusive and how it leverages diversity in the classroom and beyond. For example, the Lesson may provide examples of scientists from different backgrounds, encourage use of prior knowledge and experiences, or explicitly address access needs. Reference literature that aligns with inclusive teaching practices used in the Lesson.]

## Lesson Plan

[Provide a description of your Lesson that is complete and sufficiently detailed that a teacher with less skill or scientific expertise in the Lesson’s discipline would be able to teach it. This section should capture how you would explain to a colleague how to teach your class for you. Focus on how you actually taught the Lesson (suggestions for adaptations should go in the Teaching Discussion). In addition, expand upon aspects of scientific teaching that are particularly highlighted in the Lesson; provide examples of formative and/or summative assessments and related rubrics; and reference materials that are necessary or useful for teaching the Lesson, whether they are provided as Supporting Materials or as links to other websites.]

**All submissions must include a Table containing a recommended timeline for the Lesson, using the Table Template available** [**here**](https://qubeshub.org/community/groups/coursesource/for_authors)**.**

Subheadings can be included within any of the sections to increase readability and clarity. Use the embedded styles in Microsoft Word, accessible from the HOME tab:

### Heading 3

#### Heading 4

##### Heading 5

Please use the BlockQuote style when you want to:

Designate a student quote, label instructor script during an activity, or differentiae spoken word from the main text.

Please use the StandOut style when you want to:

Make specific text distinct or separated from the main text such as a clicker question. This is similar to BlockQuote in appearance, but should not be used to indicate speech.

*\*For website links:*

* If you want to direct readers to watch a YouTube video, read an article on a website, provide a website for purchasing equipment, etc.:
	+ Provide the URL link in parentheses following the underlined text you want hyperlinked.
	+ An example: Students watch a short video about photosynthesis (<https://www.youtube.com/watch?v=2KZb2_vcNTg>) prior to the activity.
	+ Do not include in the citation list.
* If you want to use an article from a website as a citation (*e.g.,* NPR), please use it as you would a normal citation. See the References section below to see how to format a Website citation.

The actual URL in parentheses will be removed prior to publication, but is necessary for you to include to ensure we publish using the correct links.

## Teaching Discussion

[Describe your observations about the Lesson’s effectiveness in achieving the stated learning goals and objectives, student reactions to the Lesson, and your suggestions for possible improvements or adaptations to different courses or student populations.]

**Institutional Review Board (IRB)/ Behavioural Research Ethics Board (BREB) Approval**

* **You may be required to provide an ethics board protocol number**. US Federal regulations require IRB review and approval for projects that:
	+ (1) Meet the definition of research
	+ AND (2) Involve human subjects
* Research is defined as “a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.” (*e.g.,* testing a hypothesis; randomization of subjects; comparison of case vs. control)
* A human subject is defined as “a living individual about whom an investigator (whether professional or student) conducting research:
	+ Obtains information or biospecimens through intervention or interaction with the individual, and uses, studies, or analyzes the information or biospecimens; or
	+ Obtains, uses, studies, analyzes, or generates identifiable private information or identifiable biospecimens."
* Most articles submitted to *CourseSource* will be considered as Quality Improvement and/or Program Evaluation, and IRB review is not required because the project does not constitute research as defined under 45 CFR46.102(d).
* However, ***if your project is considered research and/or you present and discuss human subjects’ data,*** [***IRB review is required***](https://www.american.edu/irb/irb-no-review.cfm). This includes, but not limited to:
	+ Student performance data (*e.g.,* pre/post scores on an assessment)
	+ Student quotes, particularly if the quotes were gathered from a survey that collected identifying information (*e.g.,* their name) or from interviews
* If you use student data, you must either provide an IRB protocol number OR certification by the IRB or the institution that IRB review was not required. Please provide this information in the Lesson Plan or adjacent to the data (often in the Teaching Discussion section).
	+ **IMPORTANT**: While your project may not be considered ‘research on human subjects’, [intent to publish results may change its designation to research and thus require IRB approval](https://stockton.edu/research-sponsored-programs/documents/irb/FAQs.pdf). Ensure that when submitting for approval to your IRB that you *state your intent to publish results from the project* (*e.g.,* survey data, test scores, quotes).
	+ If considered research on human subjects, it will likely undergo review under the “exempt” category. This means that your study requires only an initial review and is *exempt from ongoing review*. [Exempt does not mean *exempt from any IRB review* nor exempt from general requirements for informed consent and protection of subjects](https://www.iup.edu/research/resources/conducting-responsible-research/irb/guidelines/exemptions.html).
* What if my institution does not have an IRB board?
	+ We recommend that you do not provide any human subjects’ data. Instead, discuss your observations, overall student reactions, or general classroom performance.
	+ If you still wish to provide such data, you must provide a statement(s) in your article regarding:
		- IRB review was not available
		- Description of ethical procedures and practices that were followed (*e.g.,* maintaining the anonymity of student participants, data management and protection, and student consent)
		- The research posed minimal risk to students and was conducted in established or commonly accepted educational settings
* **Common exceptions:**
	+ An IRB is not needed if you are presenting data collected from an anonymous survey. If the survey collected identifying information (such as names or demographics), even if de-identified later, we cannot publish the data without an IRB.

## Supporting Materials

* S1. Writing Hypotheses – Student Handout
* S2. Writing Hypotheses – Slides
* S3. Writing Hypotheses – Quiz [Instructor view only]

[Replace the above text with a bulleted list of all your supporting files. A short description is not required, but can be added if desired. If you would like to restrict access of any supporting files to only instructors (*e.g.,* exam questions, exam key), please indicate in the bulleted list.]

Use the following nomenclature to list your materials. Begin with the letter “S” and the number representing the order *in which the material is referenced in the article* (S1, S2, S3…). Follow with a short version of your article title. For example, shorten “Using Hypothesis Writing and Testing to Develop Skills in Scientific Inquiry,” to “Writing Hypotheses”. Then include a brief title of the resource, such as lecture slides, worksheet, etc.

When referencing supporting files within the text, do not refer to these files as “supplemental.” You may refer to the supporting files using parentheses or within the text. If using parentheses, please list the numbers the same as you would an ASM citation. For example: (Supporting Files S7, S8) and (Supporting Files S10–S15). If referencing file(s) within the text, please use proper grammar.

**Examples of in-text supporting file reference in parentheses:**

* ONE: Print one set of cards for the sorting game (Supporting File S1).
* MULTIPLE: Additional learning materials (Supporting Files S1, S4–S15) were created to facilitate the online transition as a result of the COVID-19 pandemic.

**Examples of in-text supporting file reference outside parentheses:**

* ONE: If this dataset will be used for the activity, instructors may refer to information presented in Supporting File S14.
* MULTIPLE: Example grading rubrics are in Supporting Files S12 and S13.

**All Supporting Materials MUST be referenced at least once** in the main text and/or within the Teaching Timeline Table.

Important information:

* **We request authors limit the number of supporting files to 20 at most.**
* When naming the actual supporting files, *use the exact same titles as named in the Supporting Materials bulleted list*. For example, “S2. Writing Hypotheses – Slides.pptx”
* When possible, please use **editable file formats** such as Word, PowerPoint, Excel, etc. Avoid PDFs if possible – PDFs are difficult to be made accessible as well as hard for reviewers, editors, and readers to edit.
* Wherever possible, ensure that the article title and name(s) of author(s) are visible when a reader opens the file. Suggested areas include in a header, on the first page/first slide, or as a “Notes” sheet in a spreadsheet workbook.
* Upload a separate file for each supporting material item when you submit your article. **Do not embed any of this information in the manuscript text file**.
* The maximum size for each supporting file is 100 MB.
* In supporting files that contain lecture slides, it is helpful to include notes about materials and transitions to help the reader teach the materials.

### Images and Copyrighted Materials

Do NOT include copyrighted materials in your manuscript or in your Supporting Materials.

All images have to either be **open source**, the **author’s own creation**, or **have received permission** from the original creator. Figures from papers or textbooks are not allowed (unless authorized in writing).

To ensure there are no copyrighted materials, authors must provide an adequate description of where images or photos are sourced from. For example:

* Image credit: author name, picture taken in-house
* Image of Earth on left side is open source from <https://www.website.com>
* Figure reprinted with permission from journal (article citation)

Authors should provide this information in the image caption. If in PowerPoint, please put the information in the Slide Notes for each slide that contains an image.

If the image is copyrighted, **it must be deleted**. Authors can choose to replace the image with an open source version (with reference as described above). Or they can put a placeholder box with a description of what image to insert. For example:

* Insert Figure 8 from Flowers *et al.,* 2023 here (provide link, DOI, or citation)
* Place image of particle accelerator from this website (embed link) here

This way, there is no uncertainty about the image’s open source/ copyright status and it still allows readers to use images recommended by the authors.

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Below are suggested methods for finding open source images. Please only submit images that are in the **public domain** or are **compatible with our licensing**, [**CC BY-NC-SA 4.0**](https://creativecommons.org/licenses/by-nc-sa/4.0/deed.en) (Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License), such as: [**BY**](https://creativecommons.org/licenses/by/4.0/), [**BY-NC**](https://creativecommons.org/licenses/by-nc/4.0/deed.en), and [**BY-NC-SA**](https://creativecommons.org/licenses/by-nc-sa/4.0/deed.en).



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#### [Creative Commons Search](https://search.creativecommons.org/)

This site links out to a variety of search engines for various media. Try them out yourself! Simply go to Creative Commons Search, select your search engine, and submit your inquiry. Here’s how you can refine your search or check that your searched images are compatible:

#### [Openverse](https://openverse.org/)

Ensure “Filters” is open on the right side, and select compatible licenses.

#### [Flickr](https://www.flickr.com/)

Click on an image of interest. On the loaded page, scroll underneath the photo and click on “Some rights reserved” on the right side to view the license.

#### [Google Images](https://www.google.com/imghp?hl=en)

Refine your search by selecting “Tools” > “Usage Rights” > “Creative Commons licenses.” When you click on an image, you will find “License details” hyperlinked below. Click on the link to make sure the image is compatible.

#### [Wikimedia Commons](https://commons.wikimedia.org/wiki/Main_Page)

Click on an image file of interest. On the loaded page, scroll down to “Permission” or “Licensing.”

However, it is easier to do the following: On the right hand side of the search results page, click “Switch to MediaSearch.” Once the page is loaded, select “License” > “No restrictions.”

## Acknowledgments

[Replace these instructions with your acknowledgements, which can include funding information.]

## Table and Figure Captions

[**Upload a separate file for each figure and table** when you submit your article. Do not embed any of this information in this text file. **All Tables and Figures MUST be referenced at least once** in the main text.]

## Tables

**Table 1.** Name of table. Table captions should contain a short description of the table.

## Figures

**Figure 1.** Name of figure. The figure caption should begin with a sentence that describes the overall “take home message” of the figure. **(A)** Indicate figure parts with capital letters. **(B)** You should also reference/ describe each figure part in the main text as well.

**IMPORTANT:**

* All tables must be submitted using the provided [table template](https://qubeshub.org/community/groups/coursesource/for_authors) and as a DOCX file (not PDF).
* All figures must be submitted in a graphic file format such as JPEG (PDFs will not be accepted).
* Ensure that no copyrighted materials (or copyrighted materials without permission) are included in your article or in your tables and figures.]

## References

[Replace these instructions with your reference list.]

The citation style of *CourseSource* follows the [standards set by the American Society for Microbiology (ASM)](https://journals.asm.org/journal/jmbe/reference-style). Here are general guidelines:

* Cite references in the text by placing the reference number in parentheses (or brackets when relevant). Number the references in the order in which they appear. For example:
	+ Several CUREs have been developed recently in the field of ecology (1-5). CURES have the potential to increase student success (6, 7). There are multiple consortiums available to help scholars develop their own CURES (see Consortium A [8], Consortium B [9], and Consortium C [10] for more information). Despite this growth, research suggests that interdisciplinary CUREs are lacking in the current literature (4).
* If you are using reference organization software, **you must submit an unlinked version**.
* Abbreviate the names of journals, according to the list in [NCBI](http://www.ncbi.nlm.nih.gov/nlmcatalog/journals). **Remove any periods**.
* List all authors of the reference.
* Use sentence case for titles (helpful website: <https://titlecaseconverter.com/> )
* **DOI numbers must be included**, if a citation has one. Format for DOI numbers can be:
	+ doi:10.1187/05-06-0082
	+ OR
	+ <https://doi.org/10.1187/05-06-0082>
* If multiple references are cited in the same citation, number them by date order with the oldest citation as the lowest number.
* References in the list should **only be of references in the main text**. Any references in the Supporting Materials should be listed separately within the Supporting Material.

Examples of reference style:

**Journal Articles**

1. Knight JK, Wood WB. 2005. Teaching more by lecturing less. Cell Biol Educ 4:298–310. doi:10.1187/05-06-0082.

**Book/ Report**

1. Handelsman J, Miller S, Pfund C. 2006. Scientific teaching. W.H. Freeman, New York, NY.

**Book Chapters**

1. Dennen VP, Burner KJ. 2008. The cognitive apprenticeship model in educational practice, p 425–439. *In* Spector JM, Merrill MD, van Merriënboer J, Driscoll MP (ed), Handbook of research on educational communications and technology, 3rd ed. Lawrence Erlbaum Associates, New York, NY.

**Websites**

Author (if unavailable, use website host). Year published (if unavailable, use update/revision date; if unavailable, write “n.d.”). Article title. Website host (if not already used as author). Retrieved from URL (accessed day month year).

*Examples:*

1. California Department of Fish and Wildlife. 2022. Gray wolf. Retrieved from <https://wildlife.ca.gov/Conservation/Mammals/Gray-Wolf> (accessed 19 October 2022).
2. Ray J, Marken S. 2014. Life in college matters for life after college. Gallup. Retrieved from <https://news.gallup.com/poll/168848/life-college-matters-life-college.aspx> (accessed 14 July 2022).

*Please note an important distinction!* If you use a website page as a citation, please cite it properly—such as (4)—and include the citation in your references list. If you are providing information for readers (such as a YouTube video for students to watch, a website to buy lab supplies from, a popular science article for students to read, etc.), do not cite the website in-text and do not include it in the references list. Formatting would look as follows (as described previously):

Students watch a short video about photosynthesis (<https://www.youtube.com/watch?v=2KZb2_vcNTg>) prior to the activity.

Visit the [ASM website](https://journals.asm.org/journal/jmbe/reference-style) for the most current information regarding formatting of references. [This website](https://www.unr.edu/writing-speaking-center/student-resources/writing-speaking-resources/american-society-of-microbiology-%28asm%29-style) is also a helpful resource for how to cite different kinds of references, but may not have the most up-to-date information.

**Citation Managers**

Two citation styles are available to download from the [*CourseSource* For Authors page](https://qubeshub.org/community/groups/coursesource/for_authors). For information on how to install and the difference between the two versions, please visit our website.