

## Engaging College Students by Singing the Science †

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### INTRODUCTION

Short attention-getting activities are at a premium in large undergraduate STEM lectures. Music is one activity that may improve engagement. Under the proper conditions, music relieves stress (1) and improves memory (2). While singing in college classes is a fairly common approach (2–4), our understanding of best practices remains rudimentary.

Song parodies can modify words to make popular music scientifically informative (5). Students hearing parodies are familiar with the professional performances, so parodies do not need to be as polished as new songs. Also, since melodies carry much of the emotional weight of songs (5), parodies that echo emotional themes of the songs they are based on may be more memorable and help students connect science to their everyday lives.

I will discuss a general method for teaching biological concepts by writing musical parodies, including a primer on some important factors to consider while writing. This advice may also help instructors who want to sing lyrics they find online. The presentation method involves singing while presenting lyrics visually, with annotations that present more nuanced information. While either musical proficiency or self-confidence is helpful, parody songs decrease barriers to entry.

### PROCEDURE

#### Songs

I sang five songs in each of two undergraduate classes; an introductory review course attended primarily by first-year students (fall 2015) and a Genetics course (spring 2016). These songs (Appendix 1, Figs. S1–S12) or other scientific parodies may be presented as described in the Presentation

section, with or without modification. A variety of science songs are available at [SingAboutScience.org](http://SingAboutScience.org) (6).

However, I wrote my own songs to make sure they were relevant to my courses—an approach I would recommend to other instructors. My usual method was to choose songs my students know well (classics or new hits), then consider how to translate the theme of the original to a scientific context. Many popular songs are about love or anger—these can be repurposed into songs about breaking or making, coming together or separating, movement or stasis. Most biological processes can be described in these terms. In many cases I found inspiration by changing words in choruses until I arrived at a bad science pun.

For each song I chose a clear point of view. Points of view range from simple (viruses are cool!) to complex. For example, when writing a song about endosymbiosis to the tune of “Every Breath You Take,” I reframed it as “Every Breath I Take” to retain the power dynamics of the original while making a proto-eukaryotic cell the controlling party. Regardless, the point of view should match the emotions and theme of the original.

I used the original lyrics as a guide, maintaining the same number of syllables. (Trimming words from an abstract or paraphrasing scientific concepts for students is good preparation for making an idea fit the length of a musical phrase.) Where long scientific words or phrases made this difficult, I described concepts indirectly and clarified through annotations (Fig. 1). To maintain the original rhyme scheme, I often wrote lines ending with an easily rhymed sound like “ee” or “oo,” then used an online rhyming dictionary (e.g., [RhymeZone.com](http://RhymeZone.com)) to find rhymes. The same methods can be used to tweak songs found online to match the content of a particular course.

#### Presentation

Songs were always presented after first covering material by more traditional means. Before singing, I reviewed the material and gave a brief statement describing the song’s context and point of view (often clarifying that the song’s anthropomorphized subjects did not actually have feelings). I sang all songs without accompaniment by instruments or students. While karaoke tracks could have been used, they

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†Supplemental materials available at <http://asmscience.org/jmbe>

make it more difficult to eliminate instrumental sections or repeated choruses that strain student patience.

I displayed lyrics on a PowerPoint as I sang (Fig. 1). At various points, PowerPoint animations provided additional explanation of lyrics; red arrows marked these annotations so the animation was advanced at the proper time. Annotations consisted of jokes, definitions, or clarifications of the literal scientific meaning of metaphors. These allowed me to sing without interruption while still providing context and connections to students.

Some instructors may choose to find songs online, then perform them live or play recordings. These songs could be visually presented in the same way. The annotations can

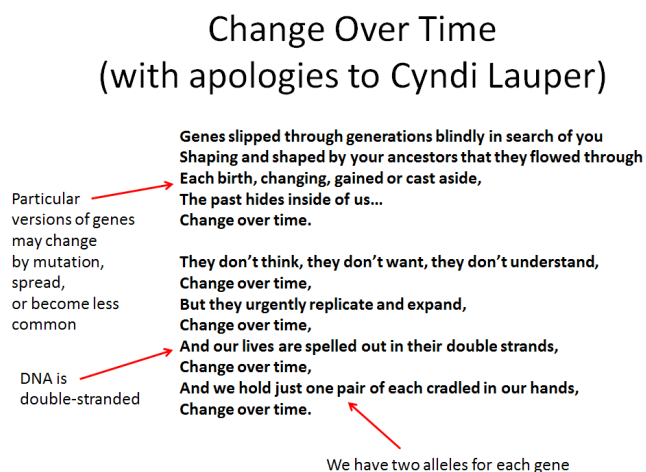


FIGURE 1. Visual presentation for “Change Over Time,” a parody of Cyndi Lauper’s “Time After Time.” Red arrows are markers that remind the instructor to advance the animation and display annotations.

tailor the content to the instructor’s class by emphasizing relevant points.

## CONCLUSION

The students appreciated the songs for several reasons (Figs. 2 and SI, Table SI). More than 90% agreed that the songs helped them refocus their attention, made them more engaged in the class, and were an effective use of class time. Engagement benefits may come from altering student perceptions of the instructor, relieving stress, or allowing students to see that science can be fun.

Approximately 70% said the songs were useful to them, a similar proportion as said the songs helped them understand the material (Fig. 2). Only 57% said the songs helped them memorize terms, perhaps because conceptual (rather than vocabulary-rich) songs were used. Familiarity of songs was important, as it was referenced by 12.7% of students in responses to open-ended questions, despite the lack of survey questions addressing familiarity.

Presentation matters. More than 90% of students found both lyrics and annotations useful (Fig. 2). The lyrics to songs are often misunderstood, and showing the lyrics may help students understand the message more than elaborate music videos (3). Annotations, a unique aspect of my approach, help clarify and direct students to more important points.

Students like hearing songs they know, especially when sung by their instructor. A great voice is not required; some students praised my voice while others said I went flat or needed singing lessons. Ability to play an instrument is not required (though 6.3% of students requested accompaniment in the open-ended responses). Nor does one need to pull off “cool”; one student responded “Sometimes it gets awkward” as both a strength and weakness of the approach.

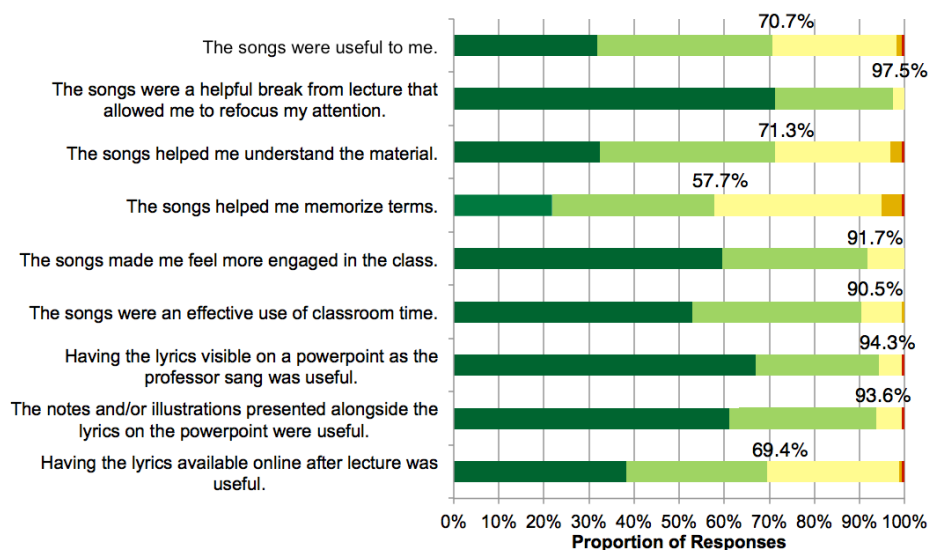


FIGURE 2. Combined survey responses from both classes. The proportion of “Strongly agree” responses are in dark green, “Agree” in light green, “Neither agree nor disagree” in yellow, “Disagree” in orange, and “Strongly disagree” in red. The proportion strongly agreeing or agreeing is marked above each bar.  $n=156-157$ .

A student who feels just a little awkward is a student who is paying attention.

### SUPPLEMENTAL MATERIALS

Appendix 1: Songs  
Appendix 2: Assessment

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