

In the format provided by the authors and unedited.

Embedding academic and professional skills training with experimental-design chalk talks

Ronald J. Heustis^{1,2*}, Madhvi J. Venkatesh ¹, Johanna L. Gutlerner^{1,2} and Joseph J. Loparo ^{1*}

¹Department of Biological Chemistry and Molecular Pharmacology, Blavatnik Institute, Harvard Medical School, Boston, MA, USA. ²Program in Graduate Education, Harvard Medical School, Boston, MA, USA. *e-mail: ronald_heustis@hms.harvard.edu; joseph_loparo@hms.harvard.edu

Embedding academic and professional skills training with experimental design chalk talks

Ronald J. Heustis^{1,2*}, Madhvi J. Venkatesh¹, Johanna L. Gutlerner^{1,2} and Joseph J. Loparo^{1*}

*¹Department of Biological Chemistry and Molecular Pharmacology, Blavatnik Institute, Harvard Medical School, Boston, MA, USA. ²Program in Graduate Education, Harvard Medical School, Boston, MA, USA.
e-mail: ronald_heustis@hms.harvard.edu and joseph_loparo@hms.harvard.edu*

Supplementary Data

Sample Video 1. A “good” chalk talk presentation based on the sample experimental design question (Figure 2) https://youtu.be/YoIh_FVkfGw

Sample Video 2. A “great” chalk talk presentation based on the sample experimental design question (Figure 2) <https://youtu.be/cvi6IEHKHRE>

Supplementary Note 1. Annotated guide highlighting key differences between the two sample videos (below).

BACKGROUND

These videos are meant to be an illustration of the differences between chalk talks that generally get the right answer (what we call a “good” chalk talk) and chalk talks that show a superior depth of understanding (what we call a “great” chalk talk). In this document, we have included a description that highlights the key differences in these two videos and how they can apply to your own chalk talks. We hope that you will all be able to deliver chalk talks with the level of sophistication and detail included in the “great” chalk talk.

For this example, we made the example question slightly less involved than the actual experimental design questions that you will encounter. Therefore, the videos are shorter than what you would expect to present in your chalk talk assignments, but still include all the necessary components.

EVALUATION OF THE SAMPLE EXPERIMENTAL DESIGN CHALK TALK VIDEOS

Motivation

In both videos, Kate explains the hypothesis that she will be trying to address in her presentation and gives some background about the protein. In the great talk, she mentions the additional detail that protein X is known to have ATPase activity – a piece of background that will become relevant later in the presentation.

Kate explains the importance of studying NHEJ in both videos. However, she more clearly describes the importance of studying it in the presence of nucleosomes in the great chalk talk by explaining that chromatin (nucleosome bound DNA) is the natural state of DNA.

In your presentations, you should be sure to include details of the background that are relevant to your experimental design. These may include things like specific binding partners or additional functionalities of a protein.

Method

In both videos, Kate describes the ensemble end joining assay that will be used to determine whether NHEJ is occurring under different conditions. However, when describing how she will use this assay in her design, she includes the following additional details in the great video: 1) nucleosomes can be assembled at the nucleotide positioning sequences using a salt dialysis gradient; 2) that using a cell extract is an alternative to using a reconstituted system for this assay, but it a poorer alternative because it may introduce confounding components that duplicate functions of protein X.

In your talks, give a brief explanation of the practical implementation of each of the main steps that would be carried out in your experiment (ie. Kate mentions that EtBr or Sybr Gold will be used for visualizing DNA on a gel). Remember to discuss alternative ways that you could go about the experiment and how those alternatives compare to your selected method.

Results and Interpretation

While both videos show the results that would be expected if the hypothesis is correct, there are some factors that distinguish the great chalk talk. When Kate discusses the results of the ensemble end joining assay in the great chalk talk, she displays a more sophisticated understanding of the technique by discussing the possibility that multimers would be formed during the assay. In that video, she also labels the various bands on the gels based on their position as linear, circular, or multimer and indicates that progression from left to right would be over time once reconstituted NHEJ factors are added. In the great talk, Kate also mentions a possible reason why circularization might be observed in the presence of nucleosomes (improper nucleosome assembly). In the case that this alternate result is observed, she explains that an MNase digest to determine whether the nucleosomes are correctly assembled.

In your presentations, you should strive to articulate possible alternate results that may be observed and they may occur. You should also try to explain how you may be able to better understand alternate results or distinguish between alternate possibilities that may lead to the same observed result. In addition, please be sure to label graphs and gels so that we can understand the different conditions that you are trying to depict.

Controls

In both videos, Kate mentions that the initial experiment with adding NHEJ to a linear sequence of DNA can demonstrate that the assay is working, but she only specifies that this is the positive control in the great talk. She also addresses the potential for a negative control and explains why it is unnecessary only in the great talk.

You should specify the positive and negative (and if necessary, system/reagent controls) that are necessary for your experiments. It is important to be able to articulate the type of control and explain either its purpose in the experiment (what it is supposed to verify) or why it is not necessary.

Presentation Style and Delivery

In both presentations, Kate spaces out the depictions of the background, different experimental scenarios, and results on the board so that it does not become too cluttered. She erases the board in the middle of her presentation to prevent clutter of text and writing and to separate different the parts of her talk. Kate alternates between facing the audience and writing on the board and does not rely too heavily on notes.

Make sure that you have a clear flow of your presentation, manage the space on the board, speak clearly, and talk to the audience (not only to the board or your notes). We strongly encourage you to practice your chalk talk before delivering it. You may use notes, but do not rely too heavily on them.