

Alice Final Project: The Gram Stain

One of the most important diagnostic stains in microbiology is the gram reaction. It is widely practiced as a first step in the clinical laboratory, and is one of the first things microbiology students learn about the cellular structure of microbes. It is easy to do, and yields pretty impressive results. For my final Alice project I chose to create an interactive simulation of the gram reaction that could be used by students who are learning microbiology but don't have access to a lab.

To guide students through the gram reaction is Dr. Hans Christian Gram, the 18th century pioneer of the staining procedure. Even though he didn't know why some bacteria were gram positive and some were gram negative, his contribution to microbiology is substantial. He first guides students through 5 steps of the gram stain: smearing the slide with bacteria, staining with crystal violet, adding iodine, destaining with ethanol, and counterstaining with saffranin. He explains why the gram stain the students perform is gram negative, and he goes on to complete a gram positive stain himself.

Instead of writing out a very detailed storyboard I wrote a basic outline, and perfected the details of my program in the actual code. Here is the storyboard I used to write the code for Dr. Gram's gram stain tutorial:

- Dr. Gram introduces himself and the technique he will demonstrate.
- He instructs the students to smear gram negative bacteria on the slide.
- He instructs students to stain the slide with crystal violet.
- He instructs students to add iodine to the slide.
- He instructs students to decolorize the slide with ethanol.
- He instructs students to counterstain with saffranin.
- He explains why the gram negative bacteria stained red.
- He performs a gram stain himself with gram positive bacteria.
- He explains why the gram positive bacteria stained purple.
- He thanks the students, says good-bye, and walks off to his next experiment.

I tried very hard to adhere to the parameters of the assignment. Using comments in the code while I was writing it helped me keep organized. My program contains two scenes, one with a gram positive stain, and one with a gram negative stain. I didn't make all the scenery change between these scenes, only the bacterial smear on the slide disappear. I used four objects for the dye pots, and I considered Dr. Gram, the syringe used for transferring dye, and the bacterial smears all to be characters. Hey, microbes have feelings too! Dr. Gram's lines that he says are all *do in order* statements, and the sounds that accompany application of stain to the slide are *do together* statements. I used *if/else* statements to coordinate Dr. Gram's instructions with the actions taken by the student (pressing 1-6 to interactively "perform" a gram stain). The *if/else* statements I used also make use of functions because they depend on the color of the smear. I used a *loop* statement to make Dr. Gram walk off screen at the end of the tutorial. I created class methods to make the smear respond to the addition of dye from the syringe, and I created world methods to perform the gram positive stain, the gram negative stain, and the actual tutorial that made use of these stains. The only thing I'm not sure about is an expression with $+ - * /$. I wasn't sure how to incorporate this into my program, but when I was setting up the objects I used $*$ to re-size things a lot, does this count?

Working with Alice I learned that programming is a lot of attention to detail, but can be extremely rewarding when your program works. Because of time and available image restraints I couldn't make this program as smooth, detailed, and interactive as I'd have liked too, but I was able to work within the confines of Alice. I feel confident that I could learn more complex coding in the future because of my experience with Alice.