Subject Matter Knowledge

Part A:

A good experiment should rely on the scientific method that studies, investigates and provides answers for questions about our natural world. The experiment should be set in a controlled environment and have a testable hypothesis. There should be measurable variables, dependent variables, and independent variables. In order to form a good experiment, one should ask a reproducible and testable question about something they are curious about. In one particular experiment I tested whether certain styles of cheeses had an effect on E. coli growth.

When you generate an idea, it should be in a topic interesting to you so that you can look at the problem from many perspectives. It is also a good idea to get peer feedback on your idea. I enjoy making cheese with experts, developing a palette for certain cheeses and selling cheese part-time. Since I am constantly diligent in food safety practices, this was a way to understand the natural world around me.

Background research may be needed to help narrow your ideas down to a few specific hypotheses. Once you have narrowed down your search it helps to understand the variables that you would like to test and measure. Some hypotheses require certain lab equipment to test or do not have testable data. These are not good hypotheses. For example, it may be very difficult to test the energy in car crashes if you do not have the materials, oversight, and safety procedures in place to do so.

Once you have decided on a specific hypothesis, decide on the independent and dependent variables that need to be tested. It is important to review your background research to find out if these variables have already been studied or if a previous experiment will add value to yours. In my case, specific cheeses had been studied but not compared. I also had difficulty getting specifics about some cheeses because the recipes are guarded secrets. I decided to compare styles and variations of each cheese chosen so I would have a better understanding of each dependent variable.

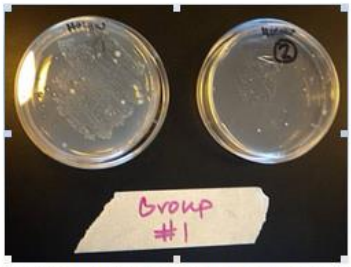
1	Manchego- 6 months raw milk
2	Manchego- 6 months pasteurized milk
3	Emmenthaler- aged 180 days
4	Emmenthaler- aged 3 months
5	Gruyere cave aged
6	Gruyere non cave aged
7	Blue Cheese- Mountain (Piccante)
8	Blue Cheese- Dolce
9	Control Plate

Fig. 1: Compared Cheeses

In planning the specific experiment you should first think about what independent variable was stated in your hypothesis. What is it that you would like to know? The experiment should have exact and reproducible step-by-step instructions. This write-up should also include safety instructions and any ethical issues. For cheeses, I had to make sure that penicillin did not contaminate the lab equipment. If the experiment has a possibility of contamination the instructions must address these issues as well. Penicillin loves to grow on any cheese and that meant I had to make sure that the samples were not contaminated with penicillin as well. Each sample of cheese had to be taken in the exact same way and incubated for *E. coli* for the exact length of time. These specifics help ensure that the experiments are valid. In my experiment I plated each cheese sample on an agar plate and also plated them on a 3M *E. coli* plate. By comparing the growth I was able to tell whether the colonies grown were *E. coli* or not. This was essential in the next step of my experiment.

Collecting and organizing data correctly is the only way to be sure that your experiment is reproducible. Just counting colonies on my sample plates would have led to

inaccurate results. While I observed many colonies I was sure that they were not *E. coli* as all of my comparative plates came out negative for *E. coli*.



Group 1: Manchego style cheeses comparison test
1. Manchego 6 month raw milk
2. Manchego 6 month pasteurized milk

Interpreting data is very important because it states what you found out about your hypothesis. You may reject or accept the hypothesis based on the data. There may not be enough and the results may warrant a different experiment. My *E. coli* experiment resulted in negative *E. coli* in the samples taken. This meant that the place I bought the cheese from was following sanitary measures. This was great news for the cheese suppliers but not for my experiment. While I could not reach a definite conclusion I did get results. If I were to continue to follow this data I would create an additional experiment that tested cheeses with introduced *E. coli*. In order to communicate these correctly you will need to write the results up in a way that your peers will understand them. This means that you will need to follow a specific format and have works cited.

Part B:

For my specific experiment it was difficult to draw a specific conclusion based on my results. A strong scientific hypothesis must have reproducible and accurate results.

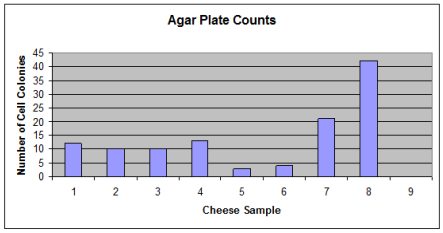


Fig. 3: Agar Plate Counts

The results of the experiment were charted and graphed. More evidence was needed to make a conclusion as there were few samples taken. If the independent and dependent variables were found to be directly linked a linear correlation test could be used. Your null and alternative hypotheses should be determined as well as your significance level. While your chosen significant level may vary the percentage chosen will depend on context. The standard significance level is usually 5%. For a linear correlation the Pearson R value would be found. Next, the t-value would be found using the Pearson R value. For my experiment is considered two tailed and this would be used to calculate the P-value from the Pearson R and the significance level. If the critical value is less than the significance level the null hypothesis would be rejected. If the critical value is higher than the significance level than the null hypothesis would be accepted.