

Detecting Genetically Modified Organisms In  
Food

Sydney Jacobsen

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## **Introduction:**

A major dilemma in the biology and food world today is the issue of genetically modified organisms (GMOs) also known as bio-engineered. One of the issues societies misunderstanding or lack of understanding of what they actually are. The International Federation of Infection Control (IFIC) performed an online survey that questioned how much people actually knew about GMO's. They said that the greatest portion of the responders (29%) said they knew some about GMO's while the second largest percentage, at 21%, said they knew very little about the subject (Food Insight). This experiment factors into another survey done by the IFIC determining how concerned people are of GMOs leading to human health problems. The largest percentage of 45% said that they are very concerned. That is almost half of the responders worried about GMOs affect on humans (IFIC). That brings into question, how many of those respondents actually knew enough about GMOs to give a fair and educated answer? Another online survey by Mintel and the Specialty Food Association determined some opinions about GMOs. This survey brings up the controversial issue of labeling GMO products. 34% of the responders said that GMOs are never okay to be used in any foods or drinks, 32% said that GMOs need more testing before they are able to be used in products, and 14% said that they are able to be used in food and drinks, but need to be labeled (Specialty Food Association). This survey, like the second one, brings into question how well informed is the public on what there is to know about GMOs. For this experiment, it was hypothesised that if a product contains corn/soy, then genetically modified organisms will be able to be detected. In order to test this hypothesis, the foods DNA was extracted, then a Polymerase Chain Reaction test was performed on both the

food DNA and plant DNA, which acted as the control. Then electrophoresis was performed to visualize the the DNA based off of the size of the DNA.

### **Methods:**

To start off the experiments, each group chose a food item to test for GMO products. The five samples were organic corn, a meatball, corn puffs, corn muffin mix, corn tortilla chips, a control negative GMO product, and a control positive GMO product. Each substance was mixed with 5 ml of water, mixed, and then another 5 ml of water was added. 50 ml of the food slurry was then placed into two screw capture containing InstaGene matrix and boiled for 5 minutes. After being boiled, all that is left should be the food sample's DNA. Then a Polymerase Chain Reaction (PCR) test will be done for two master mixes: one GMO mast mix(in order to determine GMOs) and a plant master mix(in order to make sure the DNA was extracted properly/control). Two tubes per substance were labeled, one with a G(GMO master mix) and the other with a P(plant master mix/control). Using a fresh tip each time, 20 ml of the indicated master mix was placed into the corresponding tube using a pipet. Then 20 ml of the samples DNA was added into each tube and placed into the thermal cycler. Gel electrophoresis was performed to see the DNA based on its size. 10 ml of a loading dye was added to the PCR and then 15ml of the samples DNA onto the 3% agarose. The gel was then run at 17 volts for 25 minutes. Then a ultraviolet light was shone on the gel in order to see the highlighting of the solutions.

### **Results and Discussion:**

In the hypothesis, it was stated that if a product contained soy/corn, then GMO would be able to be detected; the data did not support the prediction. It is stated that, 80% of the worlds

corn and 94% of the world's soy are genetically modified, and therefore the assumption was made that all of these popular products contain corn and soy would contain GMOs (US Department of Agriculture). Since the plant master mix test was a control to make sure the DNA was extracted correctly from the samples, in each slot for each sample, there should have been colored dye. However, as seen in **Figure 1**, sample 5 (the corn muffin mix) did not show any trace. This means that something went wrong in the testing and the DNA was not properly extracted and therefore is not reliable. As seen in both **Figure 1 and 2**, samples 1 and 9 highlighted for all of the base pair sizes. These samples were the positive GMO controls and were used to compare the other samples to. The same goes for sample 8, the negative GMO control, however, in **Figure 2**, where there was supposed to be no highlighting for any length of base pairs, it was highlighted right around 200 bp. Some experimental errors most likely occurred in the electrophoresis stage where the master mix and DNA solution had to be placed perfectly into the gel without withdrawing any substance. This action took a very steady hand and could have easily been botched. Another could be the misunderstanding of the use of the pipet and confusion of the stops and when to release which would alter the amount of substance that was supposed to be released in the tubes or gel. This experiment prompts the question, what types of products that contain corn do not have GMOs in them? In the future, this experiment could be tested with products that do not explicitly say whether they are organic on the packaging or not so that they do not influence the experimenter. Also maybe being more careful and attentive to the substances and making sure the right amounts are placed where they are supposed to go.

## Resources:

Food Insight, & IFIC. (n.d.). How would you rate your own understanding of genetically modified organisms (GMOs)?. In Statista - The Statistics Portal. Retrieved November 6, 2018, from

<https://www.statista.com/statistics/603970/us-consumer-perceptions-regarding-gmos/>.

IFIC, & Food Insight. (n.d.). Share of consumers who believe genetically modified (GM) food will lead to human health problems for the population in the United States as of 2018. In Statista - The Statistics Portal. Retrieved November 6, 2018, from

<https://www.statista.com/statistics/741958/us-consumers-who-think-gm-will-create-health-problems/>.

Specialty Food Association. (n.d.). Opinions about GMO's among specialty food consumers in the United States in 2016, by generation. In Statista - The Statistics Portal. Retrieved November 6, 2018, from

<https://www.statista.com/statistics/633205/opinions-about-gmos-among-specialty-food-consumers-by-generation/>.

US Department of Agriculture. (n.d.). Percentage of genetically modified crops in the U.S. in 1997 and 2018, by type (as percent of total acreage). In *Statista - The Statistics Portal*. Retrieved November 7, 2018, from

<https://www.statista.com/statistics/217108/level-of-genetically-modified-crops-in-the-us/>.

**Figures and Tables**

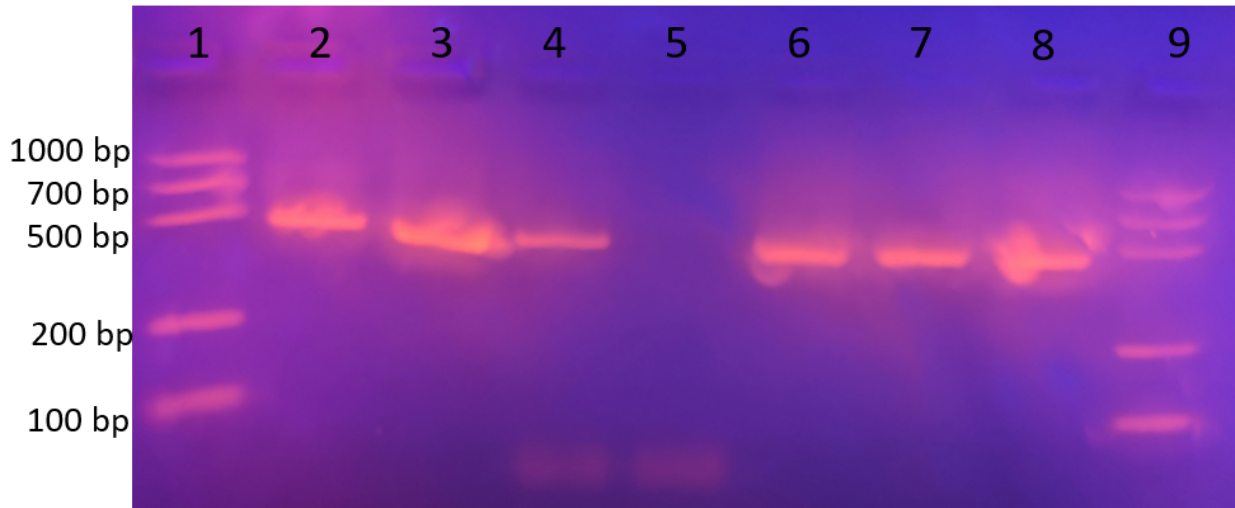


Figure 1: This is the electrophoresis of the plant gene primers and PMM DNA polymerase.

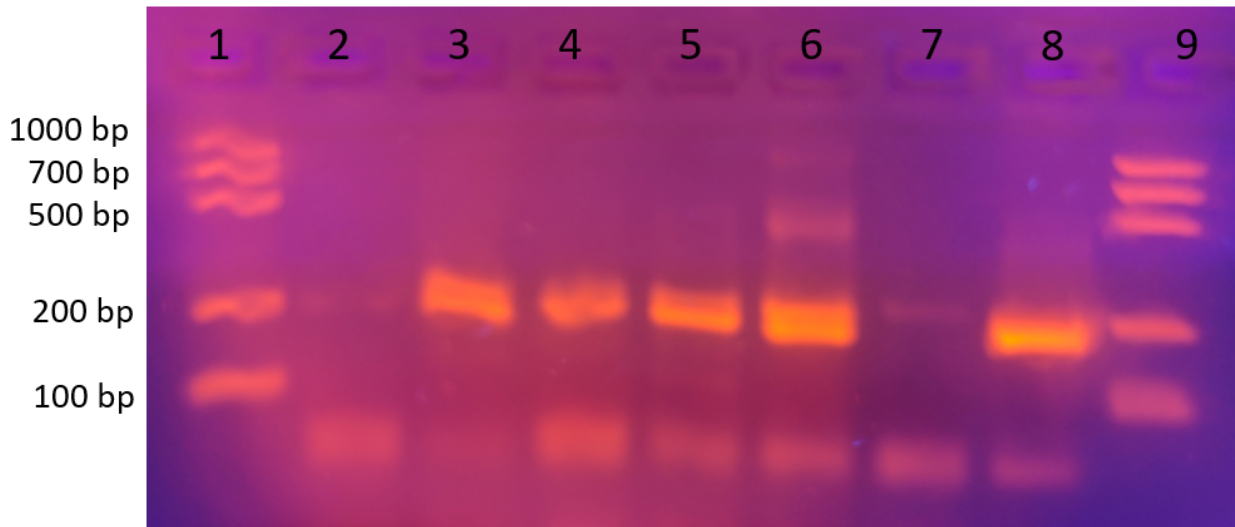


Figure 2: This is the electrophoresis of GMO Primers and GMM DNA polymerase.

Sample	Observed GMM	Expected GMM	Observed PMM	Expected PMM
<b>1.) Positive GMO Control</b>	Yes	Yes	Yes	Yes
<b>2.) Organic Corn</b>	No	No	Yes	Yes
<b>3.) Meatball</b>	Yes	Yes	Yes	Yes
<b>4.) Corn Puff</b>	Yes	Yes	Yes	Yes

<b>5.) Corn Muffin Mix</b>	No	Yes	No	Yes
<b>6.) Corn Tortilla Chips</b>	Yes	Yes	Yes	Yes
<b>7.) Negative GMO Control</b>	No	No	Yes	Yes
<b>8.) Positive GMO Control</b>	Yes	Yes	Yes	Yes

Table 1: This table shows the brief predictions versus the results of the electrophoresis.