



Beyond and Impossible Burger: Is It Really A Meat-Free Burger?

Funded by the
Thompson Family
Foundation

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Abstract

The purpose of the project is to see if the Impossible Burger is really what it claims to be, which is a meat-free burger. For this experiment, we decided to test three different burger meats offered at supermarkets, in order to have some controls which included a positive control, the beef patty, a negative control, the beyond burger, and finally the Impossible Burger. Once the DNA was extracted we were able to figure out what was in each DNA sample. Our hypothesis was that the beef burgers will come back positive for animal DNA and the other two burgers will strictly come back with only plant DNA. Our objective was to extract the DNA from these burgers and sequence them to find out what is really in the “meat” that these companies are selling. We will be using a DNA extraction method and an amplification of the DNA to get proper results. After all the extraction, we were only able to find DNA for plants. The plant came back positive in all the different burgers. This could mean that there are plants used as ingredients in many types of burgers, not just veggie, or impossible burgers.

Introduction

Is the Impossible and Beyond Burger really a meat-free burger? To answer this question we took to comparing three different burgers all sold at a local supermarket. The burgers we tested on were: the Impossible Burger, the Beyond burger and a regular beef burger. With this, we compared the DNA samples of each patty, once extracted, and really looked into the specific species present in each patty. Eight meat samples of each burger were collected, only when the patty was raw (you would not want to cook before collecting samples). This was done so that there was a little to no chance of getting no data back from any of the patties. The objective of this experiment is to clearly answer the driving question which is, Is the Impossible and Beyond Burger really a completely meat-free burger? And by extracting DNA and having some controlled variable to compare the species in all three specimens we have been able to answer that question. Our hypothesis was that the beef patty would contain animal DNA and the Beyond/Impossible burger would contain plant DNA.



The “Impossible Burger”



The “Beyond Burger:

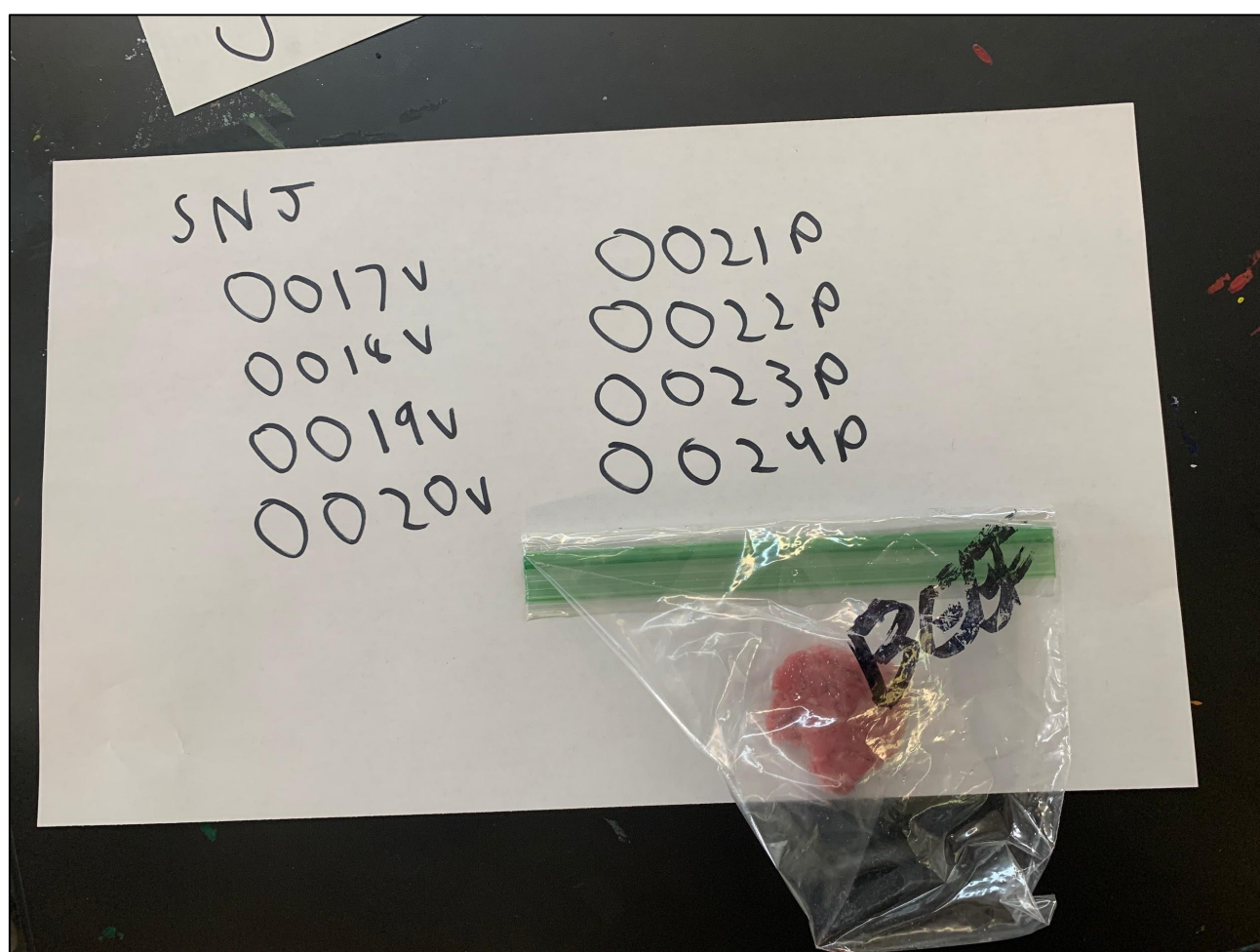


The “Standard Burger”: Our Beef Control

Materials & Methods

- 3 burgers from supermarket:
 - Impossible Burger
 - Beyond Burger
 - Beef Burger
- Tubes
- Tweezers
- PCR Machine
- Distilled Water
- Wash Buffer
- Lysis Solution
- Silica Resin
- Vortex
- Centrifuge
- Pipet
- Incubator
- Gel Electrophoresis Materials

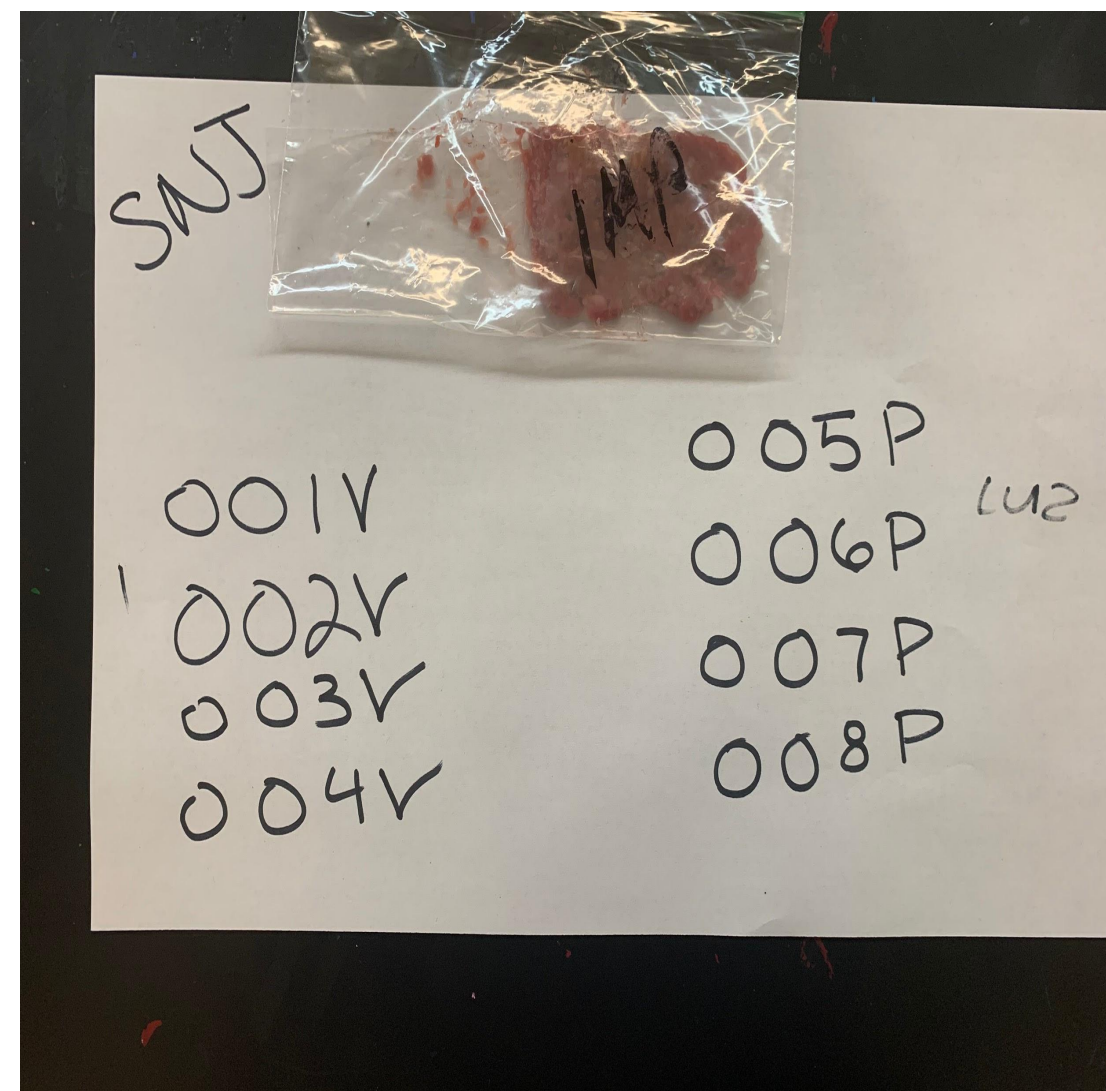
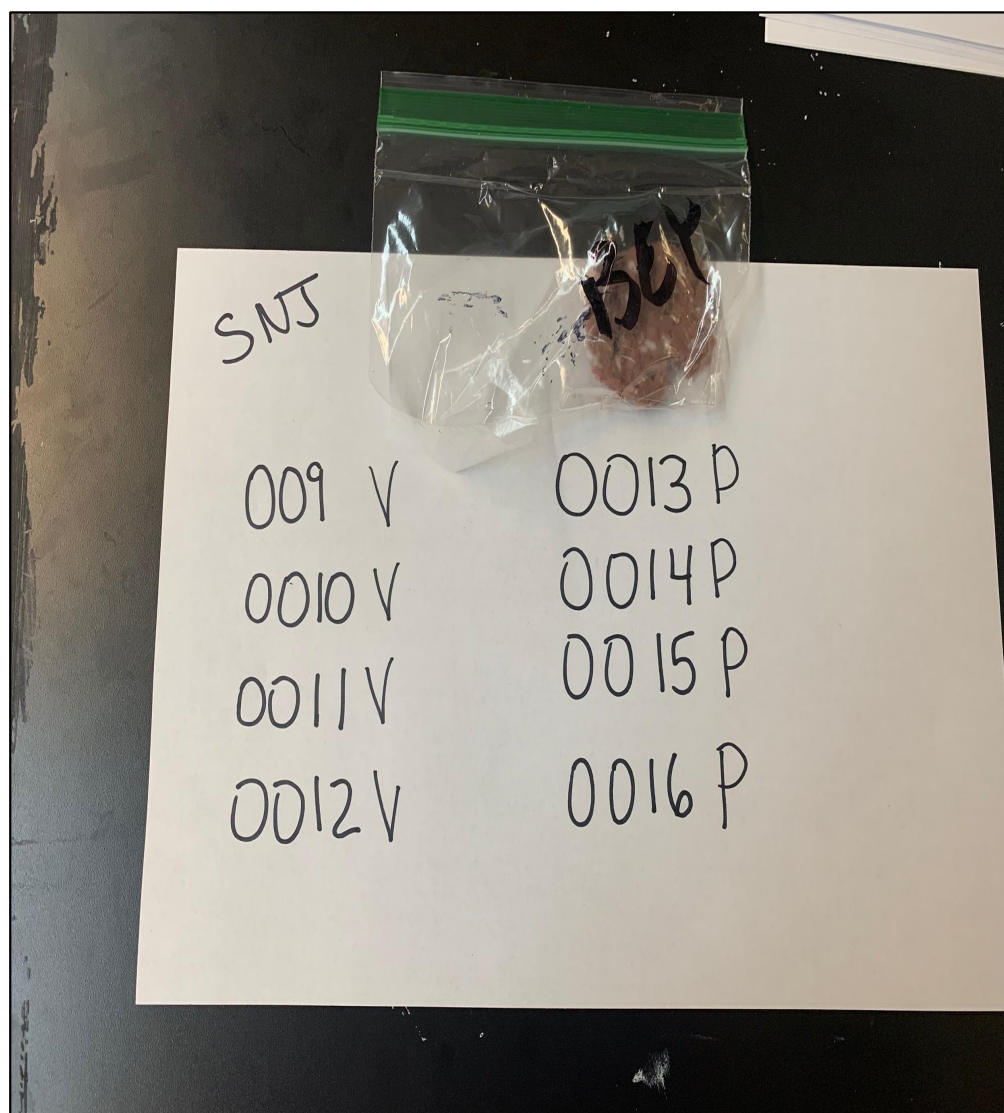
Collecting Samples: In order to find out if the Impossible Burger contains meat, we had to go to supermarkets and purchase our positive control (a regular meat hamburger) and the independent variable (the Impossible Burger and beyond burger). We purchased raw meat in its original packaging so that there would not be any potential cross contamination from any outside organisms. We then had to get very small samples from the regular hamburger and the Beyond/Impossible burger. We placed those samples in 24 clean test tubes and labeled them SNJ-001 through SNJ-024.



DNA Extraction/Isolation:For the DNA extraction, we followed the entire DNA isolation protocol as prescribed by the DNA Learning Center.

Amplify DNA: After we got the DNA, the samples need to be run through PCR. Polymerase chain reaction is a technique that can make multiple copies of DNA. After this is done, we used gel electrophoresis to analyze the DNA samples. This is a crucial step because it validates if we did the DNA extraction correctly and whether the DNA is even usable. After this process is finished, we send the results to a lab where the DNA sequence will be determined and analyzed. We can then view the sequences on DNA subway and see if the Beyond/Impossible Burger really contains meat.

Sample Number	Species Expected / Location	Species Found	e Value
SNJ 001-v	Impossible	N/A	N/A
SNJ 002-v	Impossible	N/A	N/A
SNJ 003-v	Impossible	N/A	N/A
SNJ 004-v	Impossible	N/A	N/A
SNJ 005-p	Impossible	<i>Glycine max - Soybean</i>	0.0
SNJ 006-p	Impossible	N/A	N/A
SNJ 007-p	Impossible	N/A	N/A
SNJ 008-p	Impossible	N/A	N/A
SNJ 009-v	Beyond	N/A	N/A
SNJ 010-v	Beyond	N/A	N/A
SNJ 011-v	Beyond	N/A	N/A
SNJ 012-v	Beyond	N/A	N/A
SNJ 013-p	Beyond	<i>Pisum sativum - Peas</i>	0.0
SNJ 014-p	Beyond	<i>Pisum sativum subsp. Sativum - Peas</i>	0.0
SNJ 015-p	Beyond	<i>Pisum sativum - Peas</i>	0.0
SNJ 016-p	Beyond	N/A	N/A
SNJ 017-v	Beef	N/A	N/A
SNJ 018-v	Beef	N/A	N/A
SNJ 019-v	Beef	N/A	N/A
SNJ 020-v	Beef	N/A	N/A
SNJ 021-p	Beef	N/A	N/A
SNJ 022-p	Beef	<i>Pisum sativum - Peas</i>	0.0
SNJ023-p	Beef	<i>Epipremnum aureum - Devil's Ivy</i>	6e-152
SNJ024-p	Beef	N/A	N/A



Discussion

Our results answer our question by allowing us to see what burgers are actually made out of, and if it is what the packaging or company claims.

The meaning behind the data that we found is that most of the patties came out positive for plant DNA, which is what we were expecting. We found plenty of peas, and a single leafy plant. We also found a beef burger that came back with positive soybean DNA. We were expecting for this to come out positive for cow DNA but instead we just got a relative of peas. We can clearly see that the Impossible Burger and the Beyond burger did not have any animal DNA and only plant DNA, which is what we expected. However, this could be questionable since our positive control, the beef patty, did not come back positive for animal DNA at all. This finding could have been an experimental error when taking samples or whilst carrying out the procedure. This may be a possibility but most of the DNA that came back positive for plants like peas were very strong. Before building on our findings, it is important to make sure of them. There may have been a few mistakes with the extraction and sample collecting that could be improved. For example, we could have possibly picked a part of the burger that looked seemingly more like meat instead of plant, and we could have also done more samples. Moving forward, it would be a good idea to use other veggie burger brands as well as beef burger brands to test the wide array of options in the supermarket that people may be buying everyday.

References

Cheeke, Peter. “Why Do People Become Vegans/Vegetarians? Survey Says All of the Above.” *Life at OSU, Oregon State University*, 5 Oct. 2017, <https://today.oregonstate.edu/archives/2011/aug/why-do-people-become-vegans-and-vegetarians-survey-says-%E2%80%93all-above>

Genetic Science Learning Center. (2018, October 23) How To Extract DNA From Anything Living. Retrieved November 07, 2018, from <https://learn.genetics.utah.edu/content/labs/extraction/howto/>

A Major Victory for the impossible burger, The Veggie ‘Meat’ that bleeds. Retrieved November 12th, 2018, from <https://www.wired.com/story/a-major-victory-for-the-impossible-burger/>

Menu • Bareburger. (n.d.). Retrieved November 12, 2018, from <https://www.bareburger.com/menu/>

Troitino, C. Impossible foods’ Bleeding burgers to make grocery store debut in 2019. Retrieved November 12, 2018, from <https://www.forbes.com/sites/christinatroitino/2018/11/08/impossible-foods-bleeding-burgers-to-make-grocery-store-debut-in-2019/#576c382c98ba>

What is PCR (polymerase chain reaction)? (2016, January 25). Retrieved November 12, 2018, from <https://www.yourgenome.org/facts/what-is-pcr-polymerase-chain-reaction>

Acknowledgements

Thank you to the Harlem DNA Lab and Cold Spring Harbor Laboratory