



# Mosquitoes and Disease In Brooklyn

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## Abstract

Mosquitoes are by far the most deadly animal on earth killing around 750,000 people every year. DNA barcoding will help us identify the different types of mosquitoes that live in our area, and which mosquitoes are prone to transmitting diseases. Mosquitoes can carry different diseases, such as the Zika Virus or Dengue Fever. There was only one mosquito found, carrying the West Nile disease. We found that only one species of mosquitoes that was collected in Brooklyn can disseminate disease, *Culex quinquefasciatus*. The *Culex quinquefasciatus* is the primary spreader of diseases like West Nile virus and Filariasis in India. This species can transmit several arboviral diseases in the South United States. The other mosquito samples that were collected were primarily harmless.

## Introduction

Out of the 3,000 species of mosquitoes in the world 173 of them call United States home. Our goal is to investigate which diseases carrying mosquitoes such as Zika virus, Malaria and West Nile virus, resides in Brooklyn NY. The viruses like Zika are transmitted through the bite of an infected mosquito (Zika Virus - Transmission and Risks). Most illnesses can only be transmitted by mosquitoes at temperatures between 61F to 100F (Zika: How Climate Change Could Spread Mosquito Diseases 2016). Climate change can cause mosquito diseases to take place where they usually don't exist (Mckenna 2017). You may have the potential range, but then there are other factors: socioeconomic conditions and the types of houses that interfere with these conditions (Zika: How Climate Change Could Spread Mosquito Diseases 2016).

## Materials and Methods

We collected 16 mosquitoes with a DNA trap in Brooklyn backyards. We then documented each sample, by taking a picture of each individual mosquito collected. In the first step of the lab, we did DNA extraction. In this step we took out DNA from the nucleus by adding lysis solution, which breaks open the outer membrane of the cell, thus releasing the DNA. We grinded a sample in lysis solution, added silica resin to bind the DNA, incubated the sample, centrifuged so that the matter can get divided based on density. We repeated this process and added wash buffer throughout the steps to remove excess protein. The second step of the lab was polymerase chain reaction. This is important because it copies DNA and through adding PCR reagents we can get the specific sample of DNA we need. The third step of the lab was gel electrophoresis. We sent the sequence found to Genspace.

## Results

One species we found that can transmit disease is *Culex quinquefasciatus*. This species can transmit several arboviral diseases in the South United States. The other species we found are mosquitoes that do not transmit disease. These species are *Culex territans*, *Cooperia*, *Oncophora*, *Mycetophila fungorum*, *Braconidae* sp., *Culex quinque*, *Chironomusharpi*, and *Chironomus flaviplumus*. *Psychodidae* is a fly that we thought was a mosquito but does not transmit any diseases.

Sample number	Location collected	Species name	DNA subway data	Transmittable diseases	Notes
PJG-002	Ditmas Park Brooklyn	<i>Psychodidae</i>	Bit Score:627 E-value:177 Mismatches:1	This species of flies does not transmit disease	It looks like a moth but its not its just a fly
PJG-003	Ditmas Park Brooklyn	<i>Culex quinquefasciatus</i>	bit level:1274 E-value:0.0 e level mismatches:1	Primary vector of several arboviral diseases in the Southern United States can be carrier of west Nile virus	They are commonly found in the southern part of the united states
PJG-004	New Utrecht Brooklyn	<i>Culex territans</i>	1135 bit score 0.0 e level	No transmissible disease	They are commonly found in farm ponds and roadside ditches.
PJG-006	New Utrecht Brooklyn	<i>Cooperia oncophora</i>	Bit Score: E-value:0.0 Mismatches:0	No transmissible disease	To many mis matches
PJG-007	New Utrecht Brooklyn	<i>Mycetophila fungorum</i>	Bit Score:1182 E-value:0.0 Mismatches:1	No transmissible disease	Mycetophila fungorum are found in the forest or the wooden areas.
PJG-008	New Utrecht Brooklyn	<i>Mycetophila fungorum</i>	Bit Score:1187 E-value:0.0 Mismatches:0	No transmissible disease	Mycetophila fungorum are found in the forest or the wooden areas.
PJG-009	New Utrecht Brooklyn	<i>Braconidae</i> sp.	Bit score:1187 1169 E value: 0.0 Mis-matches: 2	No transmissible disease	There was only 2 mis-matches
PJG-010	New Utrecht Brooklyn	<i>Culex quinque</i>	BitScore:121 3 E-value:0.0 Mismatches:6	No transmissible disease	Too many mismatches (6)
PJG-012	New Utrecht Brooklyn	<i>Culex territans</i>	Bit Score:1137 E-value:0.0 Mismatches:4	No transmissible disease	Had 4 mismatches
PJG-014	Bed-stuy brooklyn	<i>Chironomus harpi</i>	Bit Score:1187 E-value:0.0 Mismatches:0	No transmissible disease	Too many
PJG-015	Bed-stuy brooklyn	<i>Chironomus harpi</i>	Bit score: E level: Mismatches:	No transmissible disease	Too much mismatches
PJG-016-F	Bed-stuy brooklyn	<i>Aedes albopictus</i>	Bit Score: 1159 E-value:0.0 Mismatches:4	No transmissible disease	↑
PJG-017	Bed-stuy brooklyn	<i>Chironomus flaviplumus</i>	Bit Score: E-value: Mismatches:	No transmissible disease	Too much mismatches
PJG-018	Bed-stuy brooklyn	<i>Chironomus incertipenis</i>	Bit Score: E-value: Mismatches:	No transmissible disease	Too much mismatches
PJG-019	Bed-stuy brooklyn	<i>Chironomus quinquefasciatus</i>	Bit Score:1187 E-value:0.0 Mismatches:0	No transmissible disease	
PJG-020	Bed-stuy Brooklyn	<i>Mycetophila fungorum</i>	Bit Score:1187 E-value:0.0 Mismatches:0	No transmissible disease	

## Discussion

The goal of the project was to find out what kind of species of mosquitoes live in New York. We found that only one species of mosquitoes that we collected in Brooklyn can transmit a disease, *Culex quinquefasciatus*. The *Culex quinquefasciatus* is the primary spreader of diseases like West Nile virus and filariasis in India. *Culex quinquefasciatus* thrives in places with rapid urbanization and industrialization without adequate drainage facilities. In the day *Culex quinquefasciatus* can be hiding in places indoors like walls of homes and dark corners of closets/cupboards (Encyclopedia of Life).

Sample PJG-002 *Psychodidae* is a weird creature, it seems to resemble a moth but it's just a fly. Even though *Psychodidae* isn't a mosquito it is still important to our research to know what other species of insect live in Brooklyn (Encyclopedia of Life).

Species PJG 004-020 and PJG 016 aren't as special they don't seem to carry and diseases but are still important because we can know that they do in fact live in Brooklyn (Encyclopedia of Life).

This is important because if a species of mosquitoes that lives in brooklyn does come to carry a disease we would know to vaccinate people for that disease. Most illnesses can only be transmitted by mosquitoes at temperatures between 61F° to 100F°.

## References

- Diseases Transmitted by Mosquitoes. (n.d.). Retrieved from <http://npic.orst.edu/pest/mosquito/diseases.html>
- Encyclopedia of Life. Retrieved from: [eol.org](http://eol.org)
- Mckenna, M. (2017, April 20). Why the Menace of Mosquitoes Will Only Get Worse. Retrieved from [https://www.nytimes.com/2017/04/20/magazine/why-the-menace-of-mosquitoes-will-only-get-worse.html?\\_r=0](https://www.nytimes.com/2017/04/20/magazine/why-the-menace-of-mosquitoes-will-only-get-worse.html?_r=0)
- Zika: How Climate Change Could Spread Mosquito Diseases. (2016, January 31). Retrieved from <http://time.com/4200851/climate-change-mosquitoes-zika/>
- Zika Virus - Transmission and Risks. (2017, October 4). Retrieved from <https://www.cdc.gov/zika/transmission/index.htm>
- <http://www1.nyc.gov/site/doh/health/health-topics/mosquitoes.page>