

# Echinacea—A Potential Supplement to Treat Pain in Women with HPV-induced Cervical Cancer

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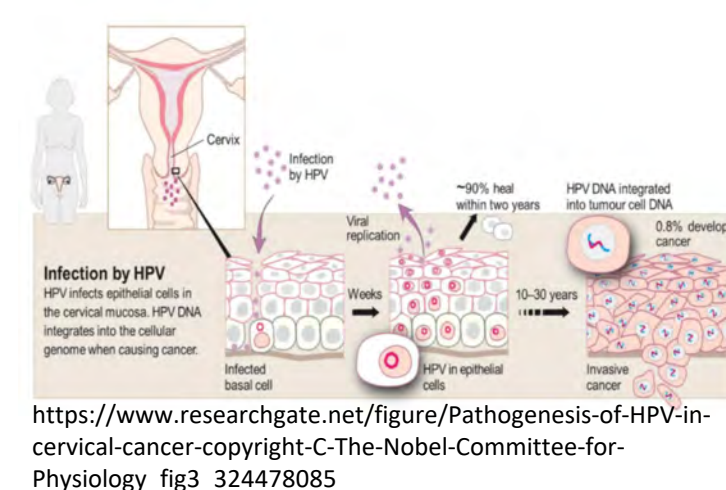
## Abstract

This year, it was estimated that cervical cancer would affect about 13,800 women in the United States (“Cervical Cancer”, 2020). This number is likely to be higher in developing countries where women do not readily have access to PAP tests or HPV vaccines. Various strains of the human papillomavirus (HPV) play a primary role in causing most cervical cancers. This virus contains two oncoproteins known as E6 and E7 which turn off some tumor suppressor genes, such as p53 and Rb, which eventually lead to cervical cancer (Salcedo et. al., 2003). Previous research has found that echinacea, an herb from the daisy family, contains anti-inflammatory properties. Inflammation typically causes pain due to the swelling of tissue that push on nerve endings (Omoigui, 2007). Cervical cancer that has advanced beyond the first stage of the disease may cause many painful symptoms such as pelvic/back pain, leg swelling, cervicitis (inflammation of the cervix), or pain/discomfort during sexual intercourse (“Cervical Cancer”, 2020; Mirzaie-Kashani et.al., 2014). The goal of this experiment is to determine whether echinacea could be a potential supplement to help treat painful symptoms in women with cervical cancer. In order to test this, *Drosophila Melanogaster*, common models for cancer research, were utilized because humans have genes associated with diseases that have homologs in fruit flies (Mirzoyan et. al., 2019). In this experiment, wild-type and Rb mutant (missing the Rb gene) adult *Drosophila* that were fed food with and without echinacea underwent a pain-sensitivity assay within a crafted heat-sensitivity chamber.

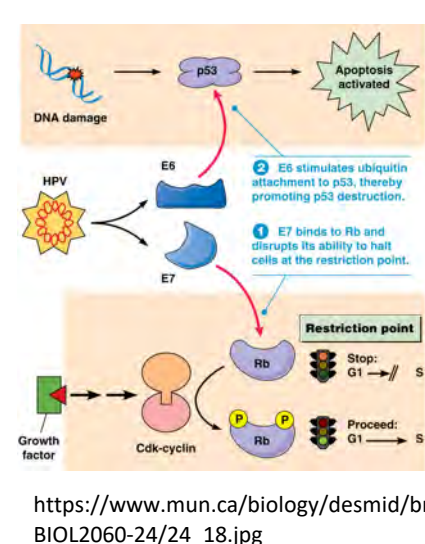
## Background

a) Cervical cancer is primarily caused by HPV and occurs within the walls of the cervix b) The Rb gene is a tumor suppressor. It does this by regulating the cell cycle by inhibiting transcription factors and inducing apoptosis in cancer cells. c) Echinacea is an herb in the daisy family. This supplement has many health benefits such as reducing inflammation and improving immunity. This is because of the many compounds that it contains such as antioxidants, alkaloids, and polysaccharides.

## a) Cervical Cancer



## b) Rb Gene



## c) Echinacea



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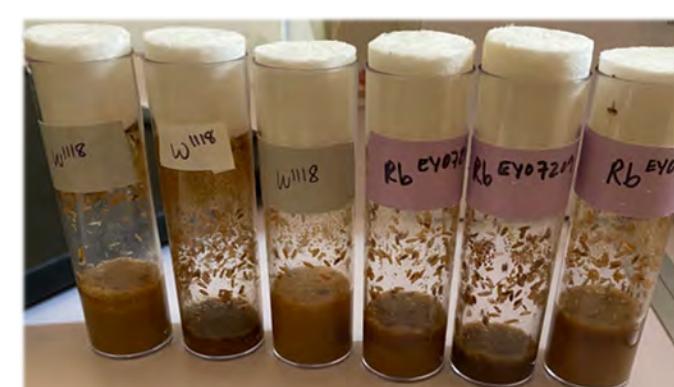
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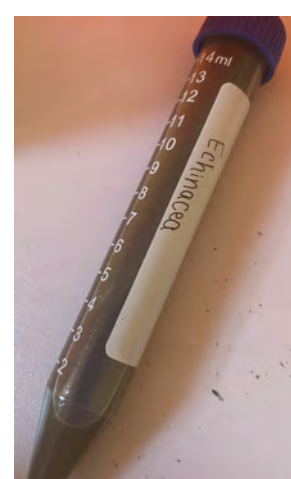
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## Methods and Materials



Wild type and Rb mutant *Drosophila Melanogaster*, were utilized in this experiment



I prepared a stock solution containing the contents of one capsule of Nature's Bounty brand Echinacea and 10 ml of solvent (saline solution)

The food for the two experimental fly vials (Rb mutant and wild-type) was prepared with 300 µL drug and 4.7 mL fly food. The food for the two control vials was made with 5 mL fly food.

The flies were sorted after they were put to sleep with FlyNap. Ten females and five males were placed into each vial



The flies were kept on this diet for a period of 7 days

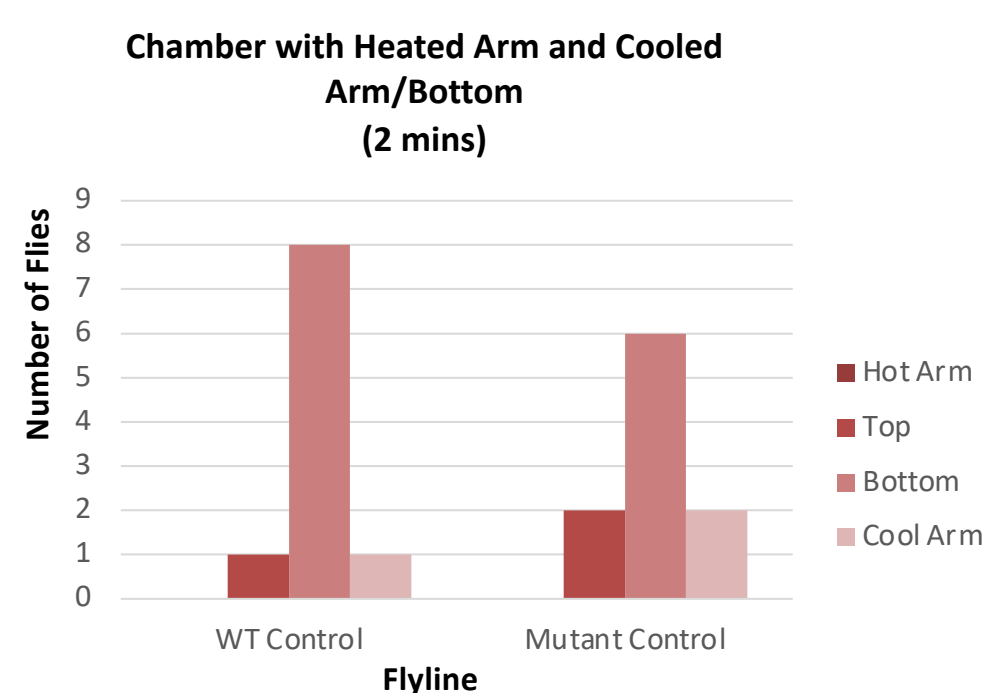


In this experiment, I used a crafted pain-sensitivity chamber and plugged the arms and the top of the chamber with cotton vial plugs or “flugs”

I conducted a preliminary experiment with the control flies to determine which areas of the chamber would be considered painful or nonpainful. (The results are listed below). During the experimental procedure, I plugged in a dry flug into one arm and a heated flug into the other arm. (The dry flugs were place into boiling water for 1 min to heat them and dried). Then, I recorded the behavior of the flies over a period of 5 mins. The number of flies at each location at the 2 min. mark were recorded in the charts below. This procedure was repeated for the four vials of flies and 3 trials of this experiment were done.

## Results

### Preliminary results and Observations



- Flugs stay hot (40-50°C) for ≈ 5 mins
- Cool flugs are 0°C (softly frozen) and Dry flugs are room temp (20 °C)
- Flies that directly touch the heated flug jump away
- Steam forms at the top of the chamber
- Flies tend to drop from the top of chamber after the steam forms

From these initial observations, I determined:  
Hot arm= Painful area  
Bottom of chamber and dry arm = Nonpainful area  
Top of chamber= Uncomfortable area

### Experimental Results

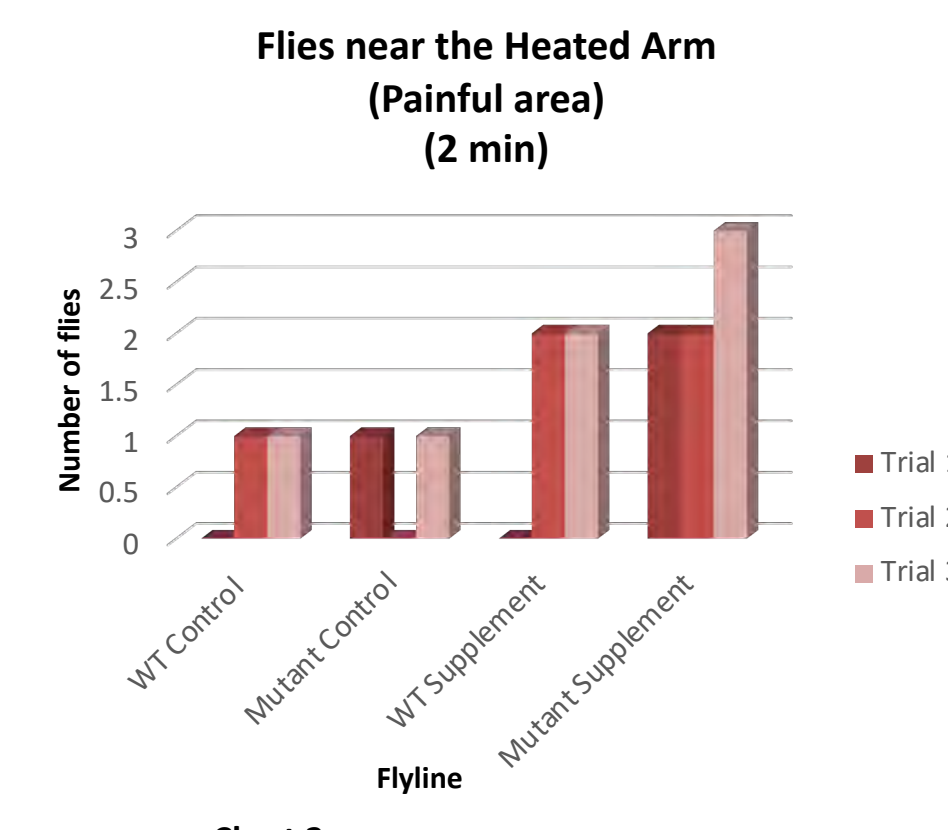


Chart 2

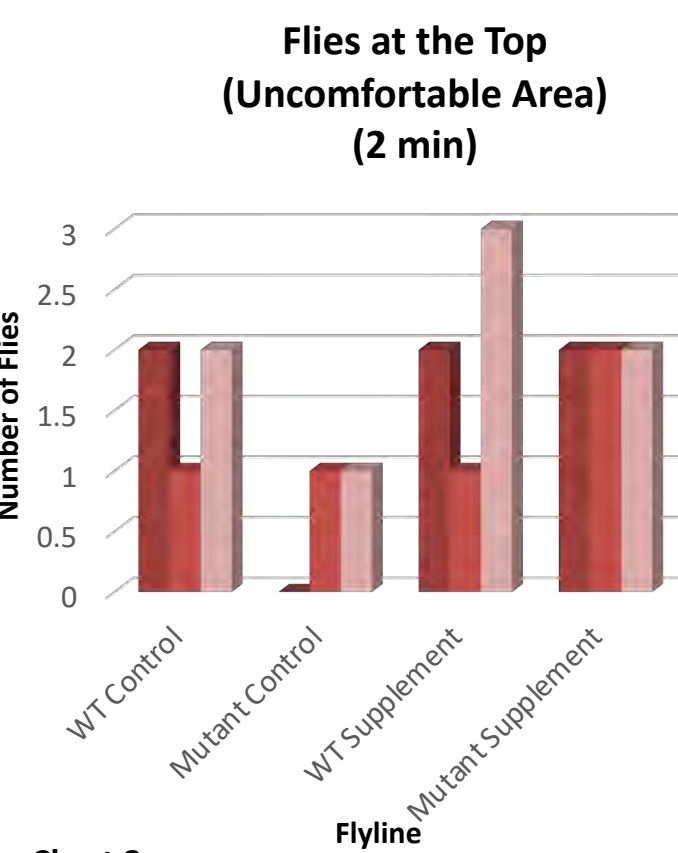


Chart 3

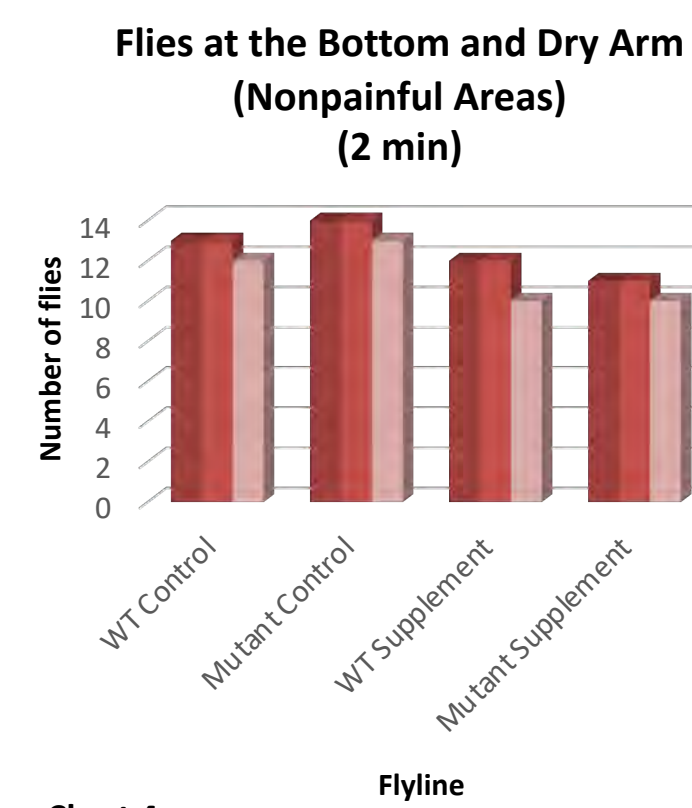


Chart 4

## Conclusions and Future Direction

In conclusion, the results of this experiment support my hypothesis. The data from Chart 2 and 3 tells us that there seems to be a slight decrease in pain sensitivity in those flies that were fed fly food with echinacea as compared to those that had normal food. The flies with the mutated Rb gene showed a higher heat (pain) sensitivity than the WT flies and the flies that were fed the supplement. Furthermore, the Rb gene mutant flies showed a slight decrease in pain sensitivity when they were fed echinacea. This implies that women who have developed cervical cancer due to their Rb genes being inhibited may also show a decrease in pain levels while taking this supplement. HPV-induced cervical cancer causes many pain-inducing symptoms such as pelvic/leg pain, leg swelling, and cervicitis (cervical inflammation). Echinacea could become a useful natural pain reliver for these symptoms and potential alternative for opioids.

Previous research has found that this supplement may have a negative impact on fertility in humans when taken in high doses. I noticed this in my experiment with the flies as well. If I were to continue this research in the future, I would reduce the dosage of this supplement until the flies could produce larvae. Then, I would conduct a pain assay on the larvae to see if I would achieve the same results.

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