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<td>The Effect of E.coli ingestion on the locomotive activity of Dugesia tigrina</td>
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Category Student Count: 11
The Effect of Green Spaces on Quality of Life
Christine Choung, Preyonty Rabbani

Cities are capable, and known for producing much of the world’s greenhouse gasses and environmental pollution. Cities have also been known as biological dead zones. Despite all this, cities are capable of being sustainable and part of the solution towards the issues presented by climate change. Green spaces are often a simple installation in cities, however they can have multifaceted effects on the population. Contact with nature is well documented as something that promotes mental restoration and relaxation. Citizens of a study agreed with this, also asserting that spaces would help with cleaner air and environments which lead to a better immune system and mental health (Jae-in, N., & By., 2020, October 7). Urban areas create a heat island effect, increasing city temperatures by 1-6 °C compared to surrounding countryside, however green spaces are thought to mitigate such (Aram, 2019, April 8). Several studies also displayed socioeconomic benefits with respect to health inequalities, showing that green spaces provided the most health benefits to disadvantaged groups. (Braubach M., 2017) However, not enough numerical data or statistical analysis are readily available to display correlations. This experiment seeks to provide such.

Major cities will be chosen based on cities with the most available data on the topics being measured. Data on total green space per city will be collected and compared individually with data on topics such as air quality, BMI, crime rates, average city temperature, suicide rates, city biodiversity, population growth, and water quality in that respective city. Data will then be collected from a previous year and then compared with data from a more recent year. This experiment will compare and contrast the statistical significance between the previously listed factors across multiple cities and draw conclusions on how the effect of green spaces affect a city’s population over time.


I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work (digitally signed).
The Effect of E.coli ingestion on the locomotive activity of Dugesia tigrina

Arnav Gupta

Escherichia coli, a bacteria in the intestines, is a cause of many diseases, such as digestive system disorders. Research has indicated that E.coli can affect the central nervous system and inhibit gene expression by suppressing specific genes in the planarian tissue. Dugesia tigrina (brown planaria) is an easy-to-use model for finding treatments for neurological impairments and addiction-like behaviors. The purpose of this research was to determine the effect of planarian ingestion of E.coli K-12 on their locomotive capabilities, which was measured through a planarian maze (average time planarian took to reach the food source). Three dilutions (1:5, 1:25, 1:125) of E.coli were prepared through a liver source and used to feed the planarians. Mean-motility times were calculated for each diluted E.coli solution and were compared to a control group (no planarian exposure to E.coli K-12). It was concluded that the most diluted E.coli solution (1:5) showed the greatest inhibition on planarian motility, as its mean-motility time was the largest (274.5 seconds). However, the 1:125 dilution inhibited the planarian system the least, as its mean-motility time was the lowest (193.6 seconds). It was seen that the more diluted the E.coli solution was, greater inhibition of motility was discovered (suppression of pathways in planarian tissue). A decrease in motility caused by the 1:5 E.coli dilution could also indicate malfunctions in the cilia. Further research could examine inhibition effects of other bacterial substances on brain function.

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<tr>
<td>1:5</td>
<td>274.5 seconds</td>
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<td>1:25</td>
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<tr>
<td>1:125</td>
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Comparing the Effects of Mental Health Disorders and Environmental Agents on the Mobility of Drosophila Melanogaster.
Lojy Hozyen, Sneha Maheshwari

Since Parkinson’s disease (PD) has been a prominent disorder in the locomotion of humans since 1817, many questions have risen about the causes of PD. It has been suggested that herbicide containing farming practices and air pollutants contribute to the condition [1]. There is a link between major depressive disorder and the loss of nerve cells containing dopamine which results in PD [2]. However, the effect of both factors and their direct correlation to PD still remain inconclusive [1]. Drosophila melanogaster (D. Melonagaster) contains highly developed muscles and nerves, similar to those of humans which allows for behavioral assays to correlate with human muscle function [3]. The purpose of this study is to determine whether major depressive disorder or exposure to glyphosate have greater effects on the cause of PD. The mobility of D. Melonagaster was investigated to determine the effect of both mental health disorders and environmental pollutants on the cause of PD. It was found that depression had a greater correlation with decreased mobility than glyphosate exposure, in comparison to the control group. Since PD is represented by a decrease in mobility, it can be concluded that mental health disorders have a greater risk of causing PD than environmental risks. Other mental disorders and environmental risks can be further explored to confirm that mental health disorders have a greater impact on the cause of Parkinson’s disease than environmental pollutants.

### LCPS RSEF OFFICIAL ABSTRACT - 2022

**Investigating the Effect of Lemon Balm (Melissa officinalis) on Impaired Learning and Memory due to Major Depressive Disorder (MDD) in Drosophila melanogaster**

**Meher Kalsi**

Major Depressive Disorder (MDD) is a debilitating mental disorder that is characterized by persistent depressed mood, impaired cognitive function, and disturbed sleep and appetite (Otte et al., 2016). MDD can cause general poor health, mortality, and substance use disorders (Hasin et al., 2018). It can also lead to suicide; approximately 50% of yearly suicides are due to and during depressive episodes (Otte et al., 2016). Treatments of MDD usually involve the use of antidepressants and mood stabilizers such as lithium chloride. However, they can cause side effects such as tremors, weight gain, or lead to hypothyroidism (Nath & Gupta, 2021). Lemon balm (Melissa officinalis) is a perennial herb in the mint family. The main constituents of lemon β-caryophyllene, α-pinene, and linalool (Pirbalouti et al., 2019), all of which have been shown to improve cognitive function and have antidepressant behavior, without severe side effects. It is hypothesized that drosophila’s impaired learning and memory abilities will improve after lemon balm administration because it has shown to alleviate depressive symptoms and normalize serotonin levels (Ghazizadeh et al., 2020) and has compounds containing antidepressant properties (Nikfarjam et al., 2017; Galdino et al., 2012). An experimental group and depressed control were created, each containing four groups of 15 flies; each group was in three repeated trials. Depression was induced using vibration stress, and each group of drosophila was trained and tested a light/dark y-maze. The experimental group was treated with lemon balm and tested again in the y-maze. Data collection is ongoing.


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The Effect of Visible Light on the Stress Levels of Caenorhabditis elegans

Sahasri Matta

Caenorhabditis elegans has a simple yet a very complicated system that is similar to the functions of human. C.elegans are known to have no eyes, but their system helps them navigate through land and soil. These elegans are provided photo-receptors that provide them the benefit of receiving help in traveling through the spectrum of visible lights and potential dangers they might observe. These organisms are known to stay away from the blue toxin produced by Pseudomonas aeruginosa bacteria. The higher the locomotion results in the higher stress levels in the nematodes. By exploring the effects of visible lights on locomotion can give insight on how more they may exhibit stress behaviors. I focused on worm speed as the component of locomotion to test the effects of the visible light colors. The five colors that were used were blue, purple, green, yellow and red. I placed one C.elegans on a set of 14 Petri dish covered with the color that is being tested and recorded the time it took to move a certain distance. By recording a video and counting the curvature of the worm for a period of 30 seconds. Then reset their behavior by placing in the incubator without any color filter attached. The data collection is in process but the predicted colors that are over the color blue on the spectrum to also affect their stress levels and the colors below to have not have that much effect on their locomotion.


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How Flowers Cure Depression
Amarah Presley

Serotonin syndrome, a neurological imbalance caused by high levels of serotonin in the brain, has raised questions about prescribed antidepressants. In this experiment, Hypericum perforatum (St. John’s wort), a dietary supplement that contains serotonin (mg), was tested on Drosophila melanogaster over 10 days of repeated stress-inducing protocols to simulate the effects of this natural remedy. The control groups were just medicine and without medicine and stress-protocol. To determine the supplement’s effectiveness, the flies’ movements (withering, shaking, slowed walking) and deaths were documented. The mean of C.U.M.S (chronic unpredictable mild stress) protocol and vibration-stress protocol with treatment had 0 changed behaviors, 4 normal, and 1 dead, and 2 changed, 1 normal, and 2 dead, respectively. Flies without treatment died on the 7th day of testing; C.U.M.S. and vibrations had 3 changed, 1 normal, and 1 dead, and 2 changed, 1 normal, and 2 dead, respectively. Although the hypothesis that if St. John’s wort is fed to fruit flies after stress-protocol application, then depression-like behaviors will regulate is accepted by the data, the p-value of 0.434 fails to reject the null hypothesis, making the data statistically insignificant. The independent variable influenced the dependent variable as the stress-protocol groups with St. John’s wort lived longer, and their abnormal behaviors regulated, while those without treatment did not. Further research could test the supplement’s effectiveness on depression in humans, and observe its performance over time to see if the supplement could work as a substitute for prescribed medications.


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An Investigation of the Effectiveness of the Administration the Root Extract of Stepheania tetranda to Drosophila melanogaster to Create a Viable Model of Obsessive Compulsive Disorder

Madeline Reames, Angela Tao

Obsessive compulsive disorder (OCD) is a neuropsychiatric condition that affects 2-3% of the population. OCD is one of the lesser understood neuropsychiatric disorders, and more research needs to be performed to better understand its mechanisms. There are currently no models of OCD in invertebrates and pre-existing models fail to accurately model the disorder. Access to a valid model of OCD in invertebrates could accelerate research on the condition and lead to the discovery of new treatments. This research aims to create a model of OCD in Drosophila melanogaster through administration of Stepheania tetranda extract. S. tetranda extract is a naturally occurring plant extract with antiserotonergic and antidopaminergic properties similar to those of second generation antipsychotics, a class of drugs known to induce obsessive compulsive symptoms. The highest non-lethal dosage of S. tetranda was determined using a toxicity assay and administered to the experimental group of D. melanogaster. Obsessive compulsive behavior was measured in this research through two assays, a repetitive reversal locomotion assay that tracked the number of direction turns the flies made to identify repetitive movements, and a grooming assay that quantified the grooming behavior of the flies. These two assays were chosen because OCD is characterized by repetitive behaviors, so an increase in repetitive behaviors -- such as excessively turning and grooming -- would be indicative of a potential OCD model. Data collection in this research is still ongoing and conclusions have not yet been drawn.


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**Algorithmically Predicting and Correcting Partisan Gerrymandering**

Lucian Tash

Partisan gerrymandering, the unfair drawing of election districts in order to favor one political party, is an ever-present issue that has only gotten harder to detect in recent decades. This project aims to help solve the issue by algorithmically predicting gerrymandering and then correcting it by drawing an alternate, optimized, and fair district map. In order to predict gerrymandering, the program creates a value to represent the "unfairness" of a district map in order to make a statistical assessment of whether or not a given state is gerrymandered. The program uses election results for a given state legislative election in order to run three separate arithmetic tests that indicate unfairness. The results are pooled into a single generalized gerrymandering score that represents how likely the given election results could have occurred by chance if there were no gerrymandering. These findings are tested for significance using simple statistical methods. The program then draws an alternate state district map that is more optimized and compact to reduce the influence of partisan gerrymandering and create more intuitive, unbiased districts. By considering factors such as equal populations, compactness, competitiveness, and partisan symmetry, the new map is intended to be a representation of what the state could look like if not for gerrymandering. These two elements combined create a powerful tool for understanding and combatting partisan gerrymandering from any perspective, whether it be an interested citizen or a legislator.


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