How Does Liquid Nicotine Affect the Burrowing Rates and Sensorimotor Reactions of lumbricina?
Abstract

When beginning the experiment, the scientists of lake country decided to see what happened to lumbricina when exposed to nicotine. The scientists expected that the earthworms were going to have a strong, negative reaction to the nicotine because the nicotine is so dangerous to humans. That is why they decided to do two types of experiments. The first one was a single exposure experiment where the lumbricina was exposed to one drop of nicotine and the reactions were observed and recorded. The second experiment was an extended exposure experiment where they tested how the earthworm's burrowing rate reacted to 51 drops of nicotine saturated in soil for an amount of time. The scientists did this because they knew that nicotine can have effects on humans that happen right away, and after an amount of time. The earthworms did have a strong sensorimotor reaction to the nicotine in the single exposure and were acting distinctly different than the normal behavior. The same reaction to the extended exposure to test the burrowing rates. After adding the nicotine to the soil and letting it saturate into the soil, the earthworm took a lot shorter and sometimes a lot longer time to burrow than the normal soil burrowing rate. The scientists decided to do these tests because there are so many health issues with nicotine and humans, that testing on animals and seeing negative or dangerous results would make people realize that maybe what they are putting into their bodies by smoking and doing other drugs would be dangerous.
**Introduction**

How does liquid nicotine affect the burrowing rates and sensorimotor reactions of an lumbricina? Throughout the years, nicotine in tobacco has been studied countless times. With these studies, scientists have proven that nicotine is a highly addictive substance with many negative side effects. Many of these side effects include nausea, high blood pressure, low blood pressure, addiction, and death. Many of these side effects can be somewhat temporary, but many of them will become a very serious problem. Many scientists have been testing to find out why nicotine is addictive. Though they may not know why the nicotine is addictive, they do have know that when the substance is absorbed or ingested into the body, it travels very quickly to the brain and creates a stimulant that gives the user a temporary relaxed feeling. That is one of the key reasons why a few scientists from Lake Country School decided to test how liquid nicotine affects lumbricina. Some scientists had an expectation that the lumbricina would have a very strong reaction to the liquid nicotine because the substance has such powerful responses with homo sapiens. When homo sapiens absorb nicotine through the epidermis, they have the ability to achieve the same sensation as ingesting the chemical through cigarettes or electronic cigarettes. Since homo sapiens can absorb and ingest nicotine through their skin and mouths, lumbricina have the ability to ingest nicotine through the layer of mucus on the outside of their body in which they breathe. That is why these scientists decided to test if nicotine has similar side effects on lumbricina as homo sapiens.

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**Materials and Methods**

The materials for the two experiments included, one bottle of liquid nicotine, two large eye droppers, nine plastic cups, 9 small beakers filled with soil, 9 ipads for recording, 27 graduated cylinders as stands for the ipads, 18 earthworms, a stopwatch, a glass of water, and one chemplate. When conducting these experiments, scientists must wear safety glasses and protective gloves. If they get even a small amount of liquid nicotine on your skin, it can be very dangerous. This can cause high blood pressure, nausea, vomiting, diarrhea, dizziness, confusion, and seizures. In extreme cases, this can include coma and death.

When starting the single exposure experiment, the scientists need to start with the control to see what the normal reactions of an earthworm is. First they need to put on your safety gear. Next they need to place your earthworm in a clean dry cup. Then the scientists need to use an eyedropper to place one drop of water on the earthworm’s head. Observe and record the results of this. To get an accurate amount of data, repeat this two more times.

Next, to gather data for the 1,000 ppm of liquid nicotine, you need to repeat the previous steps except instead of placing a drop water on the earthworm’s head, you would place one drop of liquid nicotine on its head.

For the 100 ppm single exposure experiment, they first need their chemplate. First the scientists need to place one drop of liquid nicotine in one of the slots and also place 9 drops of water in the same slot. This results in 10 drops of liquid in one of the slots. Next, they need to repeat all of the same slots as the above. The only step that

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is different, the liquid that is placed on the earthworm's head is the liquid that was mixed in the chemplate.

Finally, the 10 ppm single exposure is almost the same as the 100 ppm in steps. For the chemplate step, scientists will need to take one drop of the 100 ppm solution and put it in a clean, dry slot on the chemplate. Next, they need to add 9 drops of water again so that there are 10 drops in the slot. Next, they just repeat all of the other steps as shown in the previous experiments.

For the extended exposure experiment, you need to repeat each exposure three times for accurate results. First, to set up the ipads. Place the three graduated cylinders in the shape of a square with one of the corners missing so that the camera can get a clear shot of the cylinder. First, place your beaker with soil under the ipad. Next you need to set a timer for two and one half minutes. Place the worm in the soil and press start on the timer. Next, observe results and record observations.

For the next exposure, scientists will need to repeat the steps as shown previously. Next, instead of setting the timer for 2.5 minutes, you need to set it for 5 minutes. Then you will observe and record the results.

For the final exposure, set the timer for 10 minutes. Then you need to repeat the steps and record the results.

After these experiments have been completed, the scientists went back to the videos and watched how the earthworms reacted to the soil. Then the scientists made a graph of the the percentage of the earthworm buried in the soil. Next, the scientists made a chart of how the earthworms reacted to the single drop of liquid nicotine on the

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earthworm’s head. Each time, the earthworm had a strong to medium sized reaction to the nicotine, no matter the concentration.

1000 ppm

<table>
<thead>
<tr>
<th>Observations</th>
<th>Jack</th>
<th>Megan</th>
<th>Nick</th>
<th>Jake</th>
</tr>
</thead>
<tbody>
<tr>
<td>strong reaction and it jerks back and heads scrunches ups and a very weak reaction</td>
<td>very strong reaction, lumbricina moves very rapidly throughout the cup</td>
<td>Very strong reaction and starts to flap around</td>
<td>Strong reaction curls up into a ball then repeats the movement.</td>
<td></td>
</tr>
<tr>
<td>weak reaction and scrunches up</td>
<td>weak reaction, the head becomes larger and then resumes moving</td>
<td>Weak reaction then circles onto itself.</td>
<td>Weak reaction bundles up into a heart.</td>
<td></td>
</tr>
</tbody>
</table>

100ppm

<table>
<thead>
<tr>
<th>Observations</th>
<th>Jack</th>
<th>Megan</th>
<th>Nick</th>
<th>Jake</th>
</tr>
</thead>
<tbody>
<tr>
<td>No reaction don't care</td>
<td>no reaction-keeps moving the same way</td>
<td>Doesn't do anything does it's own thing</td>
<td>No reaction</td>
<td></td>
</tr>
<tr>
<td>weak retraction heads gets fat</td>
<td>mild reaction, head contracts and then keeps moving the same way as earlier</td>
<td>It really only fattens up the goes back to normal</td>
<td>Weak reaction head gets fat.</td>
<td></td>
</tr>
<tr>
<td>head get swollen again not a retraction</td>
<td>weak reaction, the head becomes swollen</td>
<td>weak reaction then doesn't do anything else</td>
<td>Weak reaction head becomes stout.</td>
<td></td>
</tr>
</tbody>
</table>
### Observations

<table>
<thead>
<tr>
<th></th>
<th>Jack</th>
<th>Megan</th>
<th>Nick</th>
<th>Jake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild reaction</td>
<td>Mild reaction-head contracts</td>
<td>Mild reaction</td>
<td>Gets fatter and scrunches up.</td>
<td></td>
</tr>
<tr>
<td>Just kinda didn't care about it reacted mildly</td>
<td>Weak to mild reaction, earthworm did not seem to mind the liquid nicotine</td>
<td>Mild reaction and doesn't really care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No reaction and scrounges</td>
<td>Mild reaction, head contracts, then continues moving</td>
<td>goes into it's own body</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Graph: How Earthworms React to Liquid Nicotine

- **2.5 min**
- **5 min**
- **10 min**

Lake Country School

Megan Lucyshyn

7-3

1-12-16

Voelker
Results

The results of the single exposure experiment, (Fig. 1) show that throughout all of the concentrations of liquid nicotine, the earthworms will still act irregularly when exposed to liquid nicotine. The group with the 1,000 ppm shows that it has the highest reaction rate than all of the other concentrations. The results of the extended exposure, (Fig. 2) show that liquid nicotine does indeed affect the burrowing rates of the earthworms. The groups show that even in smaller times exposed, the earthworms will be affected. The shortest time, 2.5 minutes show that the saturated soil has affected the earthworms more than any other time. This time period shows that the earthworms buried under 20% of their bodies each time a new one was exposed. In the 5 minute period, the earthworms all seemed to bury at least 50%, and then would just sit there until the scientists took them out. For the 10 minute exposure, the earthworms would move very slowly, and would bury almost all the way and would keep burrowing even when they reach the bottom of the beaker. The scientists believe that this happened because the liquid nicotine was affecting the earthworm’s sensorimotor reactions. This may have made the earthworms think there was still more dirt to bury into when they might have reached the bottom of the beaker. This also may have made the earthworms think that they reached the bottom of the beaker when they have just been sitting on top of the soil. Just like nicotine affects people in different way, the liquid nicotine might have been affecting the earthworms differently. This is why the scientists think that their thesis was valid. They had expected the earthworms to act abnormally, and they did.

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1-12-16
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Discussion

After conducting the 1,000 ppm single exposure experiment, the scientists observed that the earthworms became initially more active. Then they would start to twitch in no particular pattern. This makes the scientists correct about their hypothesis because they believed that the lumbricina would react very strongly to the single drop of liquid nicotine on the worm's head. When the lumbricina were exposed to the 100 ppm single exposure experiment, they seemed to “stiffen” and reduce their movement. After a few minutes, the worms seemed to start moving quickly or start to twitch. These results seem to suggest that the effects of nicotine on earthworms is very similar to the effects on humans. Maybe since there are so many people who die every year from exposure from secondhand smoke, (58,300 people) the effects could be hurting animals in our environment. While conducting the extended exposure, there were about 51 drops of liquid nicotine in the soil. There was a different scientist putting the liquid nicotine in the soil, so there may have been a slight amount that was added or taken from the soil. In one of the of the single exposure experiments, one of the scientists missed the head of the earthworm, and had to do two drops instead on one on the earthworm’s head.
Appendix

Works Cited


Some of the materials (not all) 2 Large droppers Chemplate (only one is used)