Vaping Worms: The effects of vaping on *C. elegans* behavior

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Why study vaping in *C. elegans*?

- Over the past several years there has been a significant increase in the usage of vapes and e-cigarettes among teens and adolescents
- With the increase in usage, we are interested to understand the effects vaping has on behavior
- *C. elegans* are model organism that are share 30% of their genome to humans

Goals

1. Characterize the effects of e-liquid containing nicotine on *C. elegans* attraction towards or avoidance from a stimulus.
2. Determine if the concentration of e-liquid exposure matters.

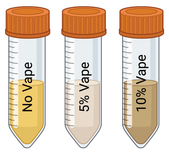
Vape Exposure & Behavioral Tests

Vape Concentrations

1. Collect vape e-liquid, containing 2.4% nicotine, and OP50 *E. coli*

2. Pipette 10ml of OP50 into each vial

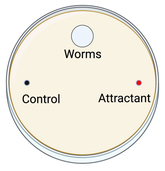
3. Pipette no vape e-liquid, 0.5ml (5%), 1ml (10%) vape e-liquid into separate vials



Chemotaxis Assay (attraction test)

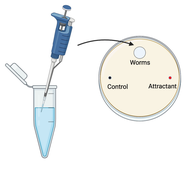
1. Pick 3-4 L4 worms and set aside for 3-4 days

2. Place 1uL of ethanol (control) and 1uL of diacetyl (attractant) on opposite sides of plate

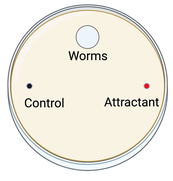


3. Wash worms using 1000 uL chemotaxis buffer

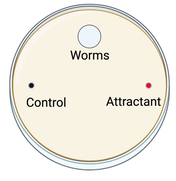
4. Plate worms by removing wash liquid and pipetting worms onto each plate



5. Leave plate for 1 hour



6. Count number of worms on control, attractant, total worms on plate, worms left on origin



Thrashing Assay (movement test)

1. Pipette 30 uL water onto L4 worm. Count number of thrashes in 4 min period

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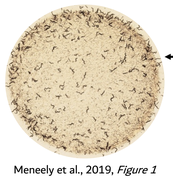
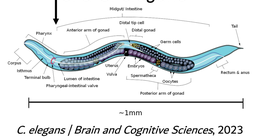
C. elegans



Meneely et al., 2019, *Figure 1*

A group of *C. elegans* on a plate with bacteria

An anatomical diagram of a *C. elegans*

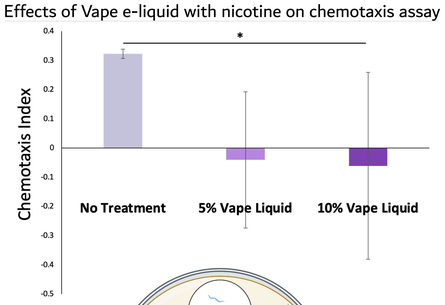


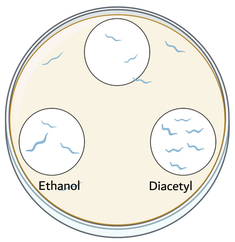
C. elegans | Brain and Cognitive Sciences, 2023

Negative behavioral effects of vaping

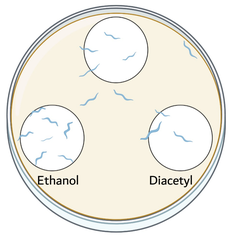
Chemotaxis Assay

C. elegans with exposure to vape were less attracted to the diacetyl as concentration of vape increased





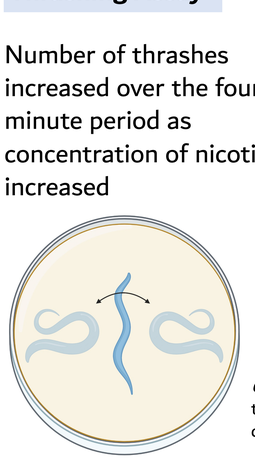
No vape exposure
Attracted to diacetyl



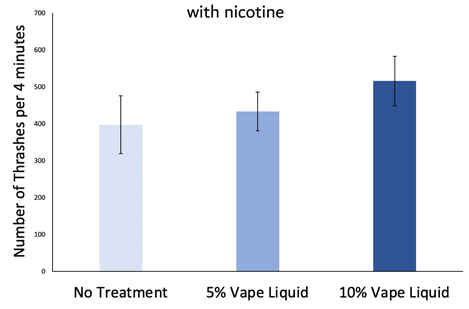
Vape exposure
Avoidance to diacetyl

Thrashing Assay

Number of thrashes increased over the four-minute period as concentration of nicotine increased



C. elegans thrash (move back and forth) more times in water if they were exposed to higher concentrations of vape e-liquid.



Conclusions & What's Next

- *C. elegans* negatively chemotax when exposed to different concentrations of vape e-liquid
- There is an increase in thrashing as exposure to vape e-liquid increases
- Both chemotaxis and thrashing data suggest there is a concentration dependent effect of vape e-liquid on *C. elegans*

What's next:

- Collect more data! (egg laying assay, lifespan assay, etc.)
- Based on additional data, look to see if certain neurotransmitters are affected
  - Because dopamine is involved in thrashing, there could be an effect on dopamine and/or dopamine receptors

UN Sustainability Goal

Good Health and Well-Being

- Ensure healthy lives and promote well-being for all ages
- Vaping has negative health impacts

Educational Connections

High School Educational Connection:

- Students will address UNSDG #3 by learning about *C. elegans* as a biological model through which to study the impacts of substances on human health
- They will perform, design and communicate about their own experiments to test the impact of various chemicals on this biological model

Middle School Educational Connection:

- Connecting the increase in global temperature over the past century with the UN Sustainability Goal #3
- Create a proposal to save their farm from rising global temperatures
  - Analyzing data and graphs to support their proposal

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