The Impact of Different Caffeinated Drinks on Planaria Regeneration

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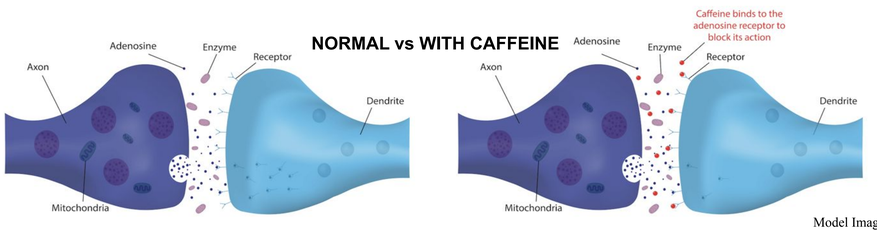
Planaria Participants

Introduction

- Animal regenerative medicine is an active field of research for developing new cells and tissues for animals.
- Planarians serve as an excellent research model for studying regenerative effects (6).
- They share major developmental signaling pathways with vertebrates (2).
- Planarians contain almost every neurotransmitter found in mammals (6).
- High dopamine levels in planarians suggest a potential role in regeneration and make them suitable for caffeine studies (2).

- Energy drinks often contain caffeine, energy enhancers, and sugar (4).
- Caffeine enhances dopamine signaling by competitively binding to adenosine receptors (2).
- Blocking adenosine receptors prevents adenosine from slowing nerve activity, leading to increased dopamine release (8).



Model Image (7).

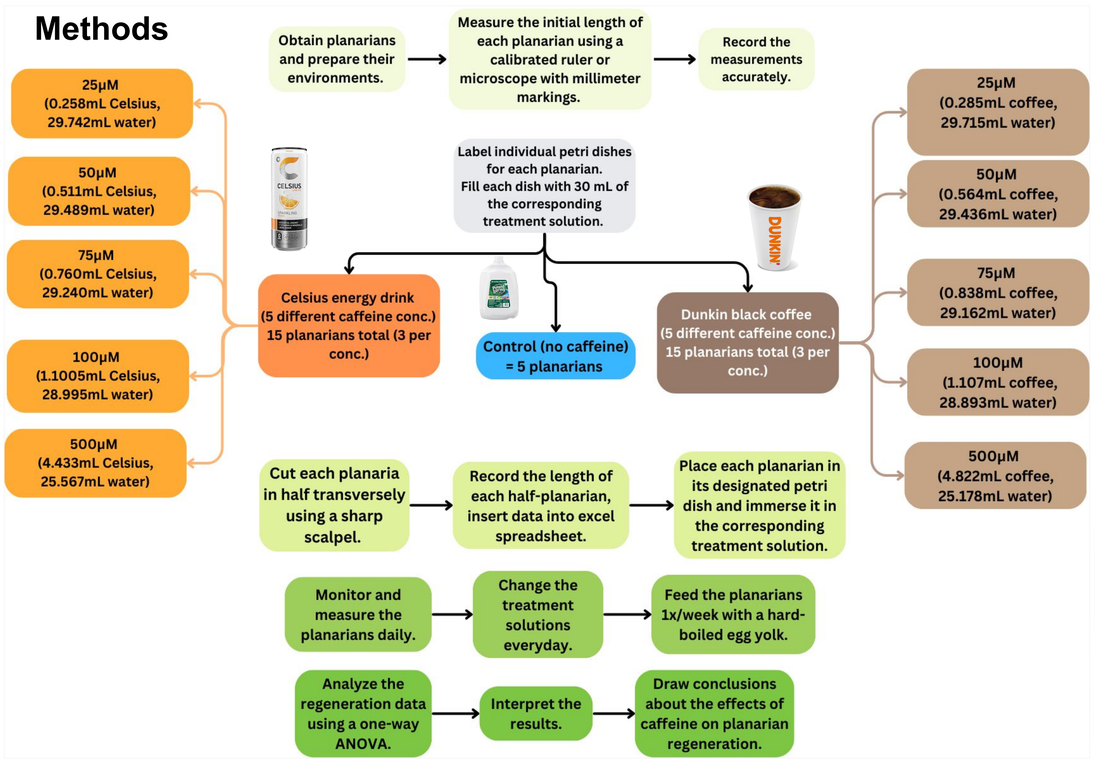
Hypothesis & Aims

Hypothesis: The growth of planarians is influenced by caffeine, with an expected acceleration in regeneration.
Null Hypothesis: Caffeine does not affect planarian regeneration.

Specific Aims

- How does caffeine intricately influence the dynamics of planarian regeneration?
  - How do other ingredients in different caffeinated drinks affect the regenerative capabilities of planarians, and do they exhibit synergistic or antagonistic effects with caffeine?
  - What is the impact of varying caffeine concentrations on the rate and quality of planarian regeneration?

Methods



Results

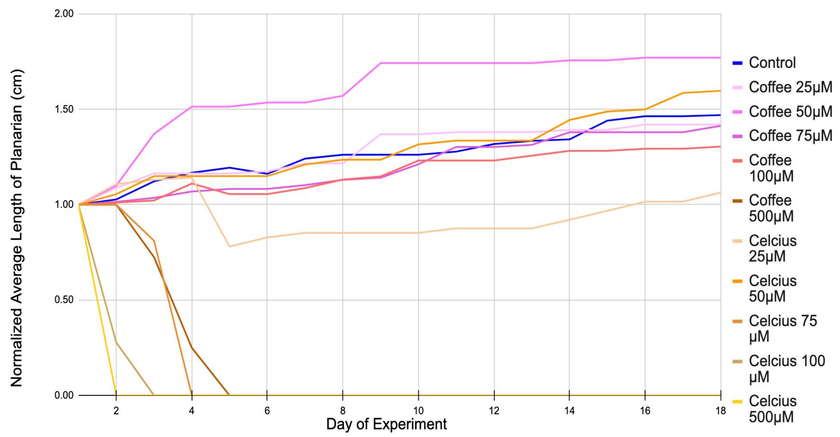


Figure 1: Average Length of Planarian Heads Per Day in Different Groups of Caffeinated Concentrations.
Each day, planarian lengths were measured in three groups (Water, Coffee, Celsius) and various concentration groups. A one-way ANOVA rejected the null hypothesis ($p = 1.07 \times 10^{-78}$). Tukey-Kramer tests revealed significance among some groups, notably a significant difference between water and coffee at 50µM concentration.

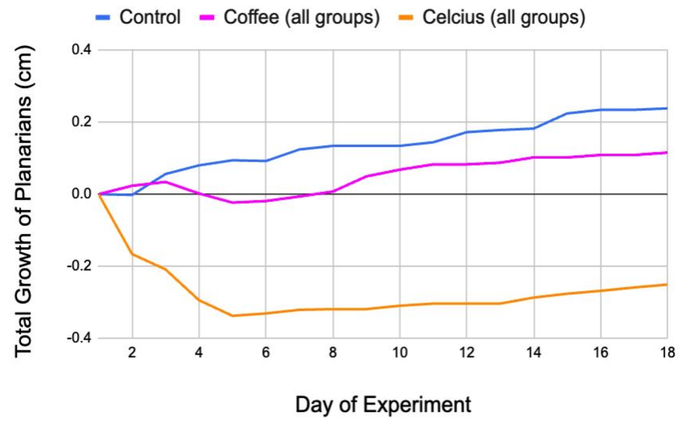
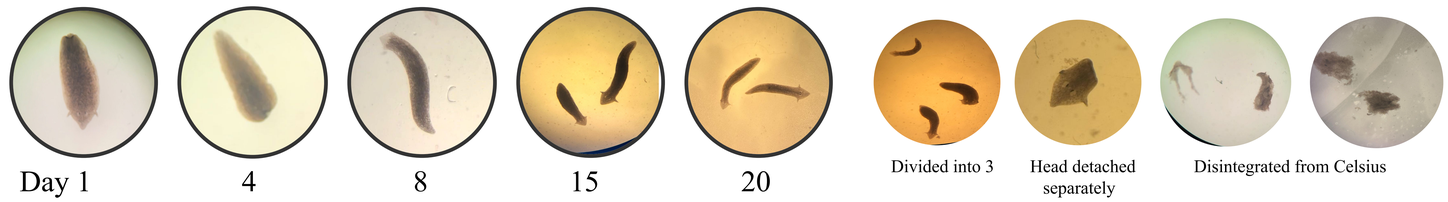


Figure 2: Total Growth of Planarian Heads Per Day in Different Caffeinated Groups.
Planarian lengths were measured daily, with initial lengths subtracted. Dead planarians were assigned 0 cm, causing negative growth. One-way ANOVA rejected the null hypothesis ($p = 2.01 \times 10^{-23}$). Tukey-Kramer tests revealed significant differences among all groups, highlighting a notable distinction between water and caffeinated groups.

Progression Photos and Extras



Discussion

Key Points

- Celcius led to death in majority of concentration groups.
- Low levels of coffee increased planarian regeneration but higher concentrations had opposite effects.

Group Comparison

- **Water vs. Celsius (25µM):**
- Variations in regeneration effects on heads & tails.
- **Water vs. Coffee (50µM):**
- Significant differences observed in both heads & tails of planarians.
- Coffee at 50µM demonstrated the greatest impact on regeneration length out of all the other concentration groups.

Specific Concentrations Comparison:

- Planarians at 500µM coffee survived for only 3 days.
- Planarians exposed to 75µM, 100µM, and 500µM of Celsius didn't survive for more than 3 days.

Reproduction Behavior

- Reproduction generally occurs approximately once a month for a planarian (3).
- Research has found that environmental factors, such as temperature, gravity, and light, an affect regeneration and division (1).
- Planarians are very sensitive to their environments; the slightest disturbance can alter the timing of their division (1).

Future Research Recommendations

- Investigate the impact of individual ingredients in caffeinated beverages on planarian research.
- Explore lower dosages of coffee and plain caffeine (without other ingredients) to understand their potential benefits on planarian regeneration speeds.
- Examine the factors that trigger planarian reproduction, necessitating further research into the underlying causes.
- Keep a more sterile environment to prevent mold growth.

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