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The Effects of Light and Hypo-Gravity on the Development and Movement of Dictyostelium discoideum

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The Effects of Light and Hypo-Gravity on the Development and Movement of *Dictyostelium discoideum*

Lawrence Davis IV, Will Ross, and Dr. Jim Taylor

Abstract

Dictyostelium discoideum is a prevalent eukaryotic slime mold that has been utilized in many experiments because of its distinct development as an organism. *Dictyostelium d.'s* life cycle (figure 2) starts as spores which develop into amoebae, which feed on bacteria and when conditions are right, they will develop into multicellular structures referred to as slugs. The focal point of this experiment is to observe the movement and development of the slugs in response to light and the influence of gravity using a clinostat. To conduct the experiment, ten slugs were placed in the center of each lactose peptone plate and were either attached to a clinostat which rotated at 1 rpm or placed in a stationary position inside a clinostat box. Each plate was either treated to white light or darkness for a period of two days. Slugs on the stationary plates showed movement towards the light vector against the influence of gravity. There was little movement downward due to gravity's influence in dark conditions. Plates on the clinostat were not affected by gravity in the light conditions as they moved toward the vector. Plates exposed to darkness and the clinostat displayed little movement from the center.

Materials

- *Dictyostelium d.*
- 2.5% Lactose agar
- Peptone
- Petri dishes
- Clinostat boxes with white light and mirrors
- Black streamer paper
- Aluminum foil
- Stereoscope

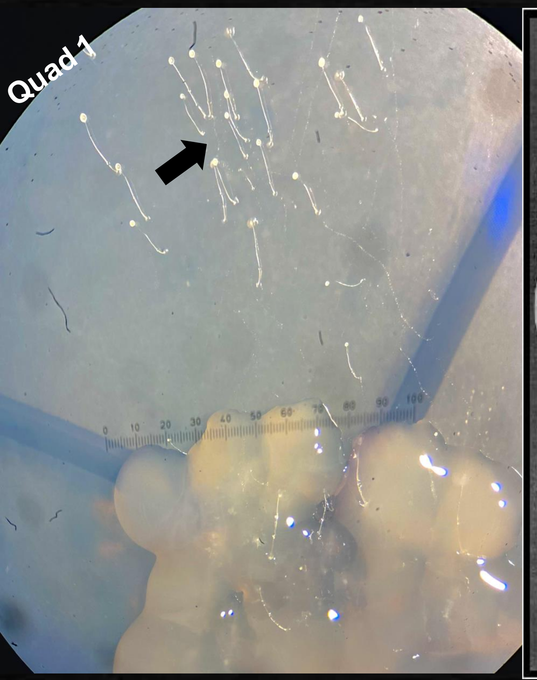

Figure 1: Fruiting bodies located in quadrant 1

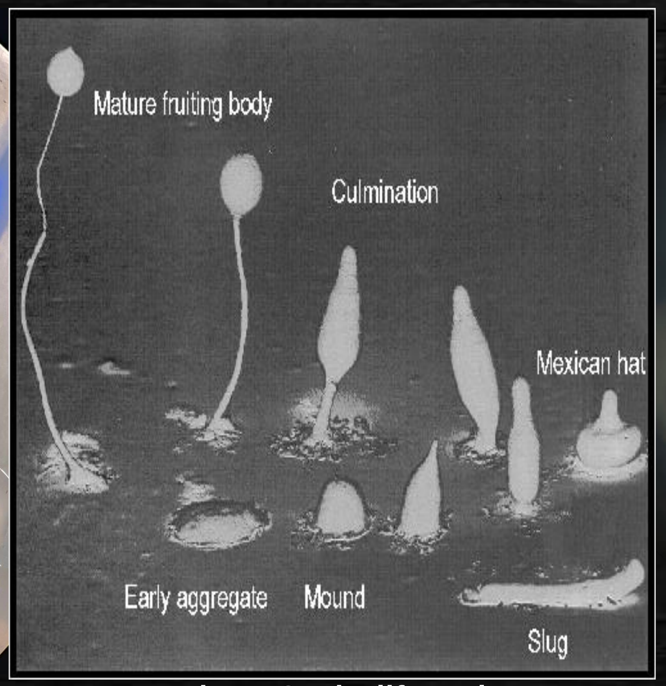

Figure 2: The life cycle of *Dictyostelium discoideum*

Figure 3: Slug movement into distinct quadrant

Methods

Dictyostelium discoideum was plated on lactose agar plates, containing peptone. These plates were placed in a dark box at 30℃ for 4-5 days to develop. The slugs (figure 3) from these plates were then transferred to the center of new lactose plates using a sterile needle and divided into quadrants (figure 4).The plates were wrapped in black streamer paper and aluminum foil. A slit was cut into the top of quadrant 1 to allow light for the plates receiving the treatment. The plates were either placed on a clinostat to simulate hypo-gravity or remained stationary inside the clinostat box (figure 5). Slug movement was recorded by counting the number of fruiting bodies in each quadrant (figure 1). A Wilcoxon Rank Sum Test and a Chi-squared Goodness of Fit Test were conducted.

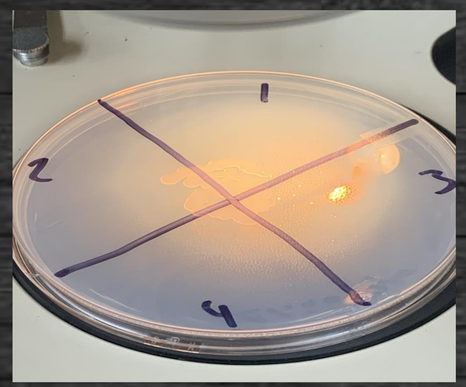

Figure 4: Lactose plate separated in quadrants

Figure 5: Clinostat light box with rotating and stationary plates

Results

Location	Light Clinostat (10 replicas)	Dark Clinostat (35 replicas)	Light Stationary (8 replicas)	Dark Stationary (37 replicas)
Center	61	279	71	303
Quadrant 1	28	1	32	3
Quadrant 2	2	5	0	6
Quadrant 3	1	8	0	3
Quadrant 4	0	11	0	26

Table 1: Numbers represent the slug count

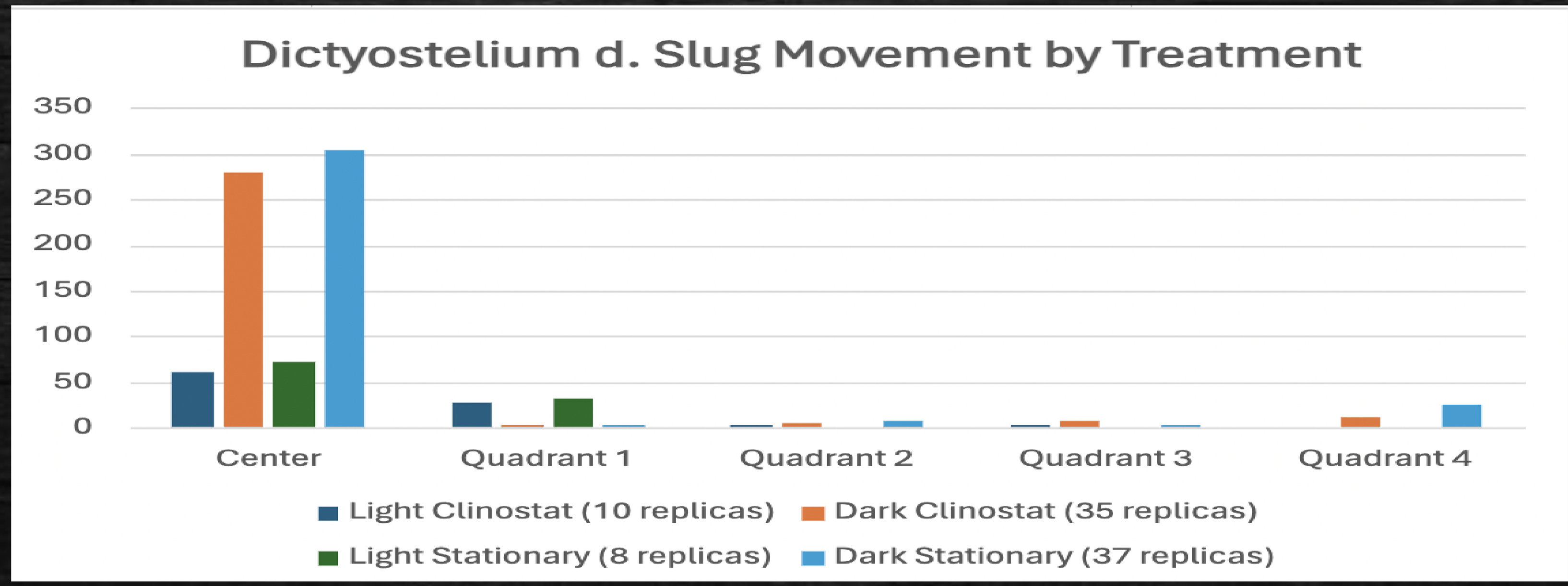

Figure 6: Bar graph of data listed showing light's effect on slug movement

Results

Data from each treatment showed most fruiting bodies formed in the center of the lactose plates (table 1). In light conditions, 47.7% displayed movement and of the moving slugs, 84.4% moved toward the light (figure 6). There was no significant difference between the movement into light by the slugs on the clinostat versus the slugs that were placed stationary according to the Wilcoxon Rank Sum Test ($p=0.109$). In dark conditions, only 9.77% of the slugs moved, and the number of moving slugs in the stationary treated culture was higher than the clinostat cultures ($p=0.03389$), according to the Chi-squared Goodness of Fit Test.

Discussion

This research supports previous research that light does indeed influence the movement of *Dictyostelium d.* towards the light vector. An independent result of the plates in dark conditions showed that while 90.23% of the slugs weren't moving, of the 9.77% that did, the stationary plates had a higher number of slugs move than those that were placed on the clinostat. This implies that gravity may have an influence on slug movement. Impending research could help confirm this observation with more data. Most of the slugs did not move on the lactose plate, thus the fruiting bodies appeared in the center. There is an array of explanations for this observation. During the transfer of slugs by needle, the slugs may have been agitated, making them stagnant. Another reason for stagnation could be that upon transfer to new lactose plates, the slugs may have been ready to form their fruiting bodies. Furthermore, to understand what light treatment works the best on the movement of *Dictyostelium d.*, other light wave lengths such as blue, red, and green lights should be tested in future research.

Acknowledgements

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www.dictybase.com