Acknowledgements:
We would like to thank Dr. Bo Sun for allowing us to use his laboratory, our mentors Jihan and Chris for their guidance, and Dr. Skip Rochefort for this opportunity.

The Force of a Slug in a Rubber Band Matrix

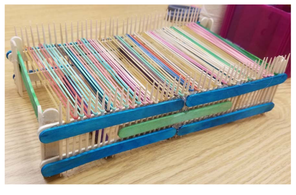
Liza Lunina and Sarah Kuykendall
Lab mentors: Jihan Kim and Chris Eddy
Head professor: Dr. Bo Sun

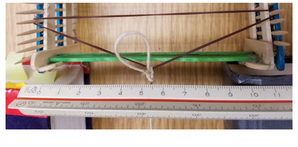
Objective

These are the questions we attempted to answer:

- What is the force applied by the slugs on the surface?
- How do the slugs move across the surface using that applied force?
- How do the slugs react to and move on varying surfaces?

Materials





We constructed a device using popsicle sticks and toothpicks to create a surface of rubber bands for our slugs to travel on.

We then calculated the spring constant of the rubber bands required to solve for the force:
F/ΔX= K
0.4748 N/ 2.3566 cm = 0.201 N/cm

Lab Group and slugs

Conclusion

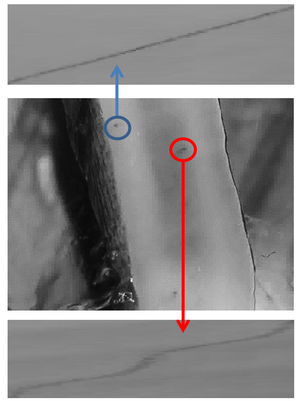
Using Hook's law with the spring constant and rubber band displacement we could fin the force of the slug's "legs":
k*Δx=F
0.201 N/cm * 0.0269 cm = .0054 N

With the image of the slug representing it's movement over time, we found the slope of its body and used that to find its velocity:
ΔY/ΔX=V whereas Y= distance and X= time
2.78309 cm/ 15.8 sec = 0.176 cm/s

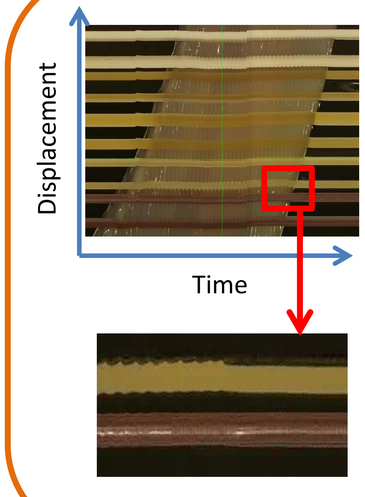
We also found the velocity of the inside muscle with the slope of the "rungs" that moves faster than the body:
0.12932 cm/ 0.0666 sec = 1.94 cm/s

Slug Mechanism

The blue dot was stained on the side of the body and it moved at a constant rate which is seen by the linear line.



The red dot was stained into the muscle in the center of the slugs underside and when graphed, shows that it gets pulled along by each individual "rung". From this jumping we can determine that each "rung" is detaching itself from the surface and the space in between attaches and pulls the slug forward.



Observations

The slug's movement across the rubber bands caused them to vibrate, which could be seen by the computer program ImageJ. That allowed us to see the slugs movement over time as well as the displacement of the rubber bands to be used in finding the force.

To study the movement of the slugs, we placed the rubber bands randomly and monitored their movement. Each slug tended to go to the side near the toothpicks and follow straight down that path.

Modifications

Initially, we were trying to calculate the force and observe the directionality of the slugs. After doing so, we noticed an odd muscle movement down the center of the slug's underside. We then decided to also find information on how a slug actually moves and the mechanism inside its body that allows it to move by staining the underside of the slug with ink dots.