Simon Says…Jump! The neural manipulation of crickets by parasites

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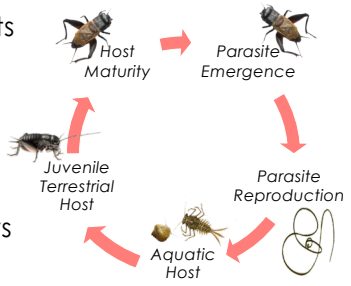
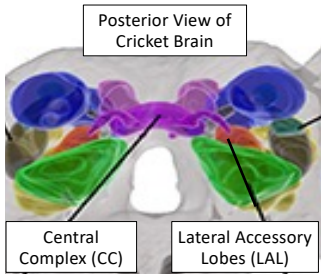
CURAS Director's Summer Undergraduate Research Fellowship

Background

- Parasites change the behavior of their hosts
  - Juvenile parasites inhibit behaviors that lead to early host (and parasite) death
  - Adult parasites increase behaviors that will allow the parasite to emerge in an ideal habitat (e.g. in or near water)
- **Horsehair worms** infect crickets for ~28 days and manipulate the cricket to jump into water for parasite emergence to occur
- The neuroamines **octopamine (OA)** and **serotonin (5-HT)** have conserved functions that modulate host behaviors that may benefit parasite growth and emergence
- Cricket are drawn to reflective surfaces when parasite are ready to emerge
- The brain regions responsible for processing refracted light are in the **Lateral Accessory Lobes (LAL)** and **Central Complex (CC)**



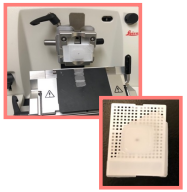


Experimental Design


Cricket infected with horsehair worms

Feed crickets control or parasite-encysted snail tissue

Histological Analysis
- Dissect brains at 28 days and slice with microtome
- Stain slides with Cresyl Violet
- Image the slides to measure the volume of the LAL and the CC

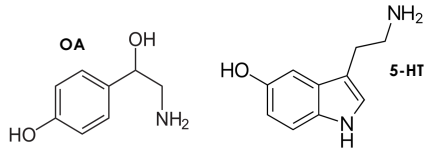

Preparing CV stain

HPLC Analysis
- Randomly assign control and infected crickets to a brain dissection timepoint:
  1) Cricket maturity or
  2) Parasite emergence
- Dissect brains at designated timepoint
- Quantify OA and 5-HT levels using HPLC


Cricket brain dissection

Aims/Hypotheses

1) **Do levels of OA and 5-HT in the host brain change at two critical timepoints of infection: cricket maturity and parasite emergence?**



2) **Does parasitic infection impact the volume of the LAL and the CC in the host's brain?**

Timepoint	Predicted Levels	
	OA	5-HT
Cricket maturity	⇩	⇧
Parasite emergence	⇧	⇩

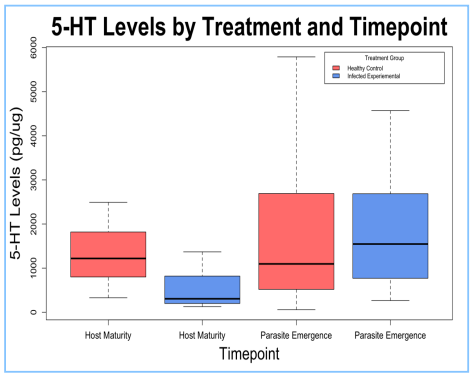
Arrows refer to the levels expected in infected crickets compared to healthy crickets

	Predicted Levels	
	LAL	CC
Infected	⇧	⇧
Control	-	-

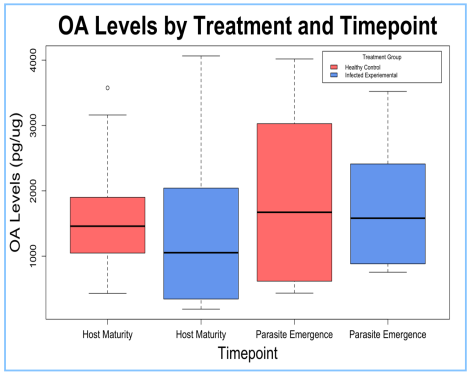
Preliminary Data

We found that neither infection status nor infection timepoint significantly altered the levels of OA or 5-HT in the host cricket brain

No significance between 5-HT levels and the treatment and timepoint (control n=13 and 9, infected n= 8 and 10 p-value=0.113, F-stat=2.134, degrees of freedom=3, 36)



No significance between OA levels and the treatment and timepoint (control n=13 and 9, infected n= 8 and 10, p-value=0.7547, F-stat=0.3987, degrees of freedom=3, 36)



Brain tissue update: Currently dissecting and imaging slides