

Chelerythrine chloride and its effects on phonotactic behavior in female crickets *Acheta domesticus*

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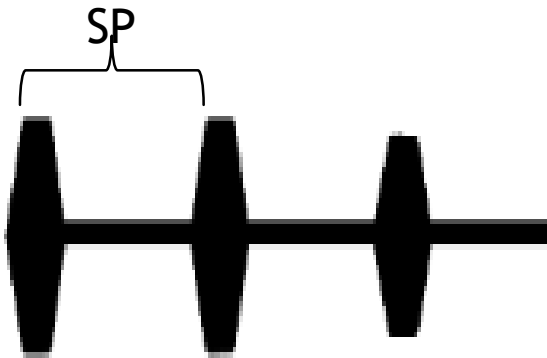


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Introduction

- ▶ Phonotaxis
 - ▶ Movement in relation to a sound source
 - ▶ Female cricket in response to the male crickets' calling song
- ▶ Syllable Period (SP)
 - ▶ 30ms~90ms



Introduction

- ▶ Selectiveness
 - ▶ Selective: responds to 5 or fewer SPs
 - ▶ Unselective: responds to 6 or more SPs
- ▶ Cricket's selectiveness in relation to age
 - ▶ Presence of Juvenile Hormone III (JHIII)
 - ▶ Stout *et al.* (1976)
- ▶ Prothoracic ganglion (PTG)
 - ▶ Auditory circuitry
 - ▶ Atkins *et al.* (2008)

Introduction

- ▶ Nanoinjection of JHIII (Choi, *et al.* 2012)
 - ▶ Response to narrower range of SPs
 - ▶ Protein Kinase C pathway
- ▶ Nanoinjection of Chelerythrine Chloride (CC) (Lynch, 2015)
 - ▶ Potent Protein Kinase C blocker
 - ▶ Neuronal response
 - ▶ More uniform, consistent physiological response

Current Research

- ▶ Evaluate the effects of CC injection on the female cricket's behavioral response
 - ▶ Gain understanding to a complex yet not fixed phonotactic response of the crickets
 - ▶ Study the behavioral plasticity and its link to neural circuits involved in controlling the behavior

Methodology

- ▶ Acheta Domesticus

- ▶ House cricket
- ▶ 2~3 months life



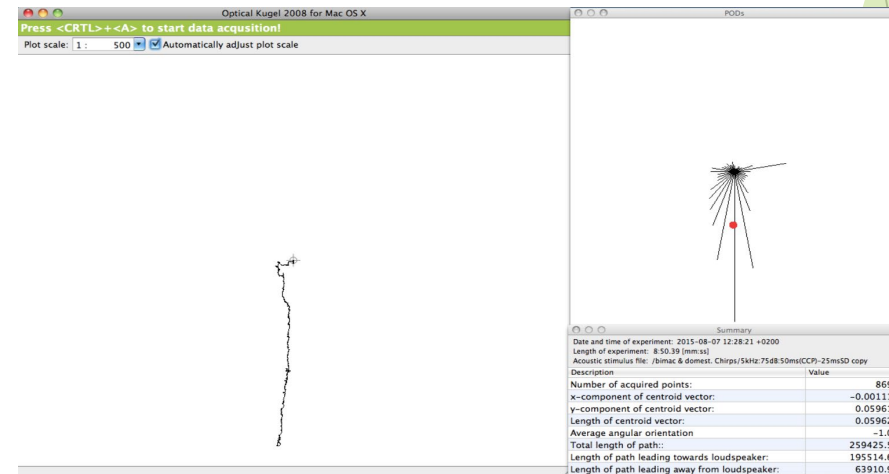
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- ▶ Animal Care

- ▶ Temperature: 22-24° C
- ▶ 12 hour light-dark cycle
- ▶ Female crickets separated from male crickets

Methodology

- 3-7 day old females tested on a non-compensating spherical treadmill
- Computer generated model calls used for auditory stimulus (Audacity 2.0.6) with syllable periods ranging from 30-90 ms
- Optical Kugel application (2008: Version 0.5 beta) used to record and quantify data



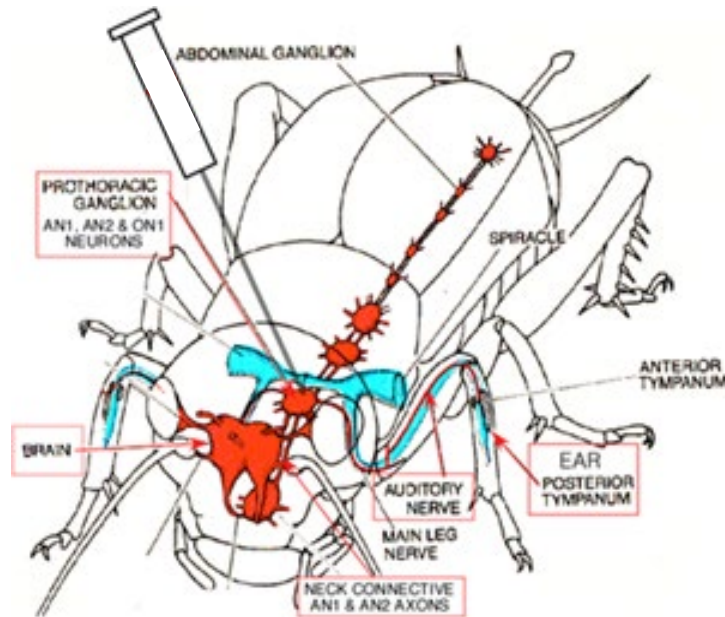
Methodology

▶ Pre test

- ▶ 50ms 90ms 70ms 30ms 60ms 80ms 40ms
- ▶ 5 minutes song, 2 minutes break

Methodology

- A small incision made to expose the prothoracic ganglion for injection
- A Drummond Nanoinject II nanoinjector (Drummond Scientific Co., Broomall, Pennsylvania) used to inject 9.2nL of 10^{-5} M CC (Sigma) in saline for the experimental group and 9.2nL saline for the control group



Results

Paired t-test,
P=0.102
n=9

Control Group

BEFORE INCISION/SALINE SYLLABLE PERIOD (ms)							AFTER INCISION/SALINE SYLLABLE PERIOD (ms)						
30	40	50	60	70	80	90	30	40	50	60	70	80	90
Shaded	Shaded												
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7	6	6	8	6	7	4	4	4	6	4	5	6	4
NUMBER OF FEMALES/SP							NUMBER OF FEMALES/SP						

Statistical Analysis

- Selective crickets remained “selective”
- Unselective crickets became “selective”
- “Selective” => “Less responsive”
 - No significant change in responds to 50-70ms
 - Paired t-test, $P=0.061$

Selective Crickets Pre test	
Before CC	After CC
0	0
0	2
1	1
2	5
2	2
2	1
2	3
4	0
4	5
5	0
5	6

Paired T test,
 $P=0.807$

Unselective Crickets Pre test	
Before CC	After CC
6	3
6	6
6	2
6	2
6	6
6	6
7	2
7	4
7	4
7	4
7	6
7	6

Paired T test,
 $P=0.00126$

Statistical Analysis

- ▶ 30~40ms range ($p=0.038$)
 - ▶ Pre test: 1.3 SPs
 - ▶ Post test: 0.86 SPs
- ▶ 50~70ms range ($p=0.061$)
 - ▶ Pre test: 2 SPs
 - ▶ Post test: 1.5 SPs
- ▶ 80~90ms range ($p=0.042$)
 - ▶ Pre test: 1.2 SPs
 - ▶ Post test: 0.82 SPs

Statistical Analysis

Experimental Group

	Post responded	Post not responded	Total
Pre responded	54	46	100
Pre not responded	17	37	54
Total	71	83	154

McNemar's test $P < 0.001$

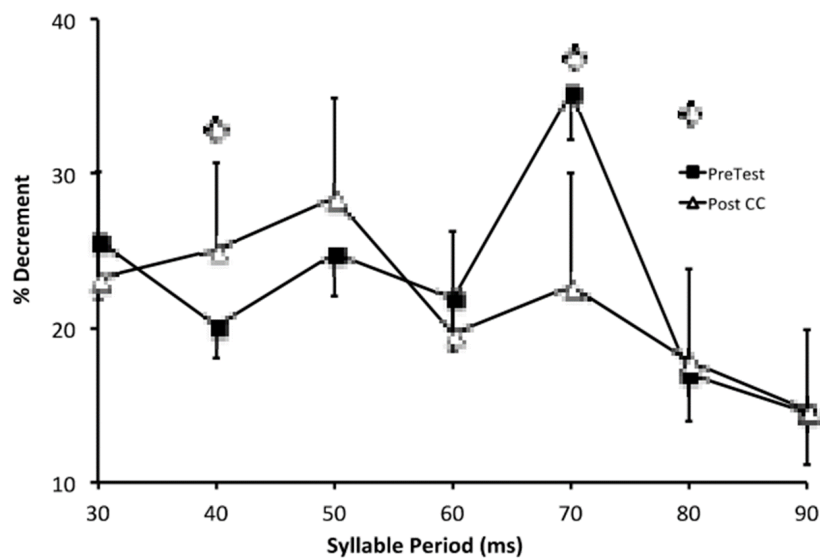
Control Group

	Post responded	Post not responded	Total
Pre responded	28	18	46
Pre not responded	5	12	17
Total	33	30	63

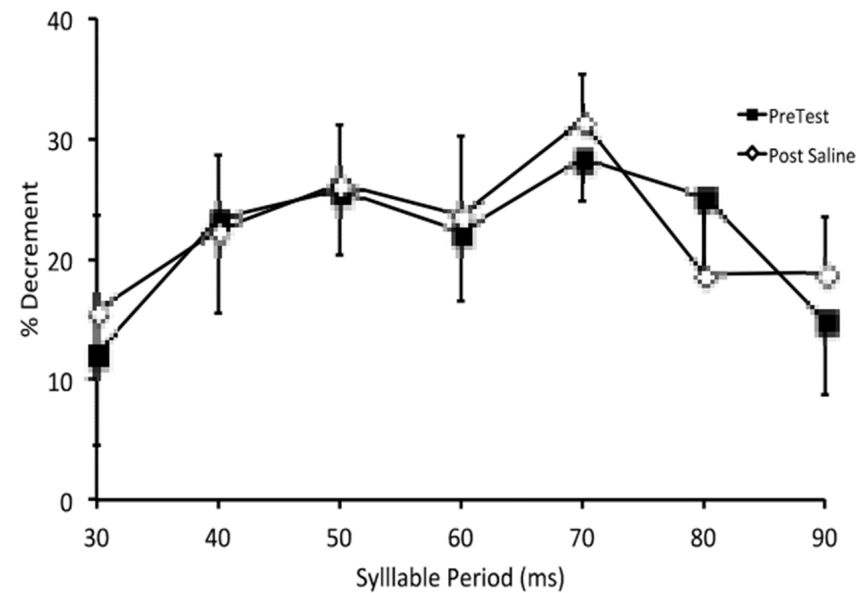
McNemar's test $P < 0.01$

Discussion

- ▶ Physiological Response graph (Lynch, 2015)
 - ▶ CC injection flattens SP-selective decrement by L3 without increasing the overall decrement.



Experimental Group



Control Group

Conclusion

- ▶ CC, a Protein Kinase C blocker, may have blocked the affect of JH III which led to a less responsiveness in the female crickets

Further Study

- ▶ Increase the sample size for both groups
- ▶ Behavioral response after the injection of CC then JHIII
- ▶ Use count data with the with values given by the Optical Kugel

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Thank you

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the frame, creating a modern, layered effect against the white background.