Do Essential Amino Acids in Reward Influence Honey Bee Learning?

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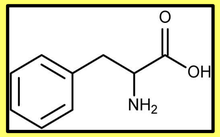


Introduction

Honey bees learn to forage for valuable nectar and pollen from flowers. Nectar and pollen contain essential amino acids which the bees cannot synthesise themselves. Before this study it was unknown whether nutrients aside from sugars could affect honey bee learning and so conditioning trials were used to test the effects of essential amino acids on honey bee learning.

Aims

- To investigate how the presence of amino acids influences the honey bee's ability to learn
- To test if there are differences in learning between old forager bees and newly emerged bees
- To see if nutritional state influences associative learning

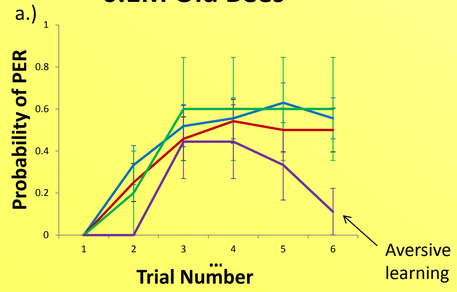
Methods

Bees were restrained using standard methods and fed to satiety on 1.0M sucrose or one of a variety of concentrations of essential amino acids in 1.0M sucrose (0.001M, 0.01M and 0.1M).
24 hours after feeding, bees were conditioned to associate the odour hexanol with either 1.0M sucrose or an essential amino acid solution over six trials with a 5 minute inter-trial interval.

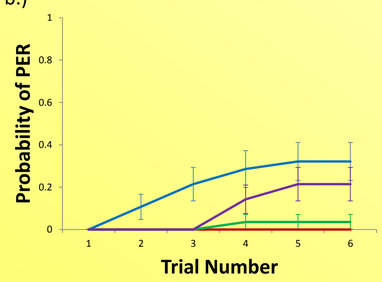
Ten Essential Amino Acids

- Arginine
- Histidine
- Isoleucine
- Valine
- Methionine
- Tryptophan
- Threonine
- Lysine
- Leucine
- Histidine
- Phenylalanine

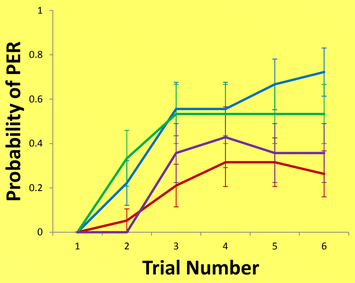
a.) **0.1M Old Bees**



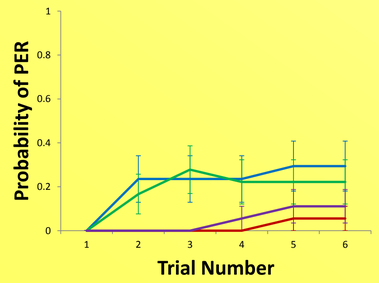
b.) **0.1M Young Bees**



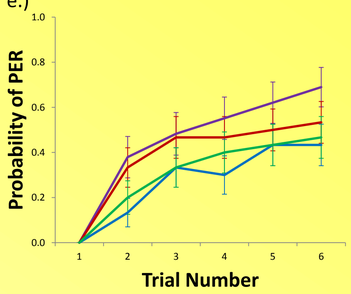
c.) **0.01M Old Bees**



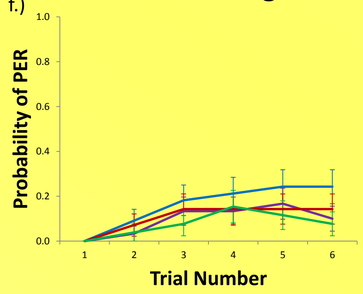
d.) **0.01M Young Bees**



e.) **0.001M Old Bees**



f.) **0.001M Young Bees**



Results

- Old forager bees learn better than newly emerged bees
- AA concentrations above 0.001M are repellent to young and old bees
- At 0.1M old bees learn to avoid AAs when they have been fed with them the day before
- At 0.001M, older forager bees learn AAs at a higher rate of acquisition than sucrose.

Figures

a.) and b.) N=5-28
c.) and d.) N=15-20
e.) and f.) N=26-33

Key

- Fed sucrose, trained with sucrose
- Fed sucrose, trained with amino acids
- Fed amino acids, trained with sucrose
- Fed amino acids, trained with amino acids

Acknowledgements: We thank Mal Thompson for beekeeping and the Nuffield Foundation for funding an undergraduate vacation bursary for HG