Honeybees, associative learning

Social rolesWorkers: Sterile females, do all work

Queen: lays eggs

Drones: males who mate with queen

Energy needs of colony-Food sources are nectar and pollen
-Forage flowers year round, with exception of spring ONHONEYBEES, ASSOCIATIVE LEARNING SPECIFICALLY FOR YOUFOR ONLY$13. 90/PAGEOrder NowWhat honeybee must do to forage enough food-Remember which food sources are productive, so they can return
-Identify new food sources based on knowledge of what has and has not been successful in past. Location-Remember based on visual queus and position of sun
-Communicate this info using special danceFood soure-Olfactory queues
-Communicate info with pollen caught in small leg hairs
-Innate preferences for some colors and shapesProboscis extension reflex (PER)-antennae/proboscis comes into contact with sucroseConditioning-Sound of metronome must be presented right before food. Classical conditioning in PERUnconditioned stimulus- sucrose
unconditioned response- PER extension responding to sucrose
Neutral stimulus- odor
Conditioned stimulus-odor
Conditioned response- PER extension responding to odor. After one trial trainingWithin minutes, learning goes down because consolidation is occurringMemory phasesShort-term memory
Midterm memory

Long-term memoryConsolidationProcess of converting memory from a short term memory to longer term form (memory is temporarily unstable at time)Sensilla-Sensory receptor on the antenna

-About 60, 000 olfactory receptors/antenna

-Project axons to antennal lobeOlfactory transduction1. Odorant binds to receptor

2. Adenyl cyclase is activated producing cAMP

3. cAMP opens cyclic nucleotide gated channels allowing positive ions to flow into cell

4. Calcium influx opens calcium activated chloride channel (cl leaves cell)

5. Opening of both these channels lead to depolarizationAntennal lobe-Axons from sensory neurons terminate in glomeruli

-160 glomeruli/antennal lobe

-Some project axons to protocerebrum, some to mushroom bodyMushroom bodies-Integrates info from multiple sensory modalities

-Each modality is located in specific area

-Contains neurons called Kenyon cellsKenyon cells- Axon branches in two and each oe enters a different lobe of the mushroom bodyMushroom body/antennal lobe necessary?-Both are necessary for olfactory learning.

-If either area is inactivated by local cooling, the bee cannot make the association (time dependent)

Neuron PE1Mushroom body neuron

-receives input from Kenyon cells

-Projects to the protocerebrum

Inhibits motor responses-learning relieves this inhibitionNeuron VUMmx1-Can

serve as US in PER conditioning (can sub for sucrose)

-Releases octopamine

-Odor has to be delivered shortly before sucrose

-If octopamine receptors are knocked down, bee cannot learn association

-VUMmx1 responds high only before association is learned.

Extinction-Weakened response when CS is presented without US

-CR can be reacquired quite rapidly when CS is again paired with US

Spontaneous Recovery-Reappearance of CS following a rest period after extinction

-Each time response recovers it is weaker and is extinguished more quicklyAcquisition-The process of developing and strengthening a conditioned response

-Asymptote- max amount of conditioning that can take place in situation (reach it faster with more intense stimuli)Rescorla-Wagner Model-An animal learns from the discrepancy between what is expected to happen and what actually happens

-More associative value if it is more suprising

-When they aren't expecting it, learning is quick

-When they expect it, odor has high associative value so learning is slow

Higher order conditioning-stimulus that is associated with a CS can also become a CSBlocking-the presence of an established CS interferes with

conditioning of a new CS

-Consists of a neutral stimulus ad a CS