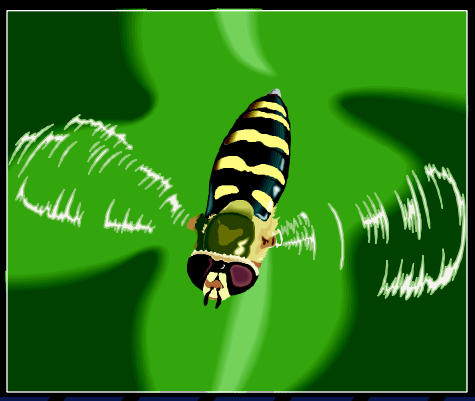
# Insect Senses

- How do insects
  - See?
  - Touch?
  - Hear?
  - Smell?
  - Taste?

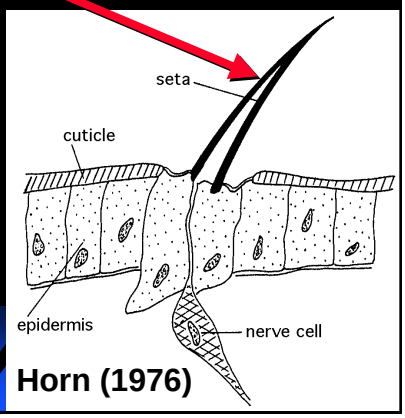


# Insect Senses

- **Vision** - compound eyes, ocelli
- **Touch** - sensilla (hair)
- **Hearing** - chordotonal organs, tympanic membrane
- **Smell** - sensilla on antennae
- **Taste** - sensilla on mouth and tarsi

# Touch - Tactile

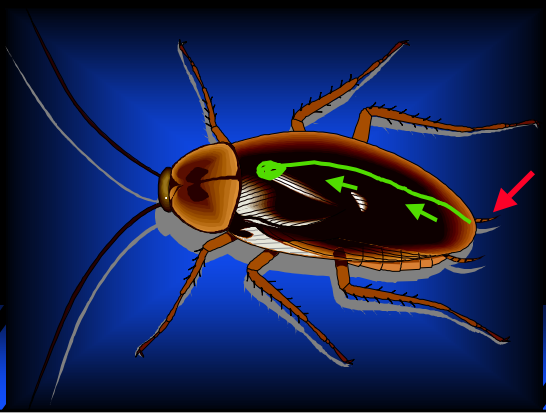
- Sensilla (hair): mechano-receptor that responds during deformation with a charge from the nerve cell to the brain. For tactile senses, there is usually only one cell receptor per sensilla
- Commonly found on:
  - legs, mouthparts, antennae, and wings



Horn (1976)

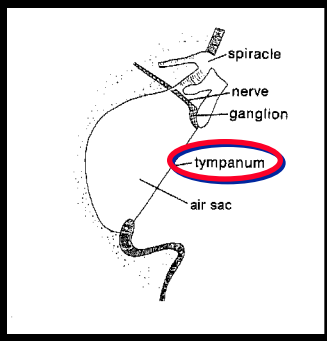
# Touch - Tactile

- Highly developed in cockroaches. Nerves from leg sensilla are connected to giant axons for rapid transmission of nerve impulses
- Result: extremely rapid movement by the insect



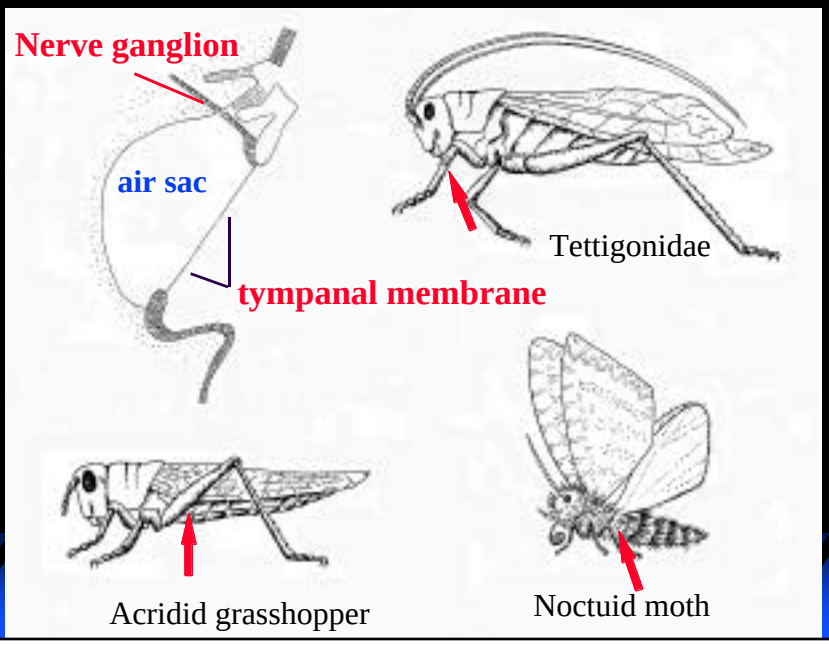
# Hearing - Auditory

- Tympanum - specialized mechanoreceptor that is analogous to human ear drums
  - Found on legs, abdomen, thorax, and even wings:
    - Noctuid moths, Mantids, Neuroptera
      - for avoiding predators such as bats for up to 30 m away
    - Orthoptera, Homoptera, & Hemiptera
      - for finding mates



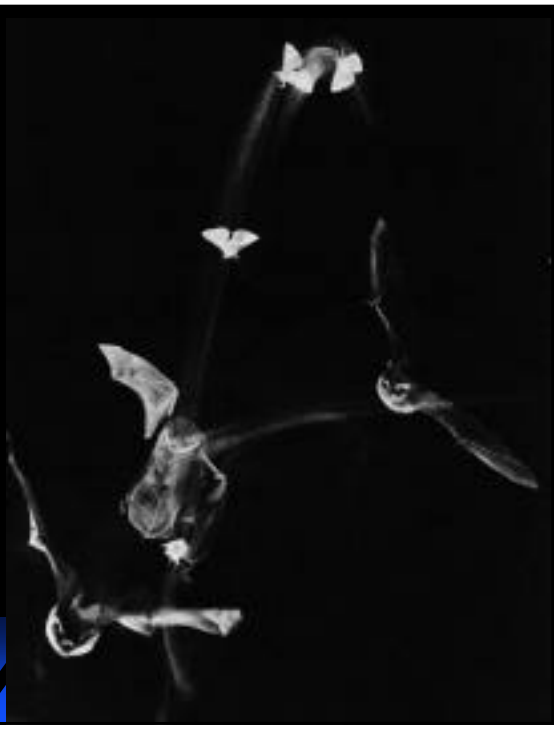

Human Ear

# Tympanum - Sound Reception



# Moths and Bats

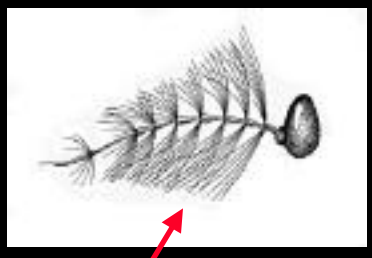
Certain moths can hear the ultrasonic cries by which bats locate their prey.



New slide

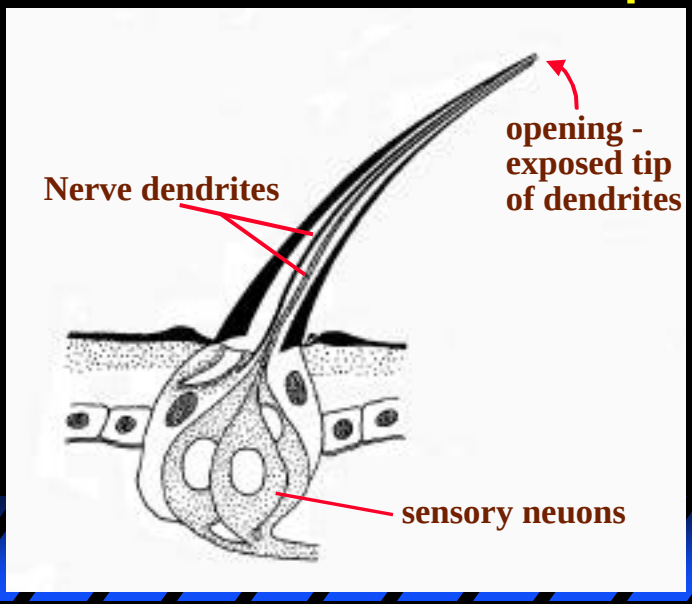
# Hearing - Auditory

- Some insects can hear with their antennae
  - Mosquitoes, midges, honey bees
  - Use sounds to locate mates or transfer information in the honey bee dances



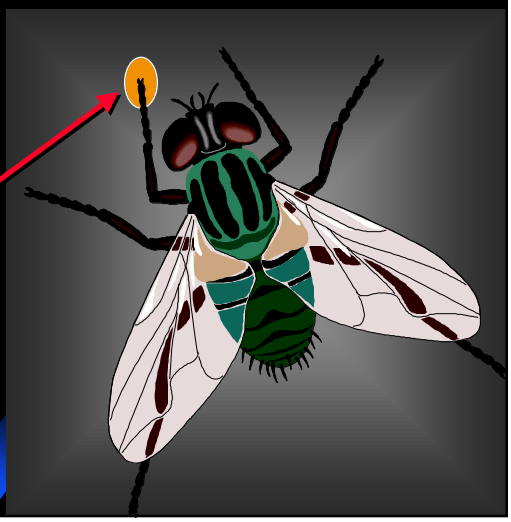
Long hairs vibrate and allow the male mosquito to hear certain sound frequencies

# Taste - Chemoreceptors



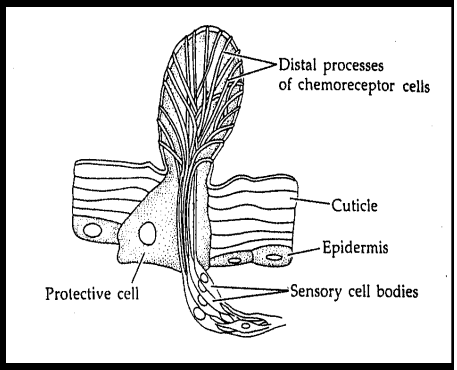

# Taste - Gustation

- CHEMORECEPTORS: respond to chemicals occurring on solid or in aqueous substrates.
  - Mouthparts for most insect species
  - Tarsi of flies
  - Antennae of bees
  - Ovipositor



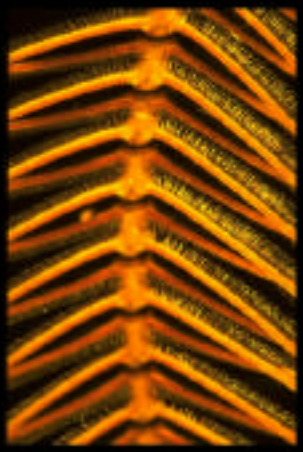
# Smell - Olfaction

- Many species have acute ability to smell
  - Used to find hosts
  - Used to find mates
- Olfactory chemoreceptors usually occur on the antennae. Volatile molecules enter tiny pores and stimulate the nerve cells and nervous system




Brusca & Brusca (1990)

# Smell - Olfaction

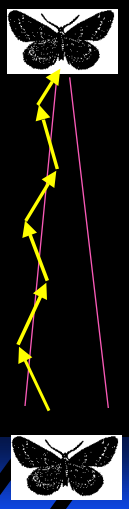


Atlas moth

http://www.pheromone.ekol.lu.se/antenna.html
Chemical Ecology Group; Univ. of Lund, Sweden

# Smell - Olfaction

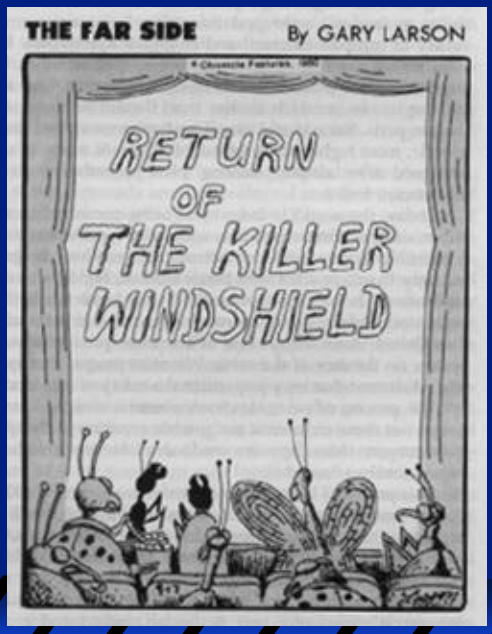
- Insects often respond to blends of gaseous volatiles. There are sensory cells that respond to only one chemical and some that can respond to more than one
- Behavioral responses - searching for:
  - good food
  - avoiding unsuitable food
  - finding mates
  - staying away from unsuitable mates
- Searching behavior - move upwind



# Smell - Olfaction

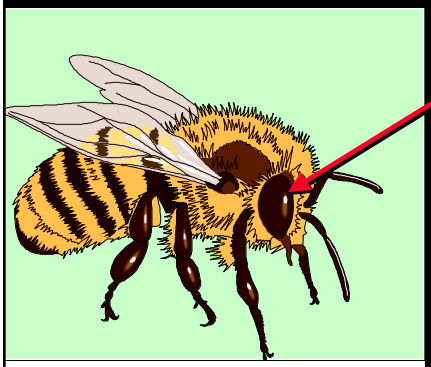
Male turnip moth
http://www.pheromone.ekol.lu.se/vt2.html
Chemical Ecology Group; Univ. of Lund, Sweden

# Insect Vision

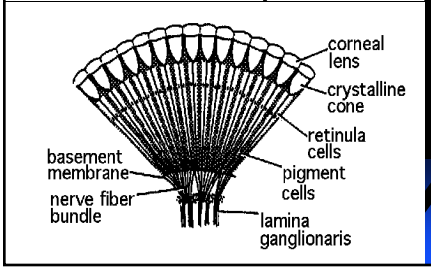


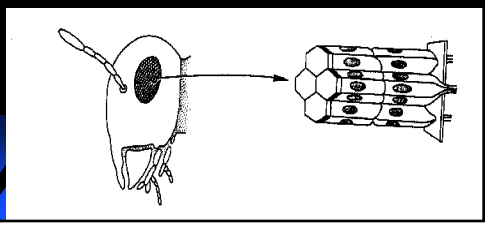

An Insect Horror Movie

# Vision



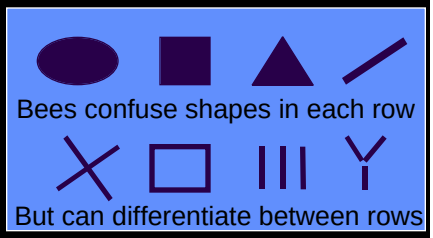
- Compound eye
  - Two per insect
  - Ommatidia are facets that make up the eye -- they are connected to the nervous system
- Perception of form -- "Mosaic Theory"



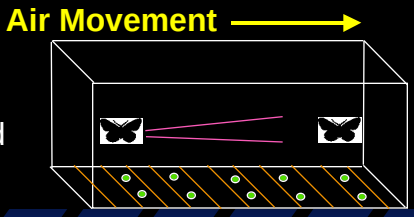



# Vision

- Form or pattern perception:
  - Bees perceive brokeness or flickering in patterns. --Notice that bees tend to land on flowers shaking in the wind.

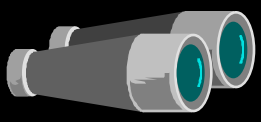



- Optomotor Response:
  - Flying insects can tell the direction and speed they are moving by observing the movement of patterns around them as they fly.
  - Important for movement perception




# Vision

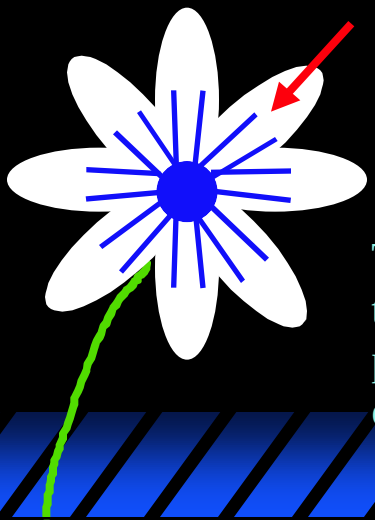
- Distance Perception:
  - Binocular vision is required
  - Human eyes can converge on points in the distance. Insects rely on different ommatidia to fix on a point.



- Color:

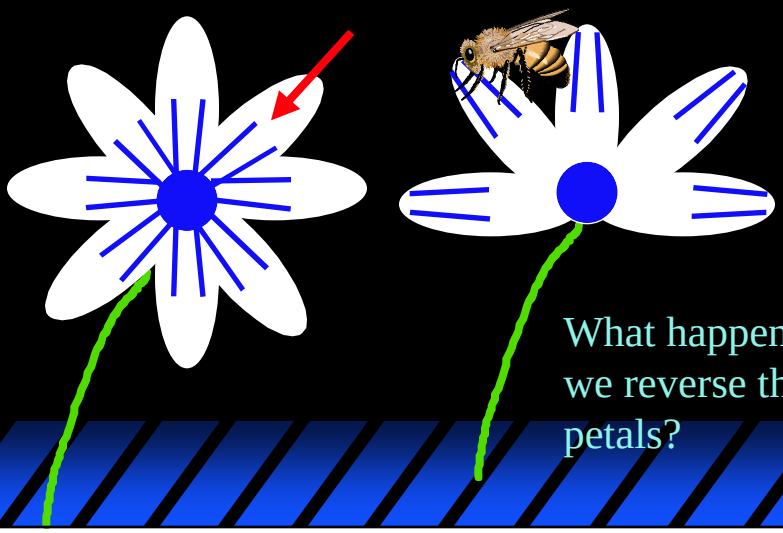

Electromagnetic spectrum of light wavelengths in millimicrons

# Nectar Guides on Flowers



The guides direct insects to the nectaries by providing both color and odor cues.

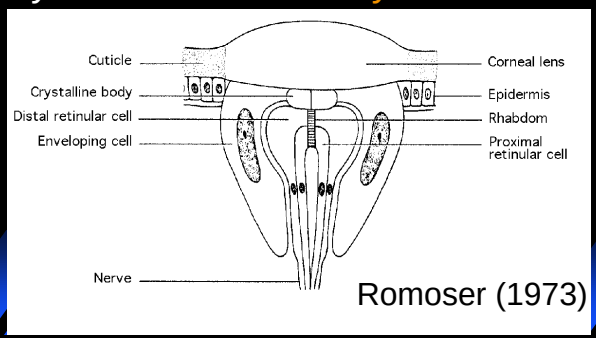
# Nectar Guides on Flowers



What happens if we reverse the petals?

# Vision

- Ocelli:
  - Simple eyes that do not form an image, used as horizon detectors, detect changes in light intensity, may aid in photoperiod determination - (important to induce diapause)
- Stemmata:
  - Simple eyes used for vision by larvae




Romoser (1973)