~ 25% of insects are predatory at some life stage...
...and many insects are parasitoids or parasites.

Predator:

Parasitoid:

Parasite:

How do predators find prey?

Foraging strategies: sit and wait

- Conserves energy
- Cryptic behavior: defense and offense

Foraging strategies: sit and wait

Aggressive foraging mimicry

Carnivorous fireflies use bioluminescent lures to attract their meals.
• *Photuris* firefly female eats males of other firefly species
• Females can mimic female flash patterns of five other firefly species
• They use light to find and lure prey

Foraging strategies: sit and wait

Foraging strategies: active foraging

Semi-random searching

- Patrol microhabitat: time allocated to a patch dictated by prey capture rate
- Eat what they touch

Directional searching

- Find prey at a distance
- Use chemicals, sound and light
- Sharply toothed mandibles, legs for seizing prey
- Often flying predators
How do actively-foraging predators find their hosts?

**Chemical cues:**
1. Kairomones
2. Synomones
3. CO₂ – usually by blood-feeding insects

**Sound / Vibration:** e.g., wing beat frequency, cricket songs detected by parasitoids.

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**Phoresy**

The phenomenon of one individual being carried on the body of a larger individual of another species

Another example: botfly eggs

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**Phoresy**

Individual is transported (hitchhikes) ride to prey source.

E.g., human botfly captures a blood sucking dipteran (mosquitoes) and attaches a cluster of eggs to phoretic intermediate. When the dipteran takes a blood meal, the rise in temperature induces eggs to hatch.

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**Ectoparasitoids:**
Parasitoids that live on the outside of their hosts

**Endoparasitoids:**
Parasitoids that live on the inside of their hosts
How do endoparasitoids cope with the immune responses of the host?

- Incompatible host-parasitoid interaction results in encapsulation.

What’s happening here?

Insects use structural, chemical, and behavioral defenses to avoid each stage of a predator encounter:

Detection → Attack → Capture → Consumption / Parasitism

by predators and parasitoids
Crypsis: Hiding
Can incorporate color, texture, pattern, and behavior
http://www.youtube.com/watch?feature=player_detailpage&v=j1xosKrZtDQ#t=21s

Masquerade: Look like something else

Detection ➔ Attack ➔ Capture ➔ Consumption / Parasitism
Detection $\rightarrow$ Attack $\rightarrow$ Capture $\rightarrow$ Consumption / Parasitism

Startle displays

Whistling caterpillars: acoustic startle displays

Aposematism: advertising unpalatability
Aposematism: advertising unpalatability

Aposematism can be acoustic, too.

All of these moths produce aposematic clicks

unpalatable unpalatable palatable

What is this?

Batesian mimicry
(ant = model, treehopper = mimic)
Batesian mimicry
(ant = model, treehopper = mimic)
unpalatable models
and palatable mimics

Müllerian mimicry
All unpalatable!
How can this evolve?

Detection → Attack → Capture → Consumption / Parasitism
Aposematism often relies on predator learning. After a predator consumes an unpalatable insect, it will avoid attacking similar insects in the future.
Detection → Attack → Capture → Consumption / Parasitism

Chemical defenses: spraying

Detection → Attack → Capture → Consumption / Parasitism

Chemical defenses: Reflex bleeding (autohemorrhaging)

Detection → Attack → Capture → Consumption / Parasitism

Chemical defenses: Enteric discharge

Detection → Attack → Capture → Consumption / Parasitism

Chemical and structural defenses: urticating hairs
Structural defenses:

- Spines and cuticle

Detection → Attack → Capture → Consumption / Parasitism

Structural defenses: autotomy

- Coatings and constructions

Detection → Attack → Capture → Consumption / Parasitism

Collective defense

(Hartbauer et al. 2010)