

BIOENG-456

Controlling Behavior in Animals and Robots

Week 5: Internal states and action selection

5 minutes fill out Indicative Feedback
(on ISA - isa.epfl.ch)

Fly internal states...

What is an internal state?



What is an internal state?

Internal state

- Hunger
- **Anger**
- **Sexual motivation**
- Contentment
- Mania
- Depression

Behavior

- Seeking food / odor responses
- **Aggression**
- **Courtship**
- Smiling
- Hyperactivity
- Hypoactivity

Male-male aggression



Wing threat



Chasing



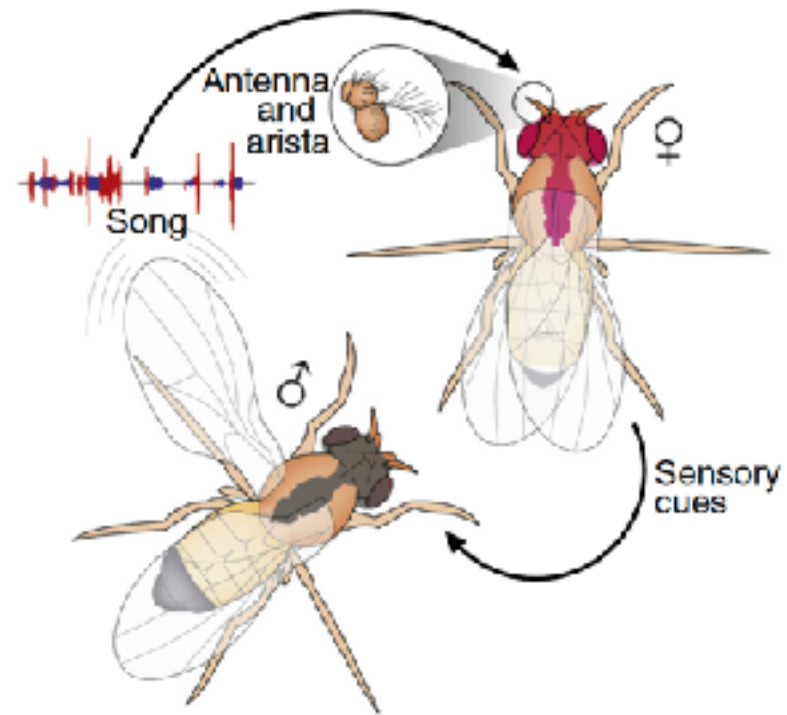
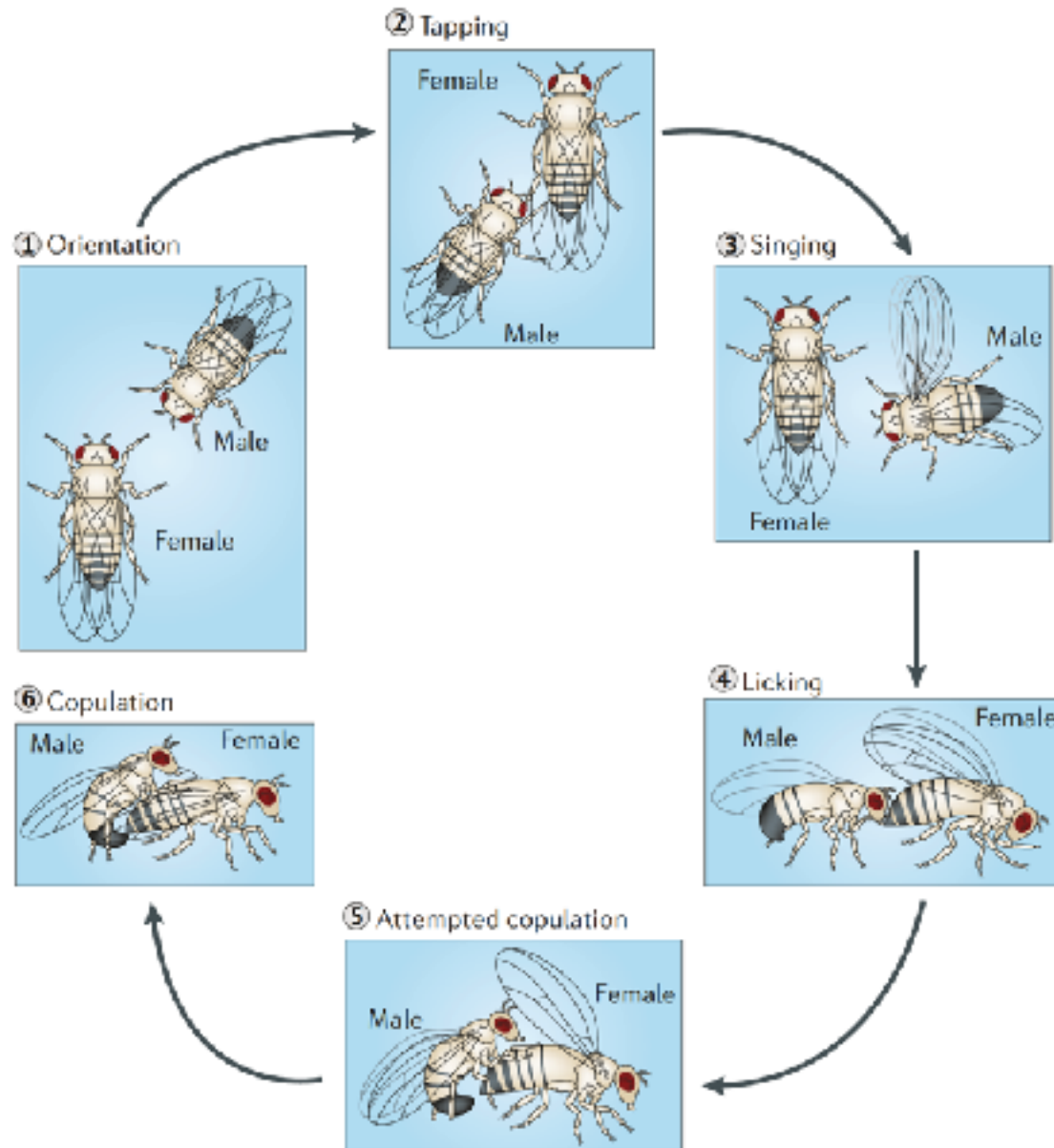
Lunging



Tussling



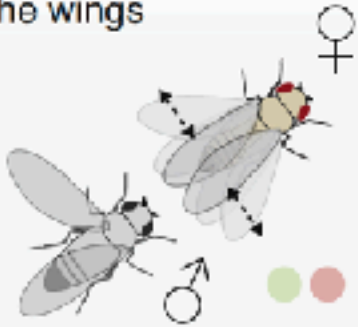
Male-female **courtship**: male behaviors



Male-female **courtship**: female behaviors

Rejection

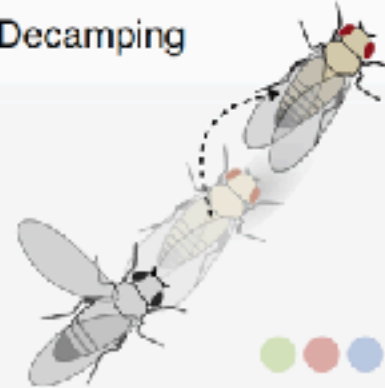
Flicking the wings



Curling



Decamping



Kicking



Fending

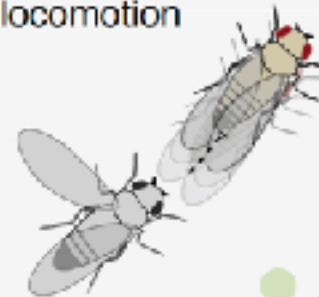


Grooming



Acceptance

Decreased locomotion



Ovipositor extrusion

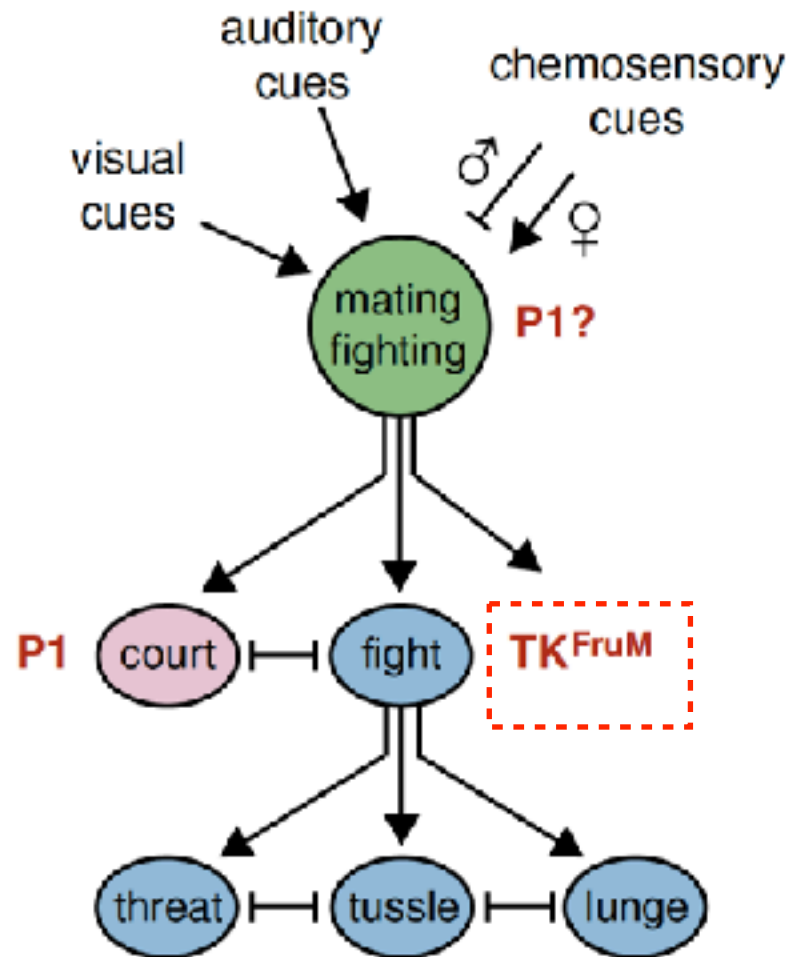


● Mature virgin

● Immature virgin

● Mated

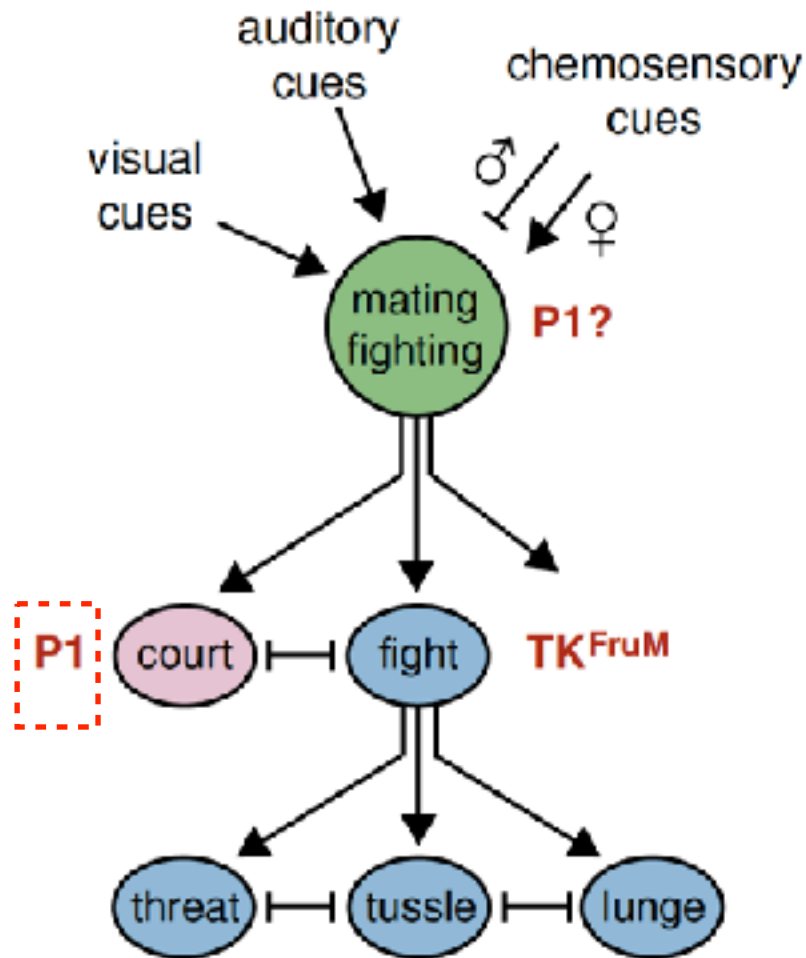
Aggression is modulated by TK



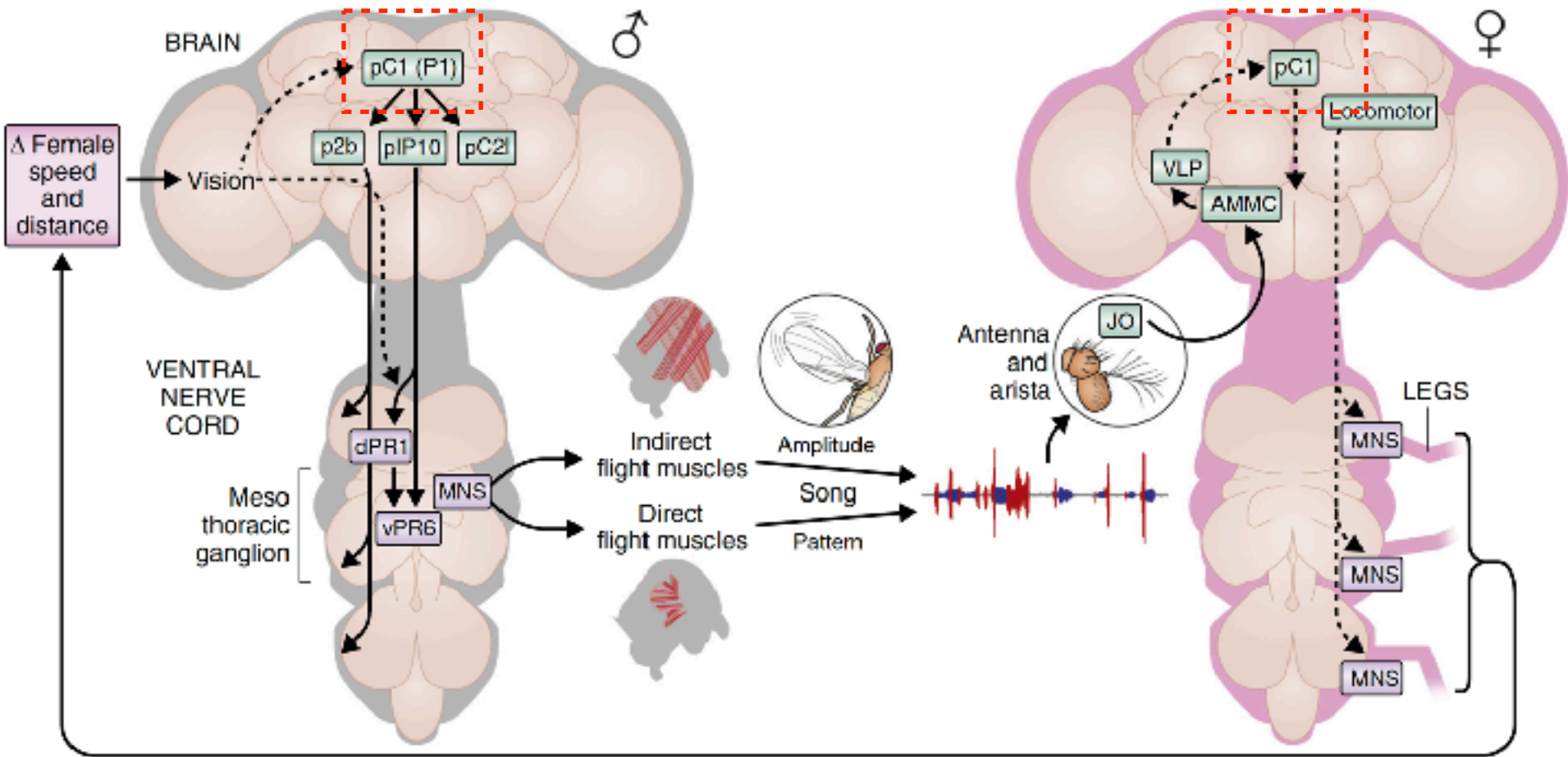
Tachykinin activation turns courtship to aggression



Courtship (sex drive) is modulated by P1



pC1 (P1) neurons regulate courtship in males and females



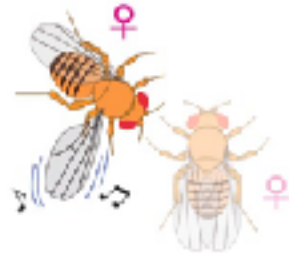
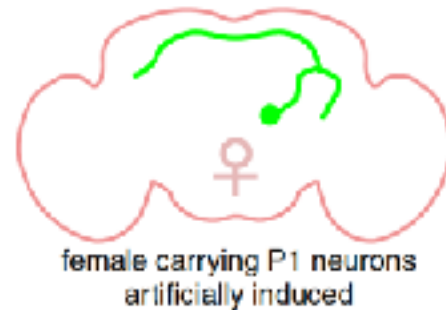
Artificial activation of P1 drives courtship



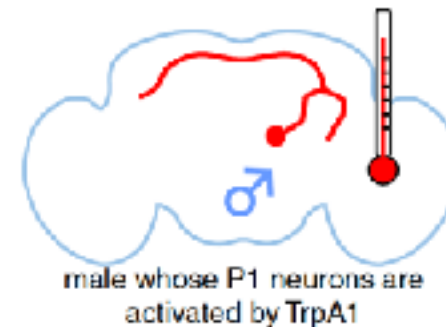
Only males have
P1 neurons



Females do not
have P1 neurons



Genetically altered females
with P1 neurons active
court other females

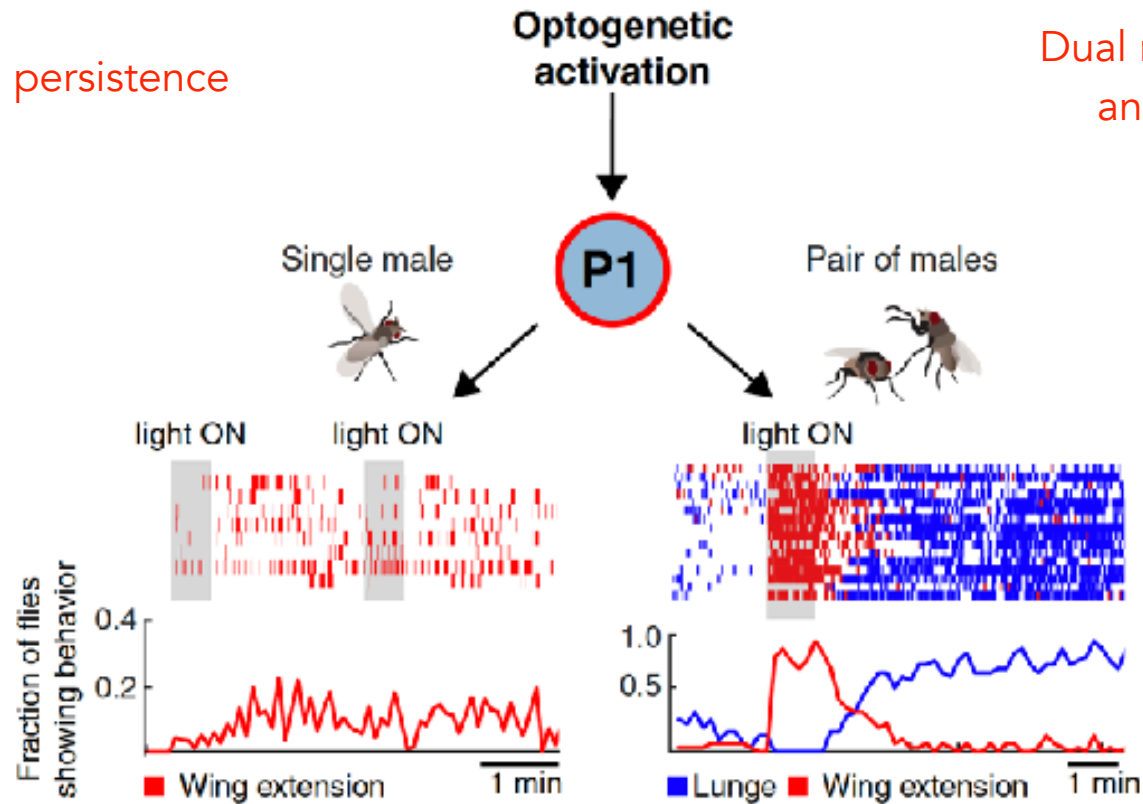


Males with P1 neurons active
court nothing or objects

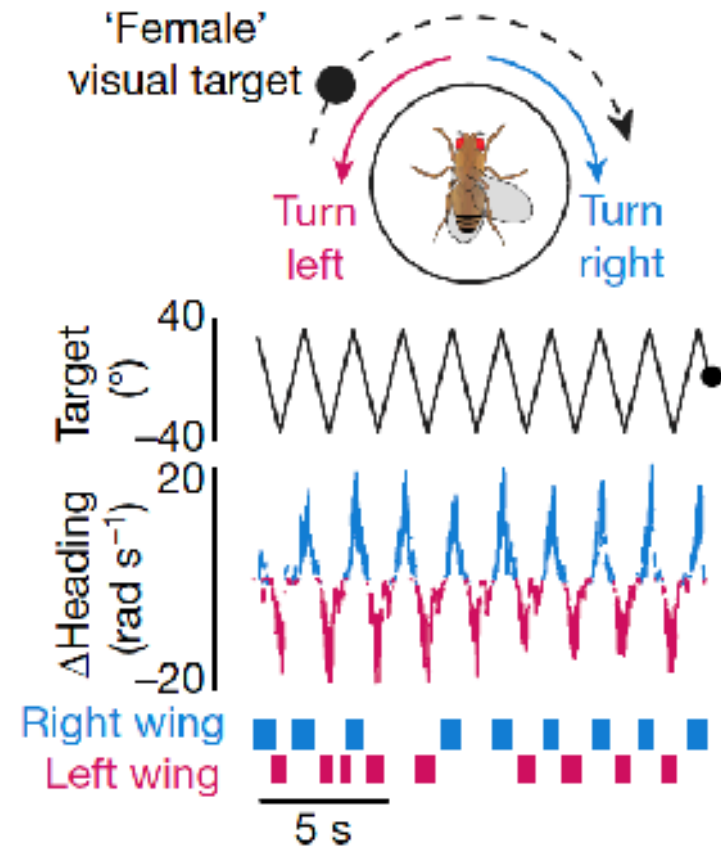
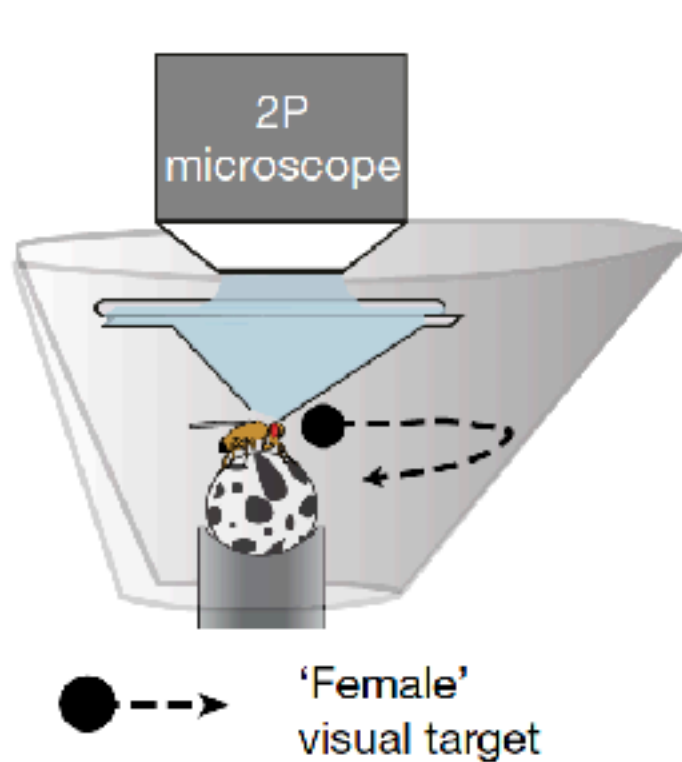
P1 activation drive persistent switches between aggression and courtship

Behavioral persistence

Dual role in courtship and aggression



Paper 1: Internal states modulate visual behaviors



Paper 2: Choosing between two actions

