

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?



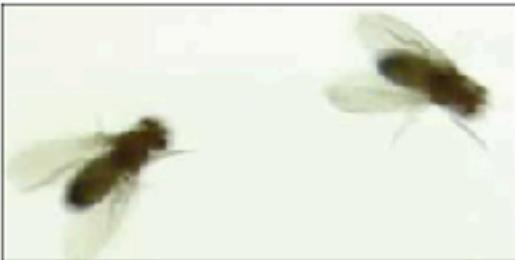
What is an internal state?

Internal state	Behavior
• Hunger	• Seeking food / odor responses
• Anger	• Aggression
• Sexual motivation	• Courtship
• Contentment	• Smiling
• Mania	• Hyperactivity
• Depression	• Hypoactivity

Male-male aggression



Wing threat



Chasing



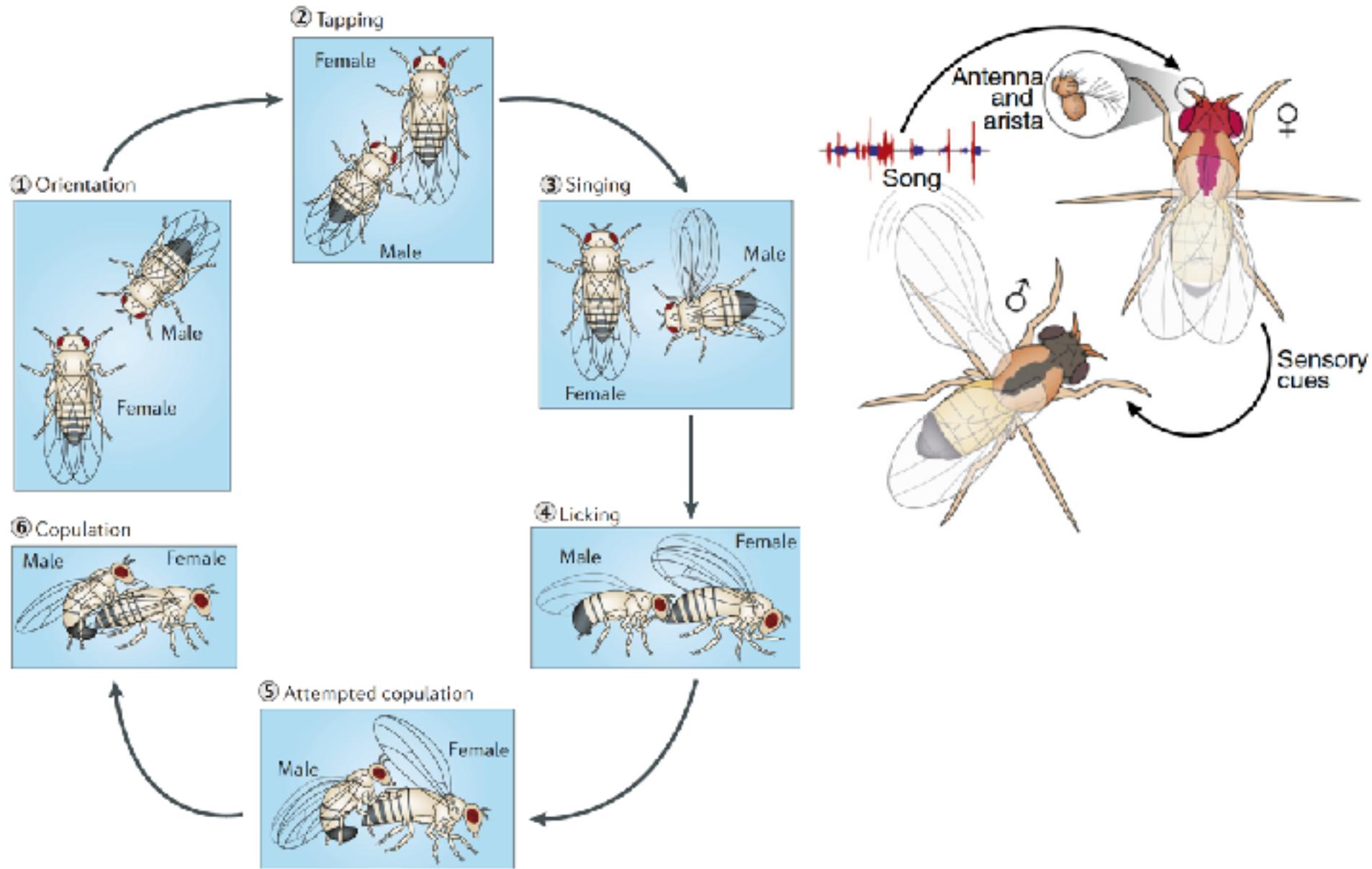
Lunging



Tussling



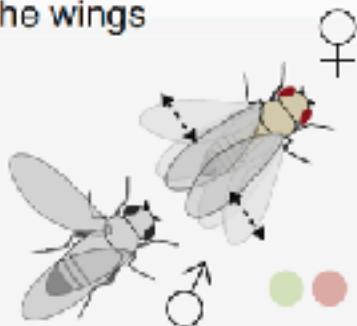
Male-female courtship: male behaviors



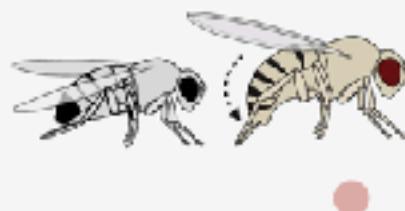
Male-female courtship: female behaviors

Rejection

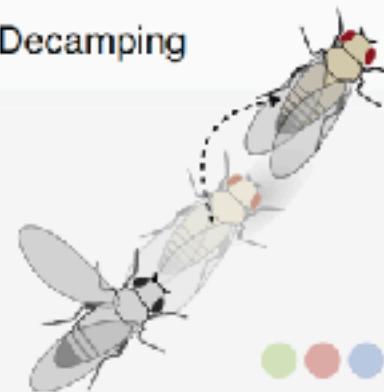
Flicking
the wings



Curling



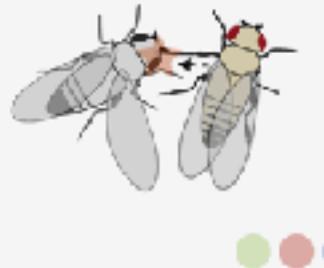
Decamping



Kicking



Fending

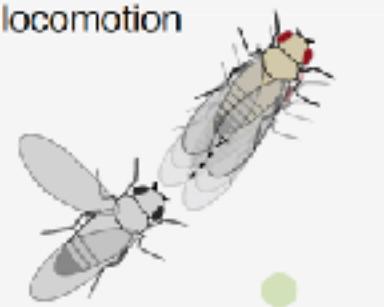


Grooming



Acceptance

Decreased
locomotion



Ovipositor
extrusion

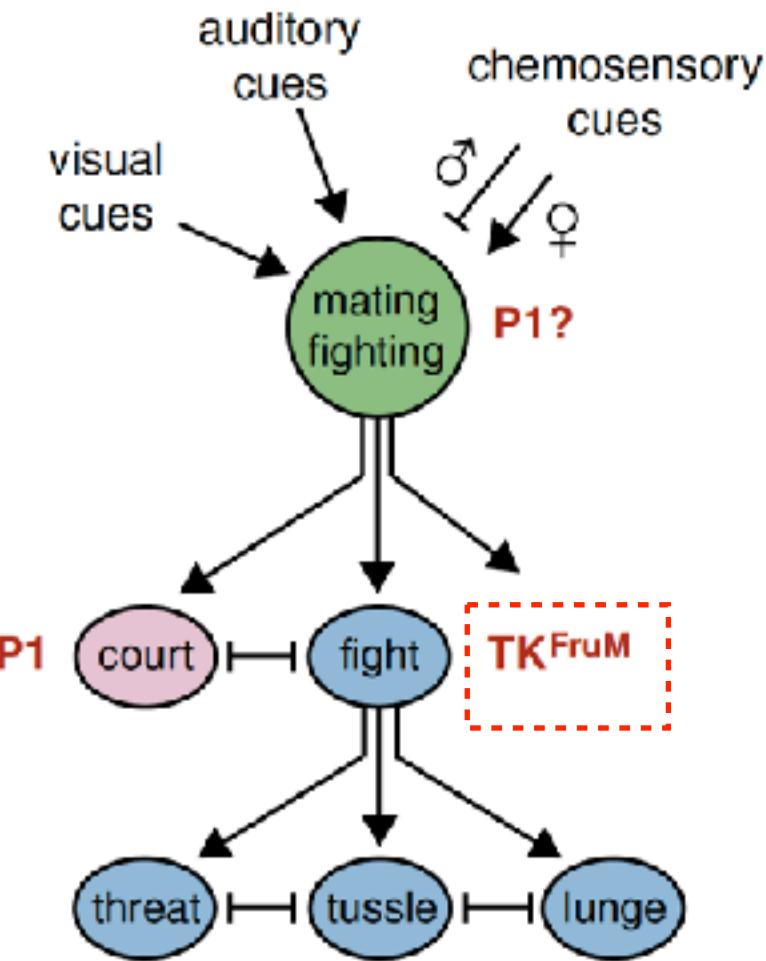


● Mature virgin

● Immature virgin

● Mated

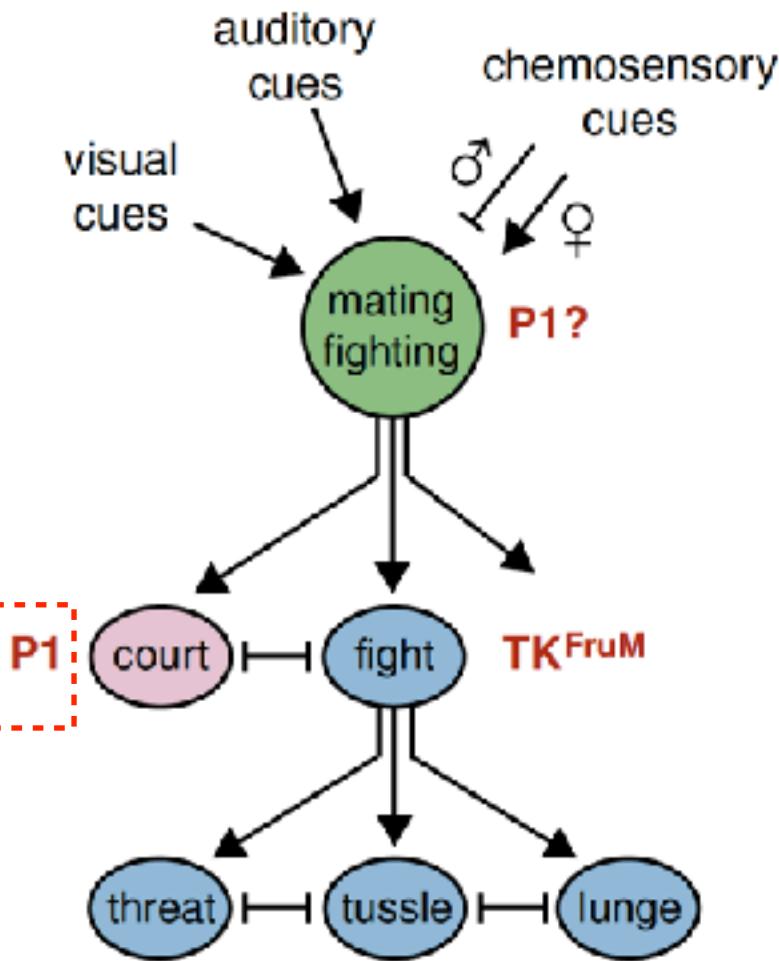
Aggression is modulated by TK



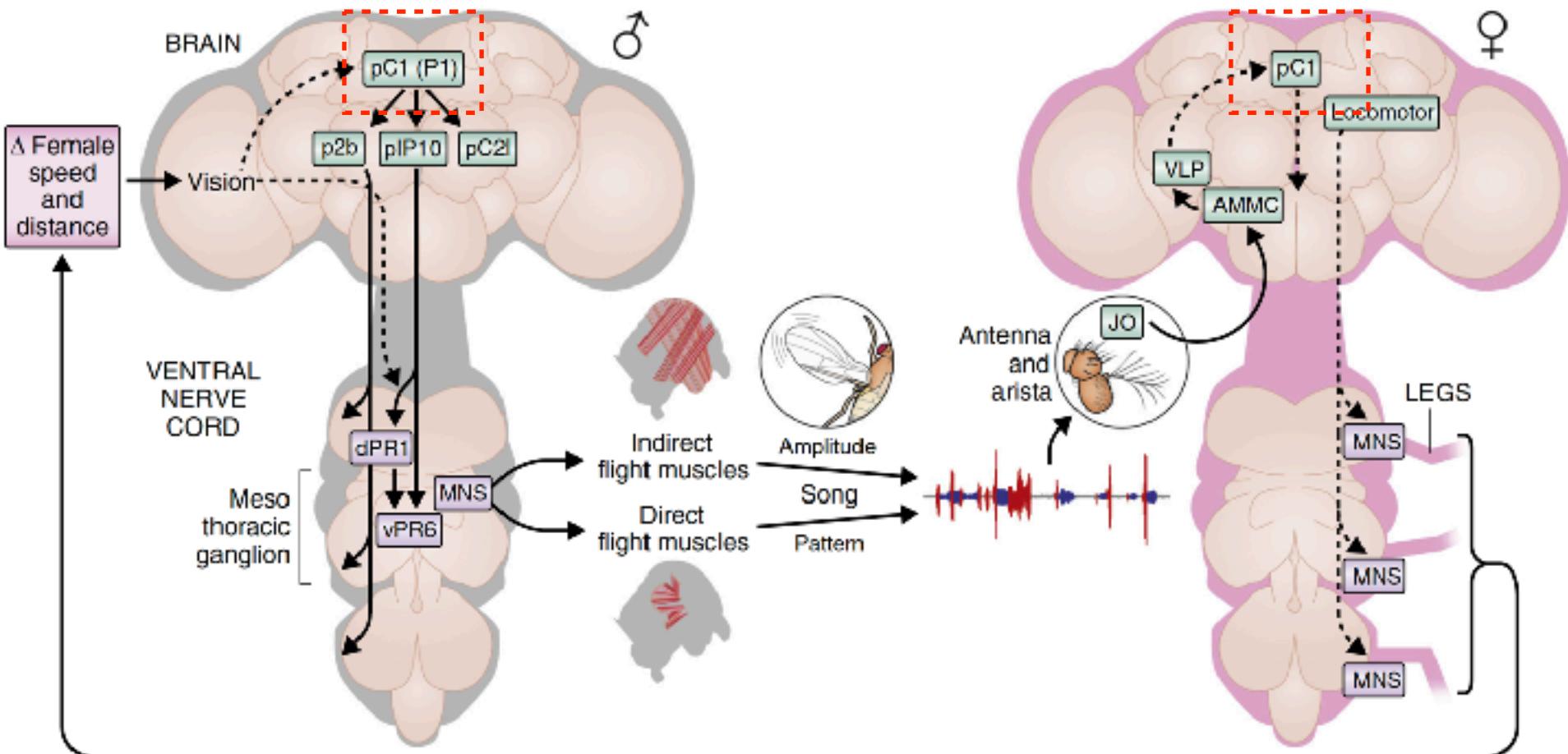
Tachykinin activation turns courtship to aggression



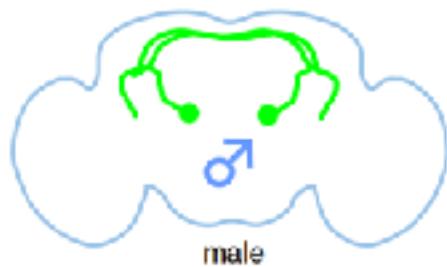
Courtship (sex drive) is modulated by P1



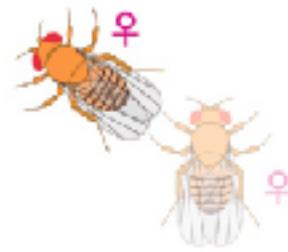
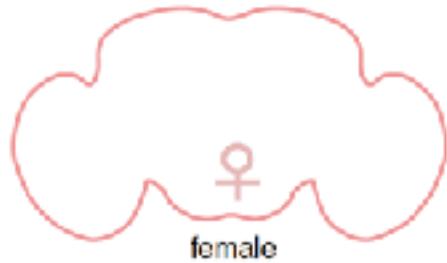
pC1 (P1) neurons regulate courtship in males and females



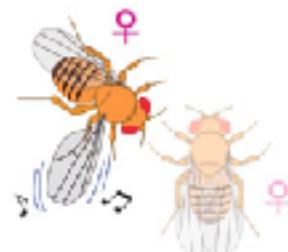
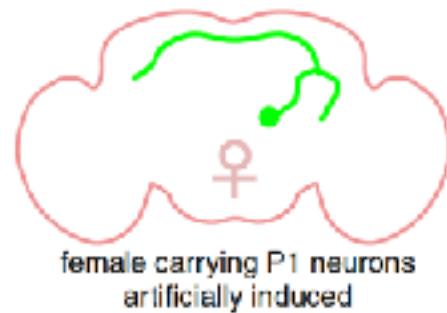
Artificial activation of P1 drives courtship



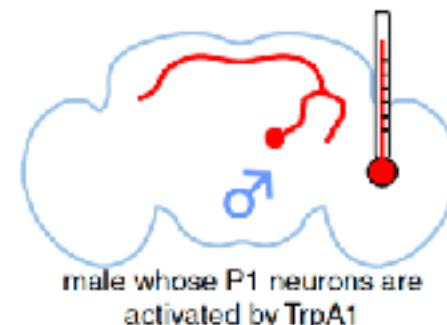
Only males have
P1 neurons



Females do not
have P1 neurons

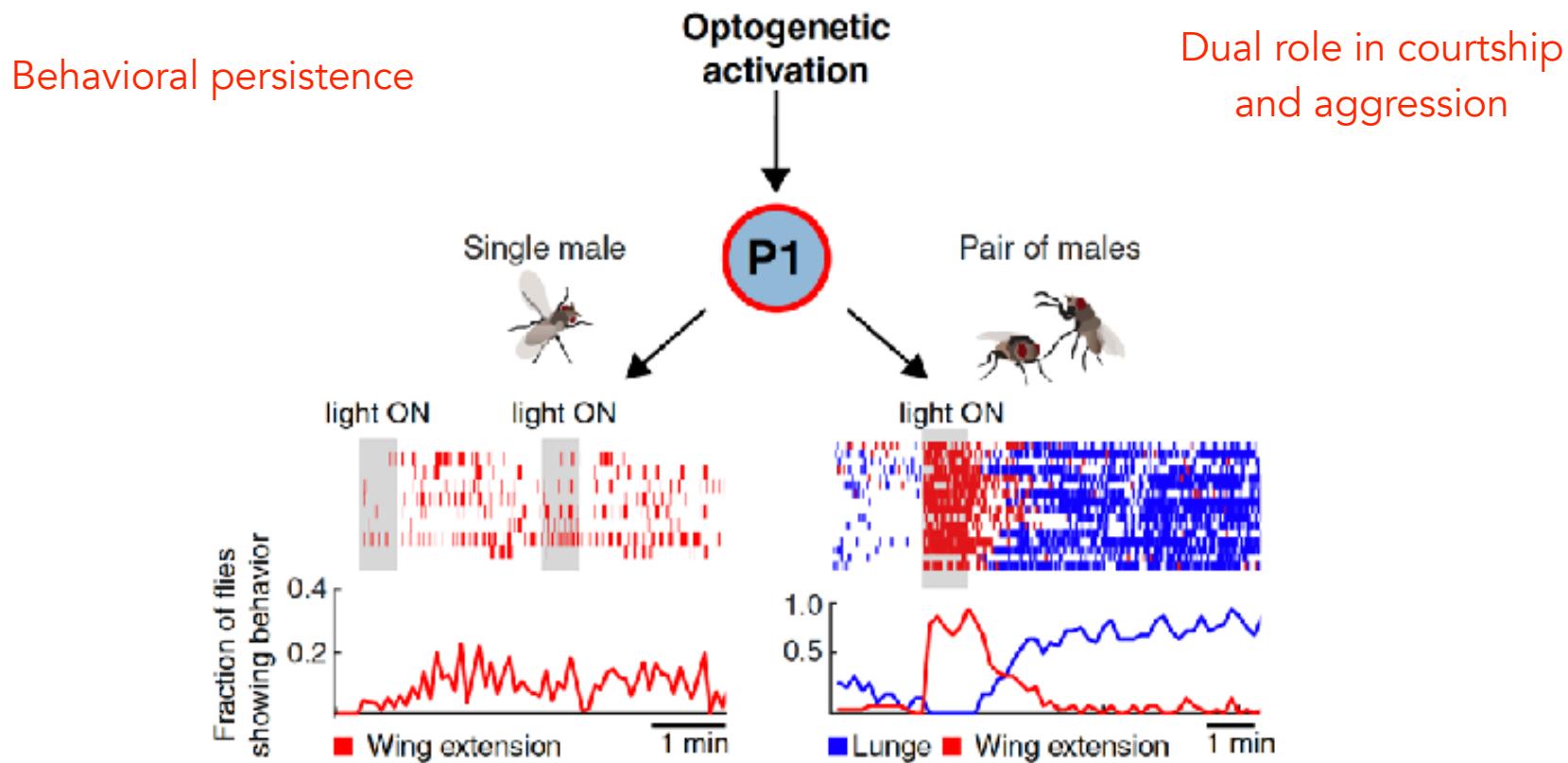


Genetically altered females
with P1 neurons active
court other females

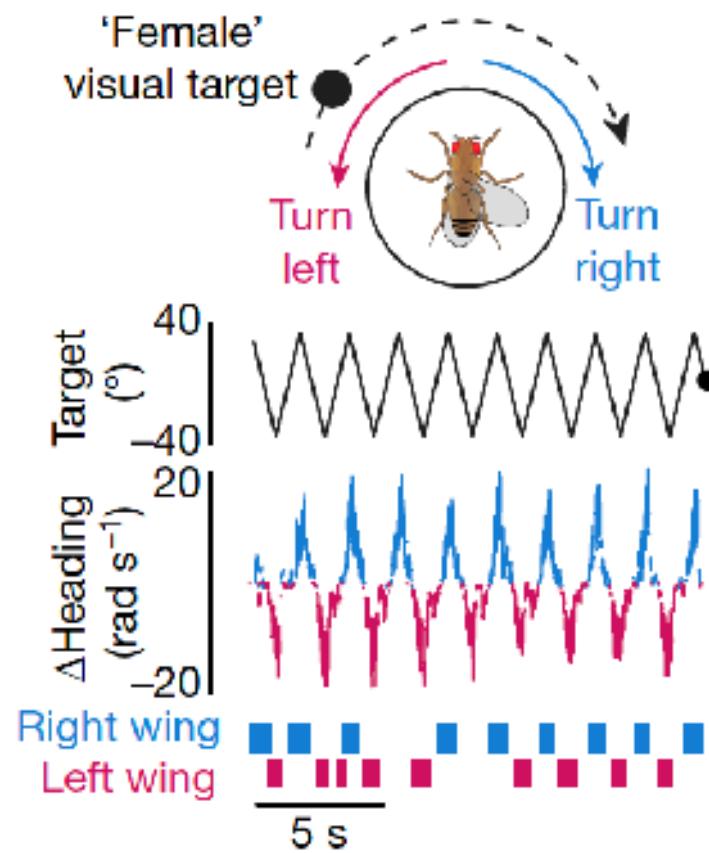
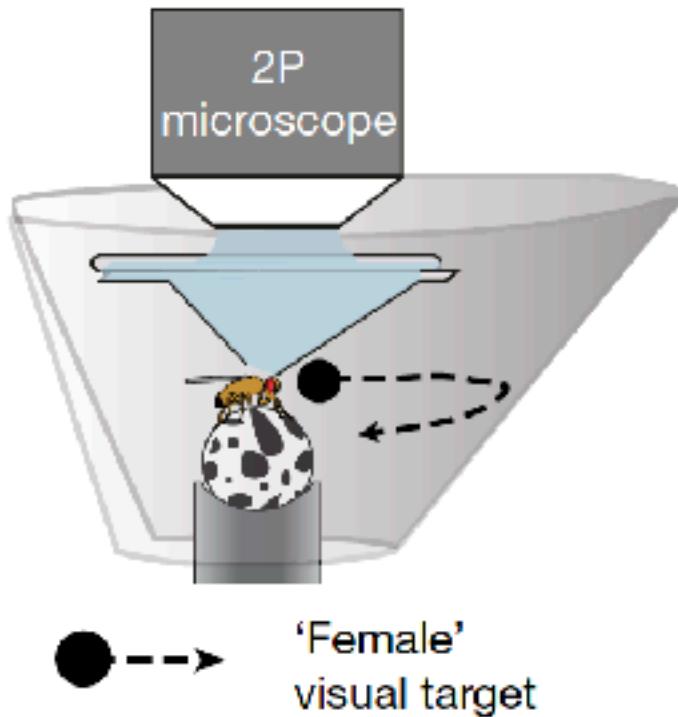


Males with P1 neurons active
court nothing or objects

P1 activation drive persistent switches between aggression and courtship



Paper 1: Internal states modulate visual behaviors



Paper 2: Choosing between two actions

