



# Identification of a candidate queen cuticular hydrocarbon affecting fire ant social form



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# Fire ant *Solenopsis invicta*



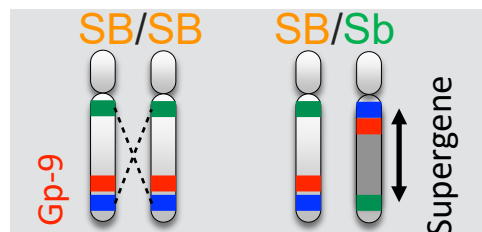
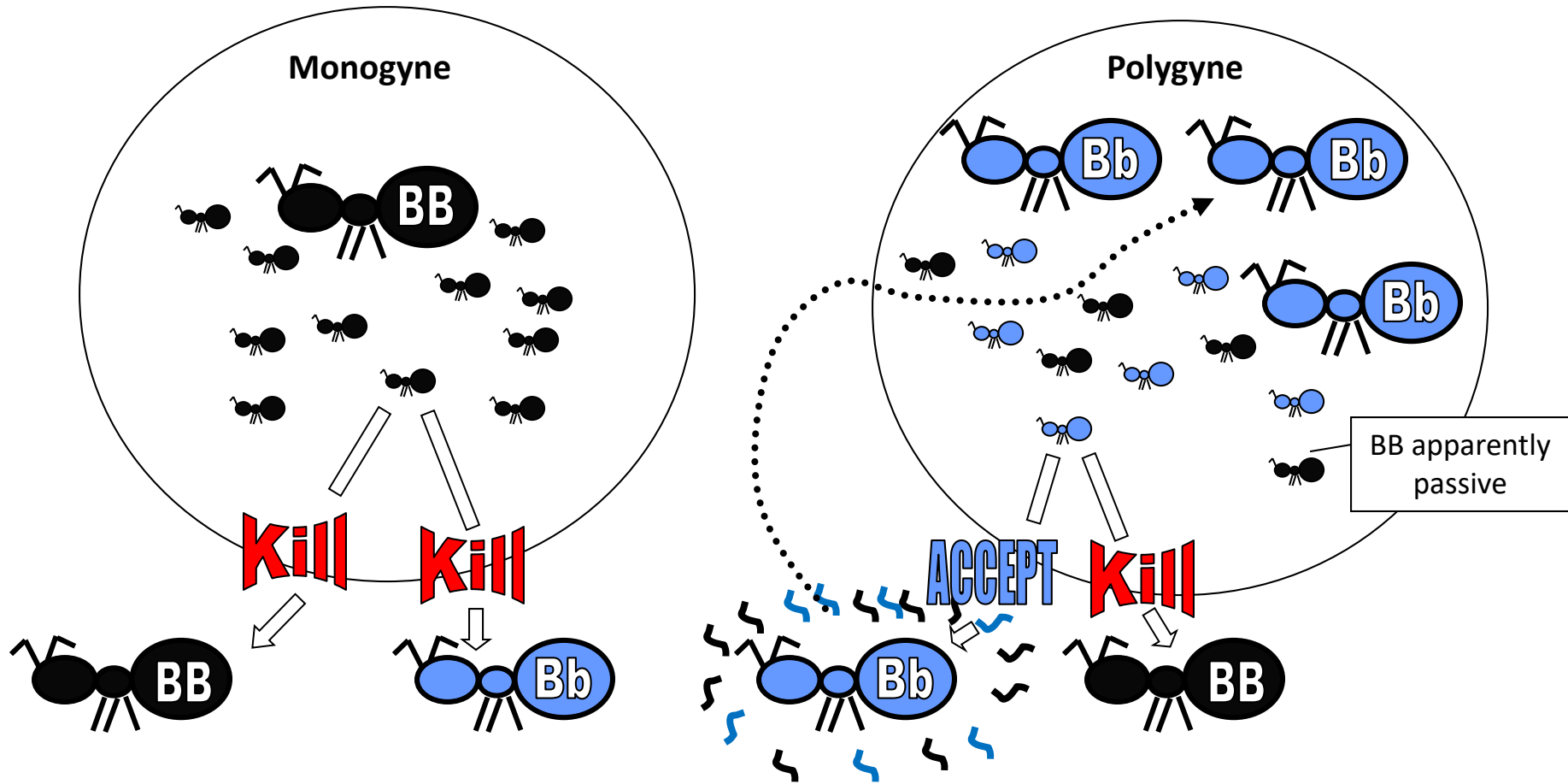
Monogyne



Polygyne

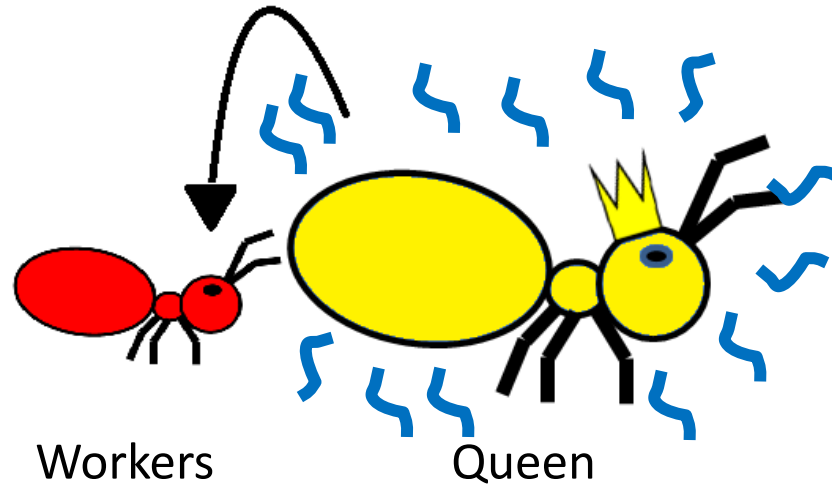
A selfish element drives colony form  
(simultaneously a social supergene)

# Fire ant social organization is linked to selfish *Gp-9* locus



aka Greenbeard effect

Ken Ross and colleagues  
Laurent Keller and colleagues  
Our lab



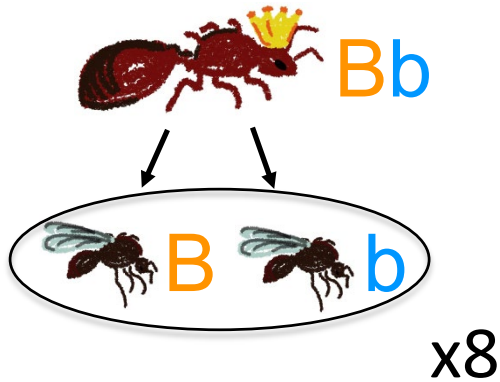
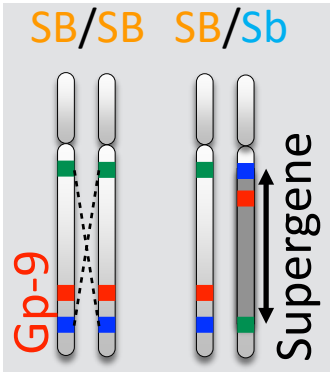
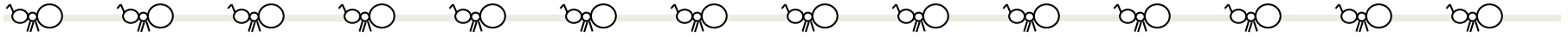
Can we determine:

- Odor
- Receptor

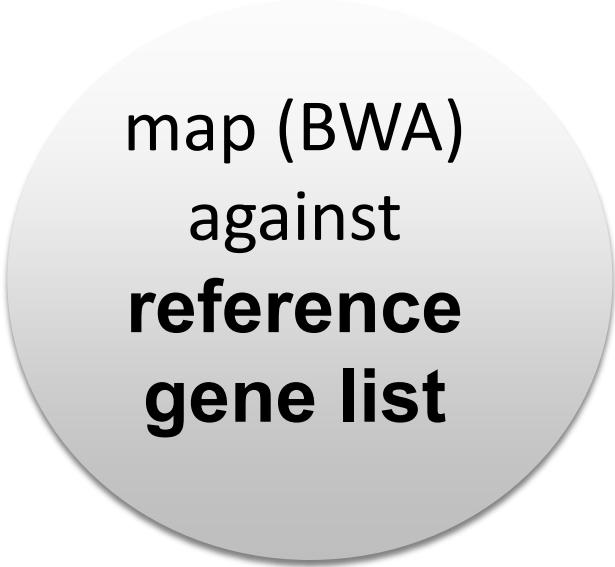
Genomic  
analysis

Chemical  
ecology

# Copy number variation analysis

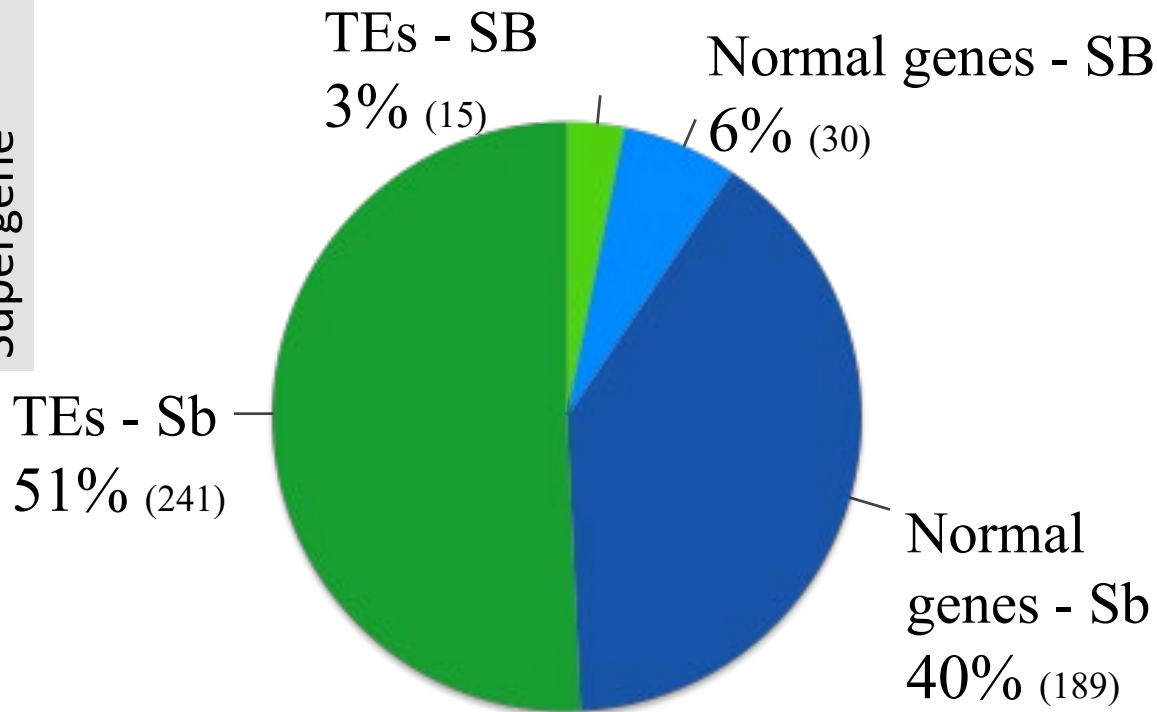
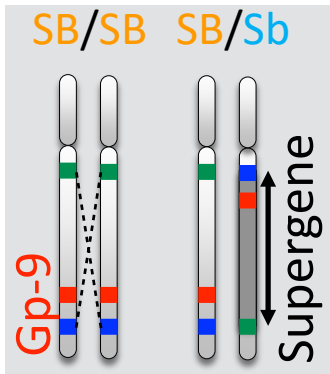


DNA  
seq data →



→ mapped  
reads  
SB ≠ Sb?

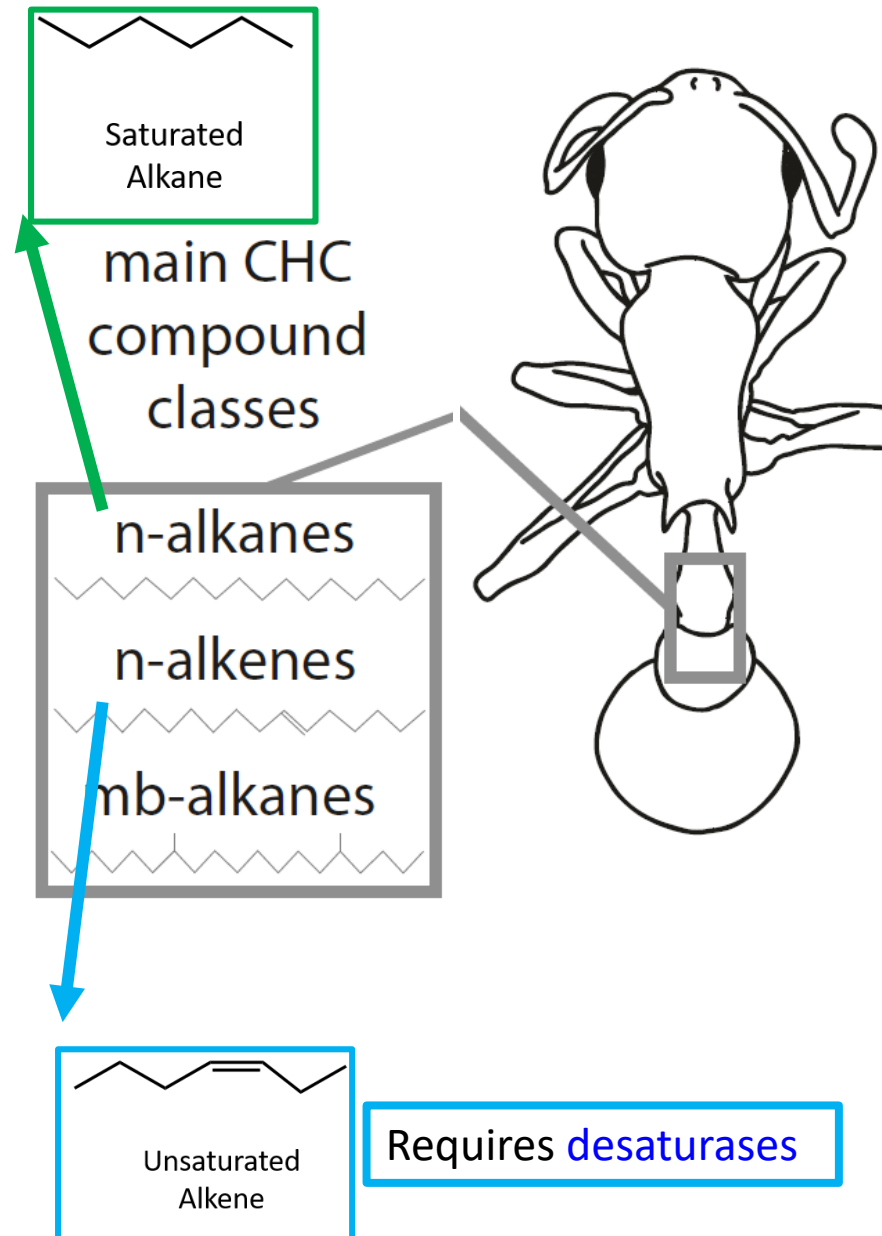
# 475 genes with CNV difference: Sb vs SB, [including a desaturase]



~50% are **transposable elements**

Surprisingly many “normal” genes

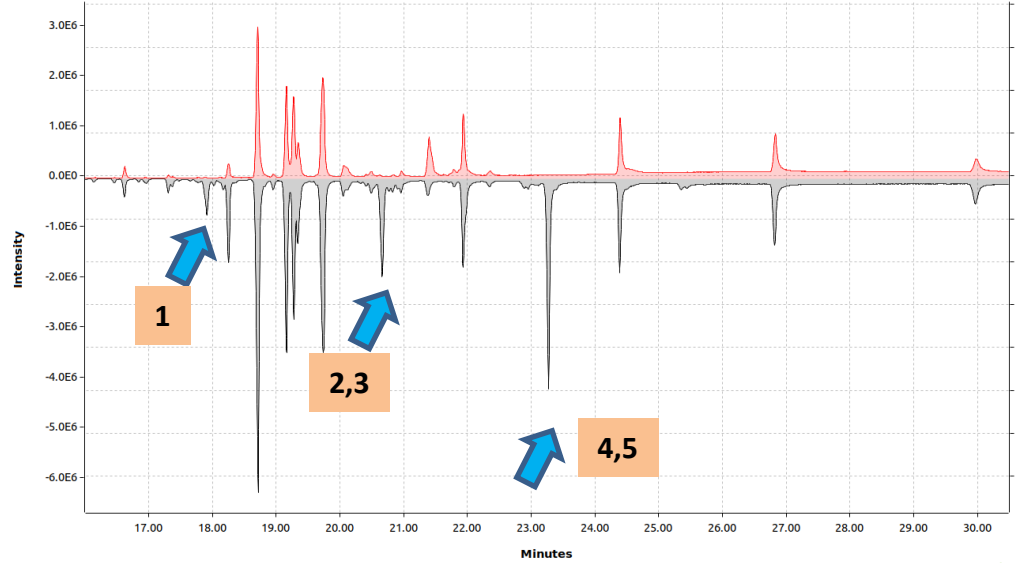
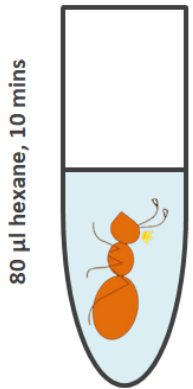
- Including 49 encoding putative **cuticular hydrocarbon synthesis** enzymes
- **Desaturase enzyme**



# More unsaturated hydrocarbons in SB/Sb queens



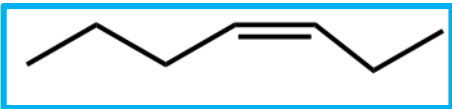
## Gas chromatography-mass spectrometer



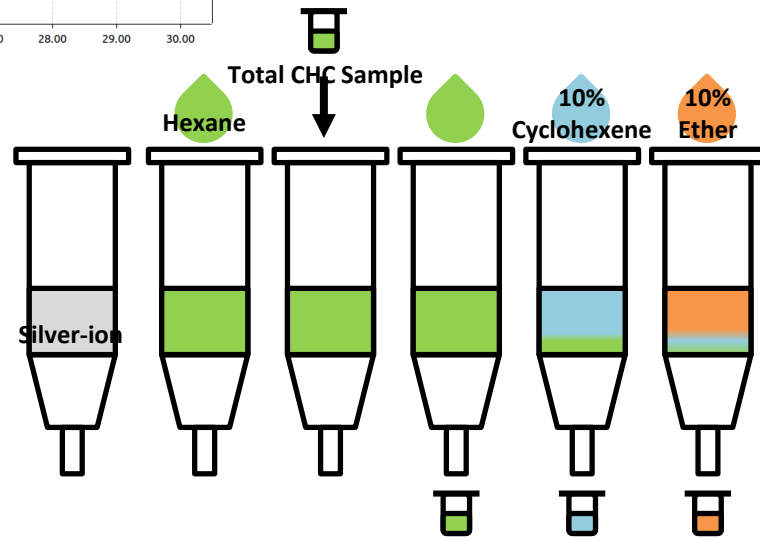
*SB/SB*

*SB/Sb*

All unsaturated CHCs



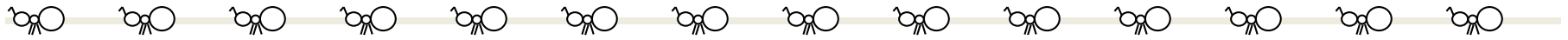
GC-MS analysis



Eliyahu et al 2011 JChemEcol  
Unpublished

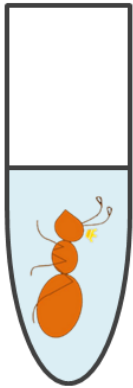


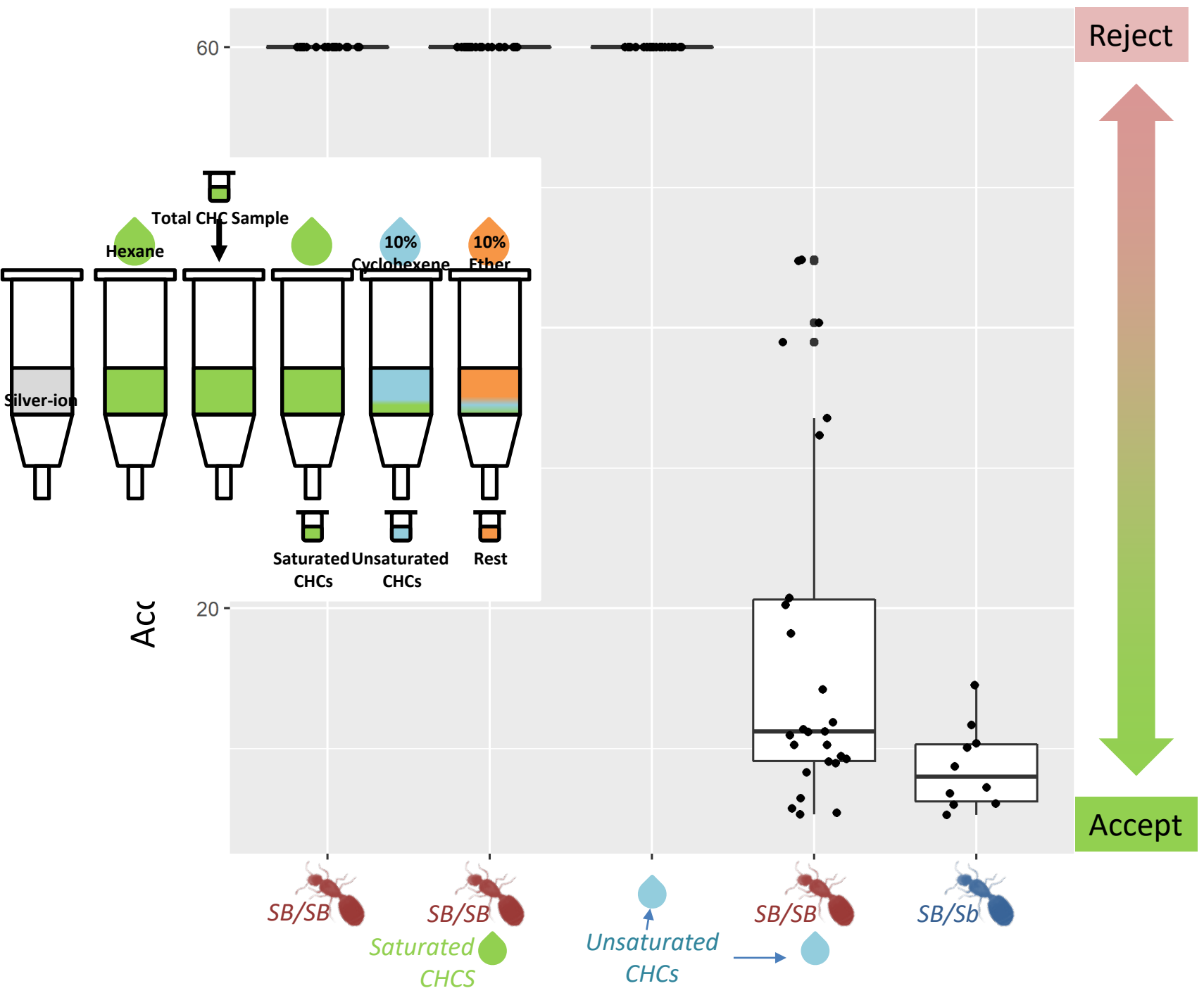
# Hexane extract of queens → “paper surrogate”



- *Bb* queen taken home
- *BB* queen tossed

80  $\mu$ l hexane, 10 mins





Reject

Accept

Silver-ion

Hexane

Total CHC Sample

Saturated CHCs

Saturated CHCS

*SB/SB*

*SB/SB*

Unsaturated CHCs

*SB/SB*

*SB/Sb*

10% Cyclohexene

10% Ether

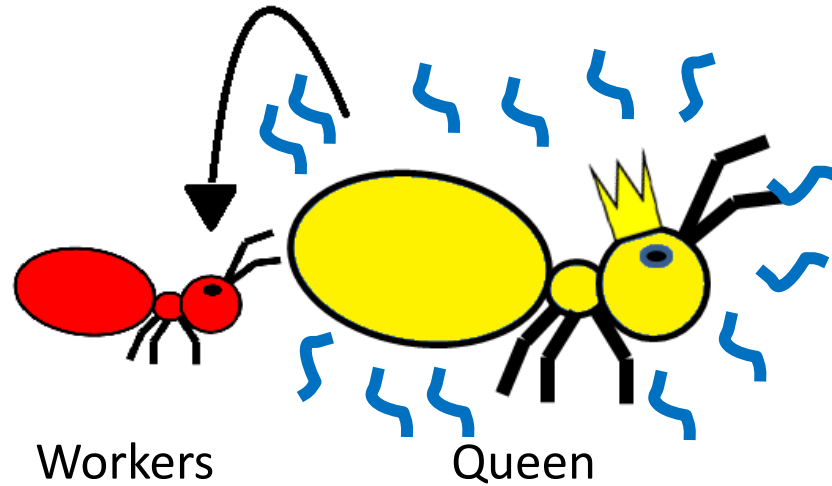
Unsaturated CHCs

*SB/Sb*

Acc

60

20

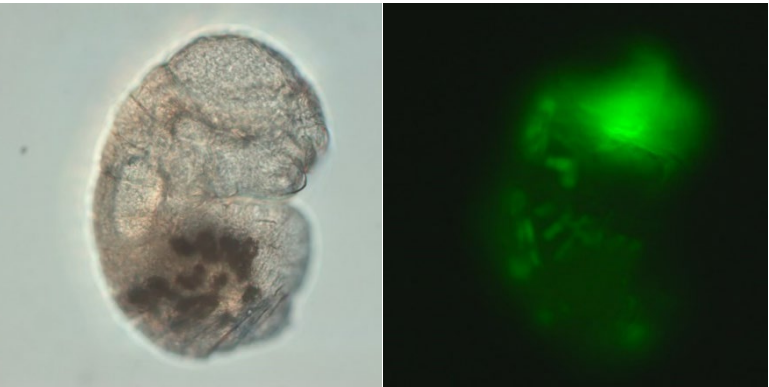


Narrowed it down to 1 unsaturated CHC  
Trying to synthesize it

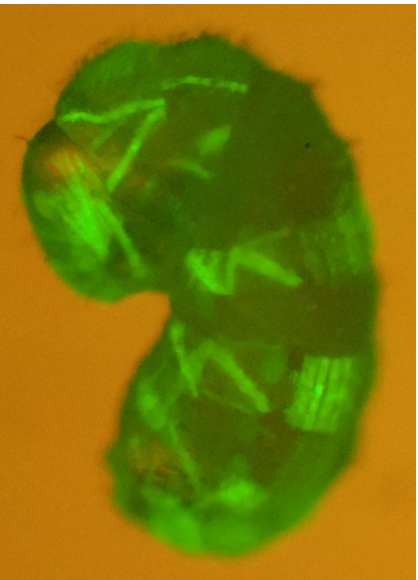
# PiggyBac mediated transgenesis & CRISPR/Cas9 mutagenesis



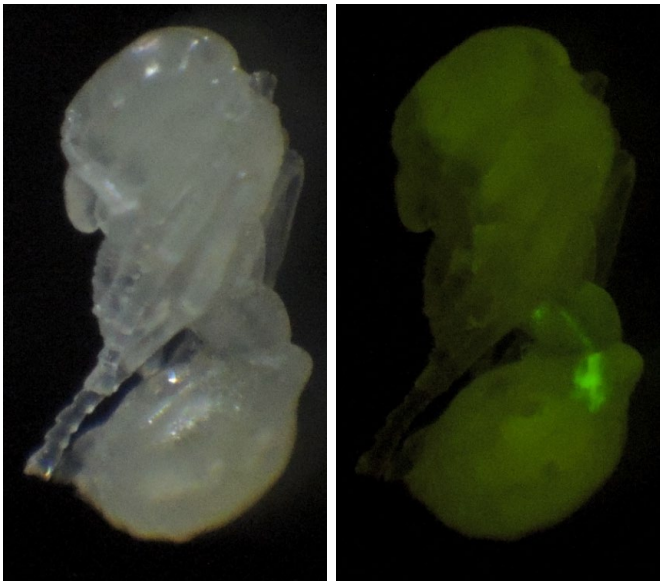
Embryo



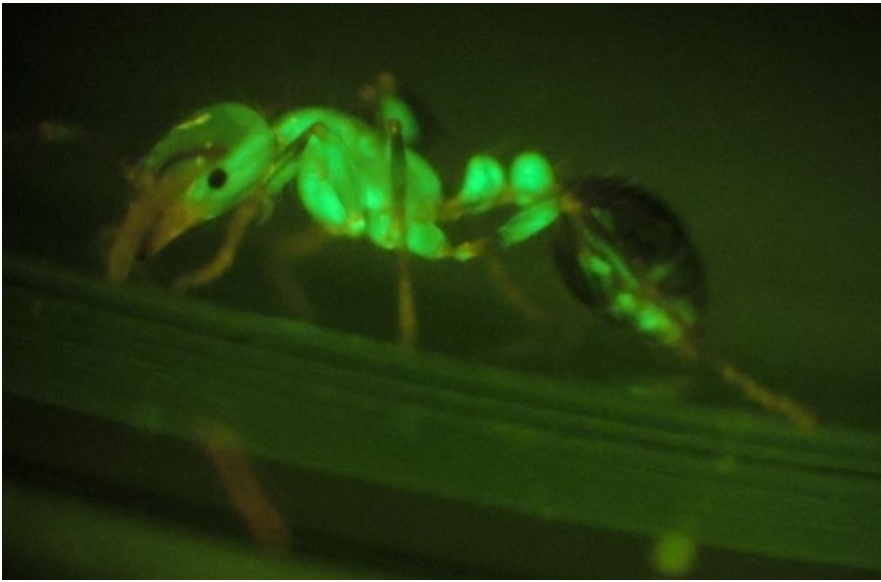
Larvae



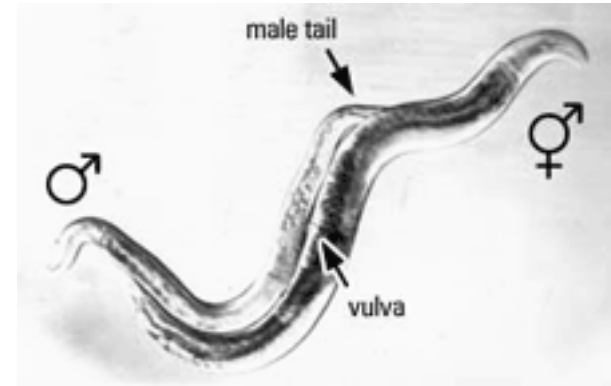
Pupae



Adult



# Our interests



1. Social evolution
  - Social supergene
2. Sex determination
  - Novel non-coding gene?

1. Sex ratio bias in *Caenorhabditis*
  - Sperm competition?
2. Selfish gene in *C. briggsae*
  - Toxin-antidote

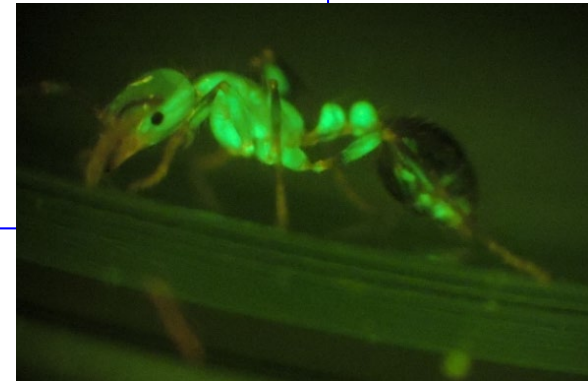
# Collaborative possibilities



## Can help:

in fire ants (ants/insects) and *Caenorhabditis* worms (nematodes):

- Genetic analysis
- Transgenesis
- CRISPR/Cas9 mutagenesis



## Need help:

- Chemical ecology, chemistry
- Other monogyne/polygyne ants

