


UC Davis Bee and Pollination Program

ELINA L. NINO

EXTENSION APICULTURIST

Brief history

Harry H. Laildaw Jr. Honey Bee Research Facility was founded in 1969

Designed specifically for honey bee research by Dr. Harry H. Laidlaw Jr. (hence the name)

Dr. Laidlaw is often referred to as the father of honey bee genetics

Others:

Dr. Eckert, Dr. Gary, Dr. Page, Dr. Peng.

Meet the UC Davis Bee and Pollination Team

Brian Johnson

Johnson is an integrative biologist who studies social behavior, genetics and evolution using a combination of behavioral ecology, genomics, proteomics, and computational biology approaches. The lab uses the honey bee as the primary model for all questions. The lab also studies honey bee health in the context of insecticide resistance. Researchers in his lab are currently working on the genetic basis of di`vision of labor and on the fascinating ways that honey bees sterilize nectar before making honey.

Elina Niño

Extension Apiculturist Niño and the members of her lab are devoted to supporting honey bee health and California beekeepers through research, extension and outreach. Our basic research explores various factors modulating honey bee queen mating and reproductive quality with a goal of supporting breeding efforts for pathogen and pest resistant bee stock. Our applied research seeks novel solutions for management of the #1 pest of honey bees – varroa mite. Lastly, through our diverse extension and outreach efforts we strive to provide science-based honey bee education for beekeepers of all levels and citizens of all ages.

Neal Williams

Williams is a pollination ecologist and bee biologist who works to develop more sustainable and resilient pollination services for agriculture and native plant communities. His team explores native flowering plant mixes to enhance wild bee populations and managed bee health as part of Integrated Pollination strategies. He also researches more fundamental questions of life history plasticity, foraging and movement of bumble bees and native solitary bees.

Eric Mussen

Emeritus Extension Apiculturist Mussen devoted his career to developing and acquiring information on honey bee colony health and management. His outreach program included beekeepers who managed one to thousands of colonies; UC county farm advisors; county, state, and federal regulatory personnel; and numerous media outlets. His bi-monthly newsletters from 1994 through 2014 are archived on the Bee biology website. He is past recipient of numerous industry and academic awards. Mussen continues to work on research projects and extending his knowledge of honey bees.

Robbin Thorp

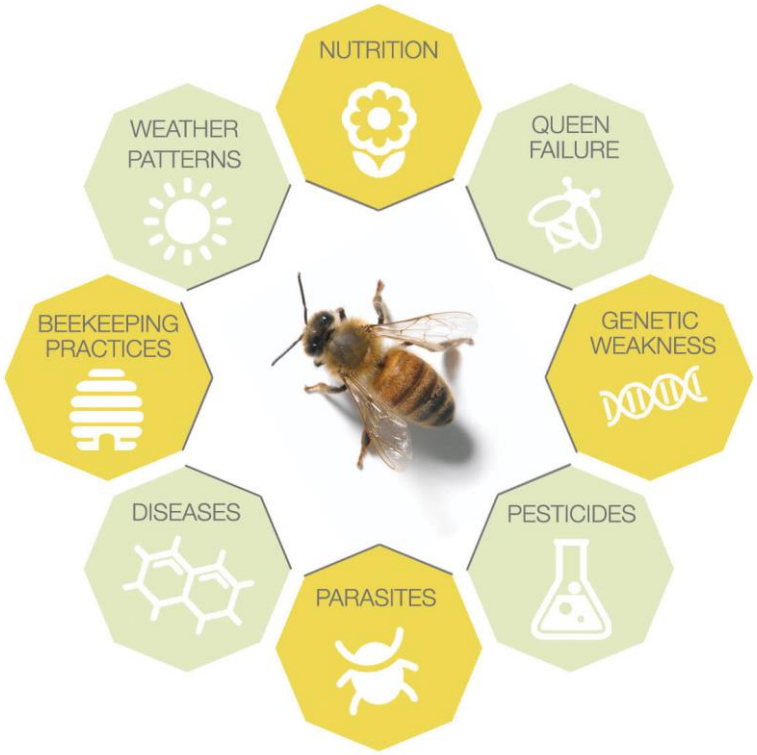
Thorp retired in 1994, but he continues to conduct a program of research and publication on bees. After 30 years of studies of honey bee pollination of crops, especially almond, his program since retirement focuses on native bees. His research interests include ecology, systematics, biodiversity, and conservation of bees; host specificity of solitary bees for pollen; specialist native bees in vernal pool ecosystems; native bees in urban and agricultural landscapes; and declines in bumble bee populations.

Rachel Vannette

Vannette is an ecologist whose research examines the chemical and microbial ecology of floral nectar. Nectar is a complex chemical solution and is commonly inhabited by bacteria and fungi, which may modify nectar chemical composition. Work in the Vannette lab examines microbial effects on nectar quality, pollinator foraging and health and other aspects of plant-pollinator interactions.

Program's mission

To enhance our understanding of bee biology and pollination ecology with the ultimate goal of developing practical solutions for improved bee health and pollination success.



Research in Johnson Lab

Integrative Bee Biologist:

Understanding behavioral traits on level from genes to ecology.

Evolution and Behavior:

Understanding the evolutionary genetic basis of phenotypic novelty

- How novel (new) genes regulate evolution of new traits (e.g., sociality)

Understanding insecticide resistance in honey bees

Understanding how honey bees sterilize nectar before making honey

Research in Williams Lab

Pollination Biology:

Integrated Crop Pollination: Developing strategies to promote sustainable pollination for California agriculture.

- Synergies between wild bees and managed honey bees
- Documenting the role of wild bees in pollination of different crops (almonds, watermelon, onion, squash)

Bee Ecology:

Developing and promoting plant mixes to support bee nutrition and diversity for California

Multiple drivers of bee declines. Landscape mapping of pesticide risk and forage benefits.

Native bee responses to resource variation

- Bumble bee life history and demography
- Solitary bee life history and demography

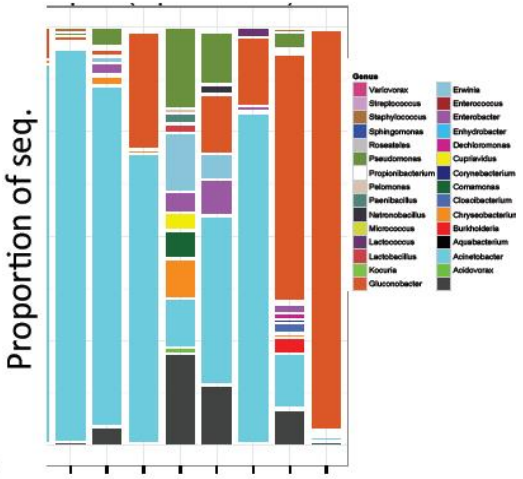
Honey bee impacts on native plant- pollinator interactions

Integrating research programs with SAFS interns “Sustainable Pollination Fellow”

Research in Vannette Lab

Main research topics

- Ecology of pollination microbiomes
  - Which microorganisms on flowers and associated with bees and birds? What is their function?
- Nectar chemistry
  - How much do plant species vary in nectar chemistry (e.g. sugars, amino acids, etc)?
  - What ecological factors cause variation in nectar chemistry?



Research in Niño Lab

Improving honey bee colony health through integrated colony management

- Understanding effects of stressors (e.g., pesticides) on honey bee longevity to minimize impact in California agriculture
  - Minimizing fungicide input – using honey bees as delivery agents for biocontrol of fungal pathogens
- Improved control of *Varroa* – development of new biomiticides
- Effect of supplemental forage plantings in almond orchards on colony growth and survival
- Understanding queen health to improve colony survivorship
  - Regulation of mating and reproduction
  - Effect of various stressors including pesticides and *Varroa* mites

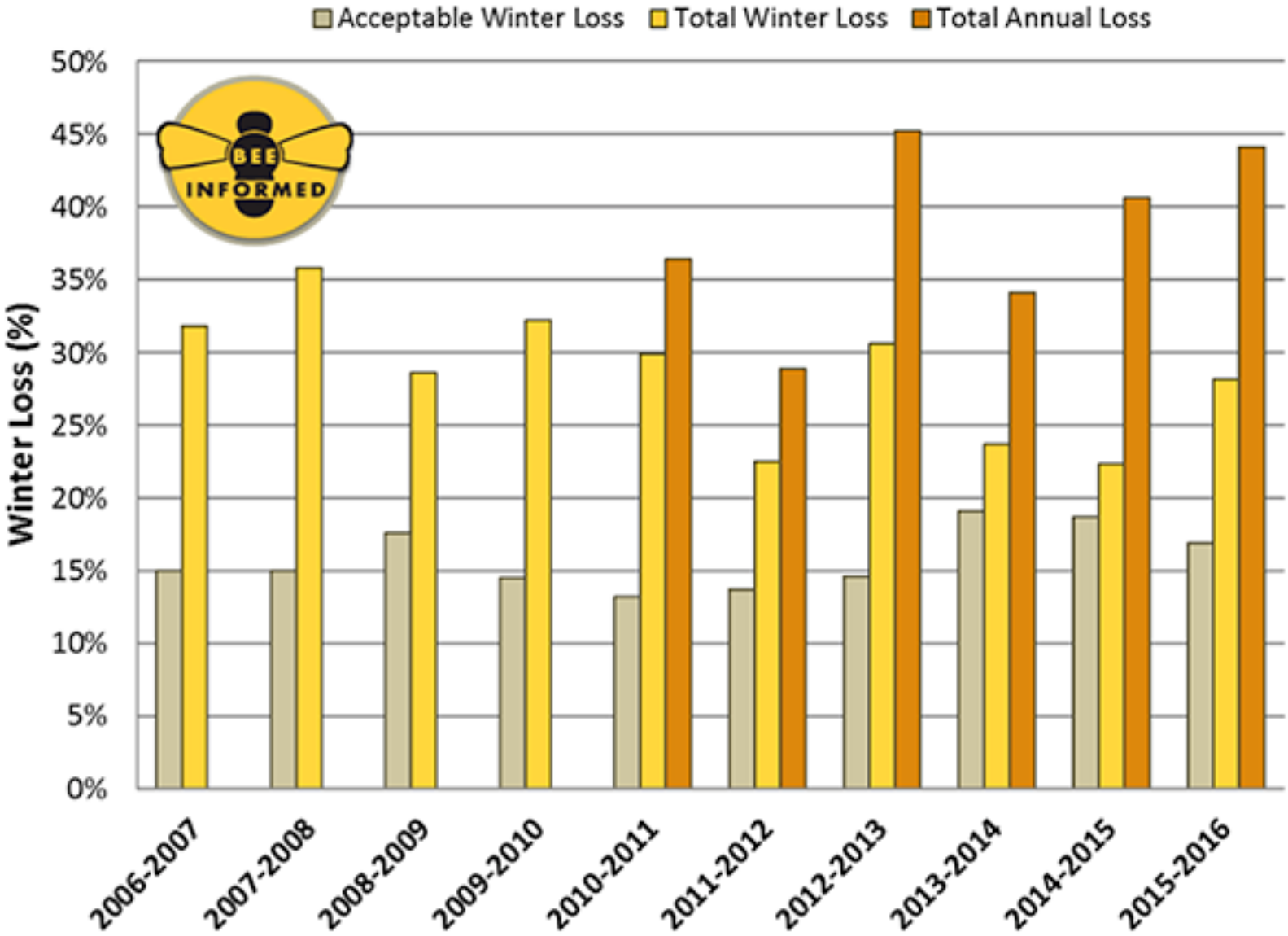
E.L. Niño Bee Lab
RESEARCH • EXTENSION • OUTREACH
APICULTURE
University of California, Davis

The goal of the E. L. Niño Bee Lab

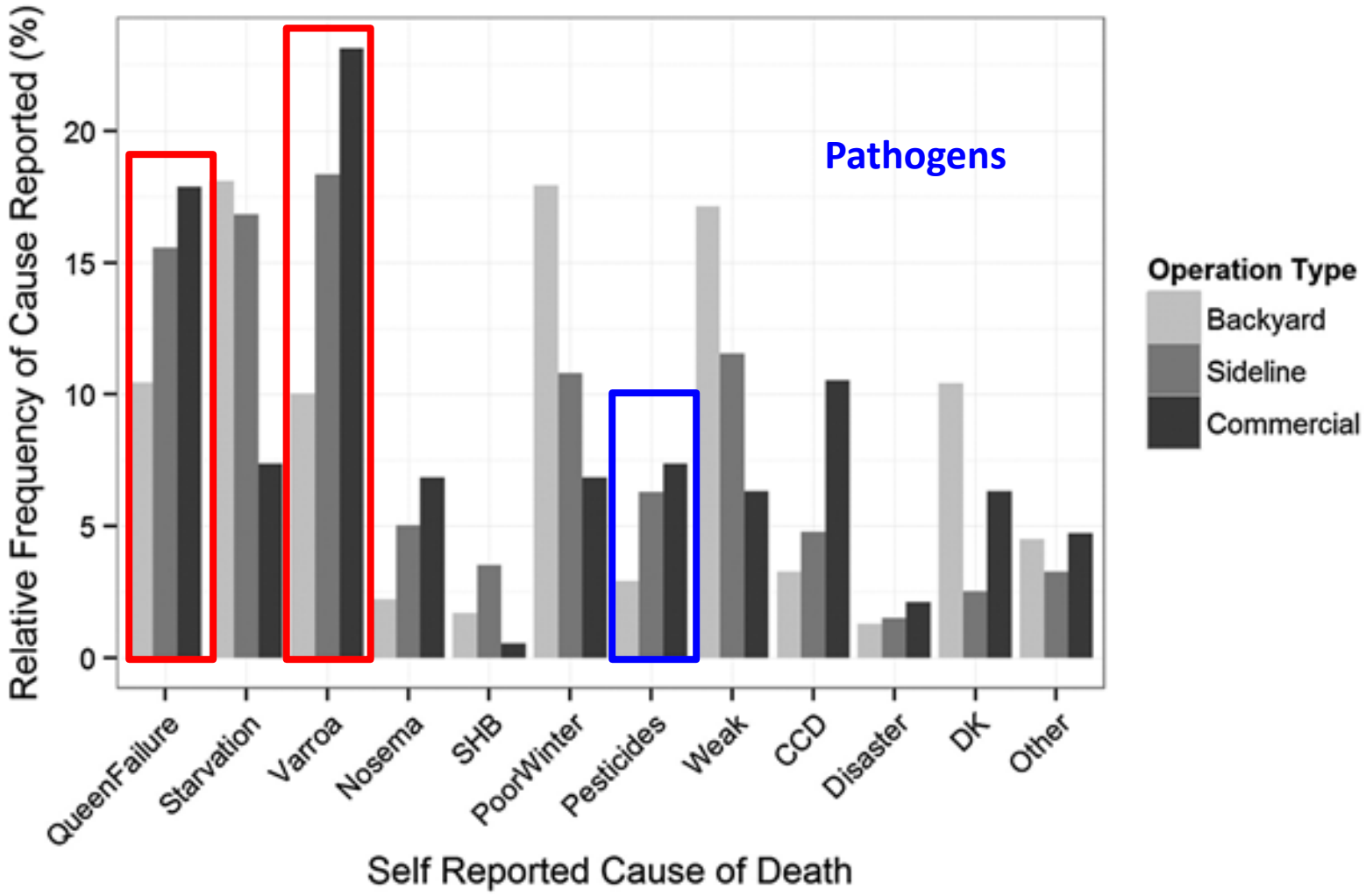
To characterize biotic and abiotic stressors affecting colony health in order to inform development of immediate and long-term solutions for bees and beekeepers.

- Research program overview
  - Understanding honey bee stressors
    - Queen reproduction and health
      - Current and future work
  - Working towards solutions
    - Varroa mite management
      - Current and future work
  - Future directions
    1. Developing an IPM program for *Varroa*
    2. Longitudinal assessment of colony health in almond orchards with supplemented forage
    3. Reducing honey bee pesticide exposure
- Extension program overview

Total US managed honey bee colonies Loss Estimates



Suspected causes of colony loss in the US reported by beekeepers



Seitz et al. 2016

- **Research program overview**
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- **Extension program overview**

The honey bee queen

- Produces all the workers in the colony
- Produces pheromones that regulate social organization of the colony (e.g., Hoover et al. 2003, Slessor et al. 1990)
- Any factors affecting the queen can have negative consequences for the entire colony
  - Colony loss due to queen failure
  - Decreased productivity of colonies with high queen replacement rate (Kostarelou-Damianidou et al. 1995)
- Still a large gap in our understanding of regulation of queen mating and reproduction

Overview of queen biology

What are the factors that trigger and maintain post-mating changes in queens?

Mech. stimulation (e.g., Saunders and Dodd 1972)

Seminal Fluid Proteins (e.g., Avila et al. 2011; McGraw et al. 2015; e.g., Boes et al. 2014)

Seminal volume (e.g., Sugawara 1979)

1. Effects on Queen:

Ovaries activated
All should be same physiological state, but are they???

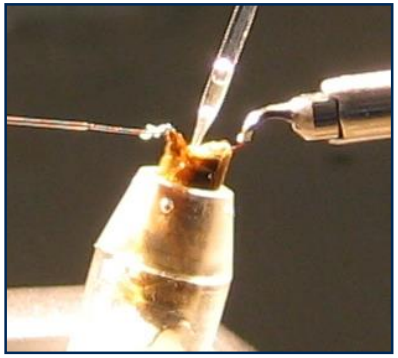
Laying Queen

2. Effects on Colony:

Worker behavior
Worker physiology
Colony health/productivity

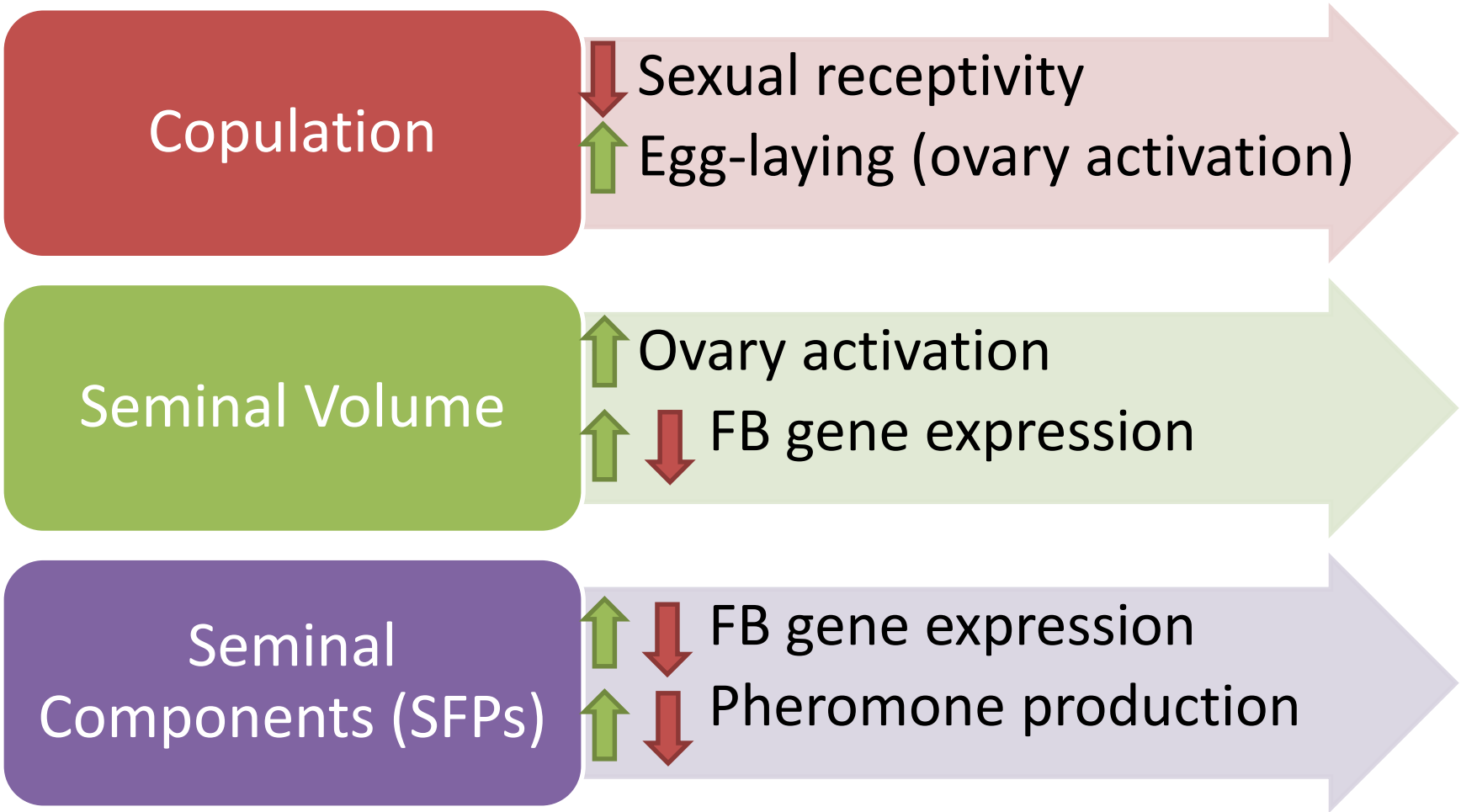
Funding: **USDA-NIFA-AFRI Postdoctoral Fellowship (2012-01221) and Florida Department of Agriculture and Consumer Services**

Do insemination volume and/or seminal components modulate long-term post-mating changes in queens?

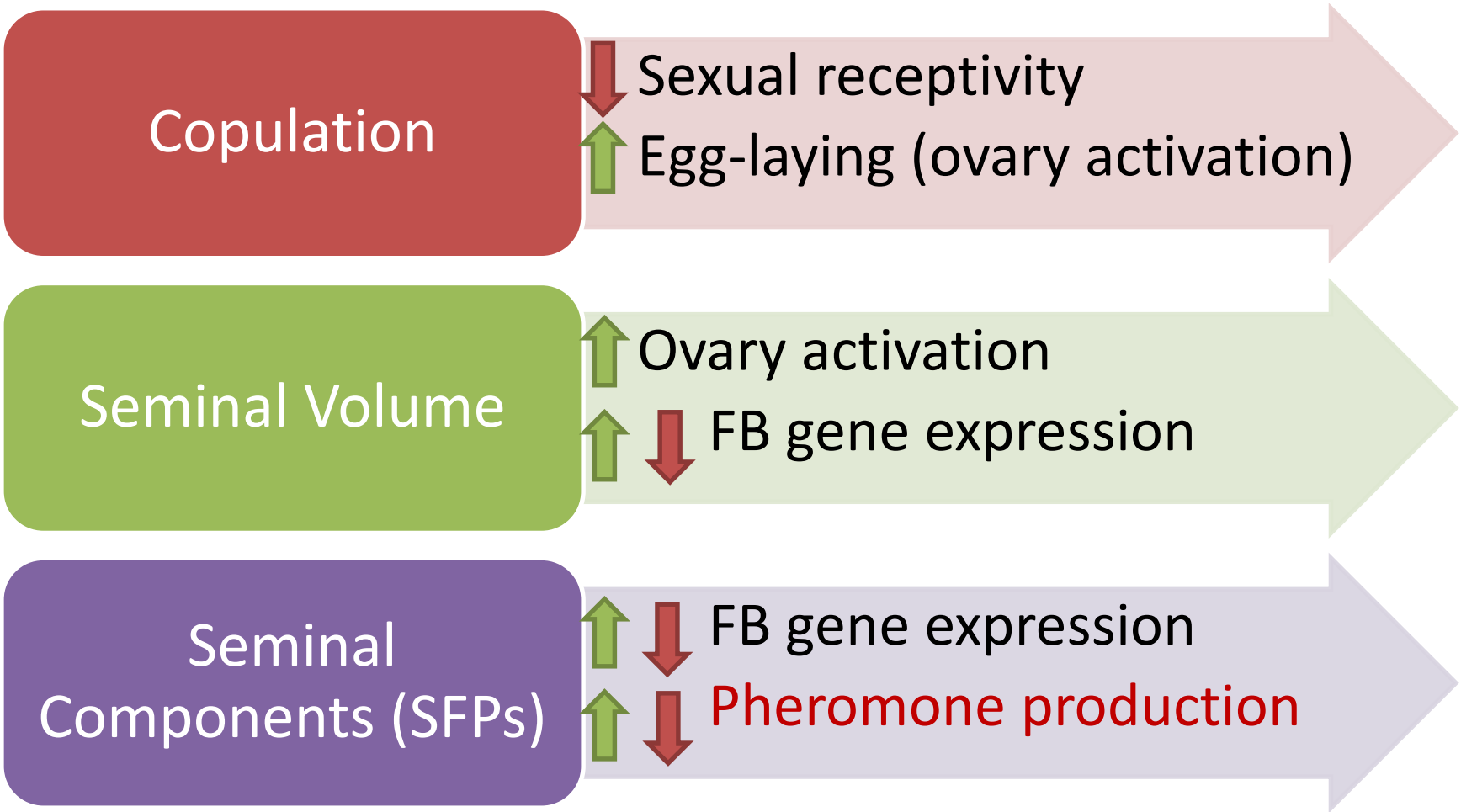


- **Five groups:**
  - Virgins
  - 1 μL and 8 μL semen
  - 1 μL and 8 μL saline

- **Behavioral observations:** mating flight attempts and egg-laying
- **Physiology:** ovary activation, pheromone production, gene expression



Niño et al. 2011, 2012, 2013 a, b



Niño et al. 2011, 2012, 2013 a, b

Current and future research

- In progress
  - What are specific SFPs involved in regulating specific post-mating changes
    - Separating proteins based on size (Niño 2017)

- Further longitudinal studies of spatial and temporal changes in bee populations due to potential negative effects of biotic and abiotic stressors on queens
  - Pathogens
  - Pesticides (including miticides for varroa control)
  - Pests

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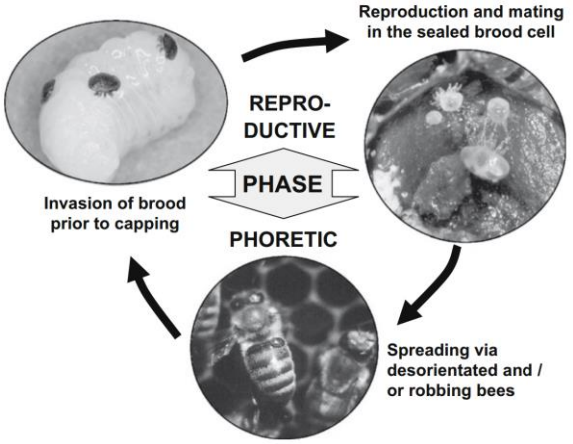
Providing additional Varroa mite management tools to beekeepers

- *Varroa destructor*
  - **#1 pest of honey bees**
- **Introduced into the US in the late 1980s**

- **Detrimental for bee health**
  - **Feeds on honey bee hemolymph** (reviewed in Rosenkranz et al. 2010; fat bodies? vanEngelsdorp Pers. Comm.)
  - **Transmits pathogens** (e.g., De Miranda and Genersche 2010)
  - **Suppresses immune gene expression** (Yang and Cox-Foster 2007)

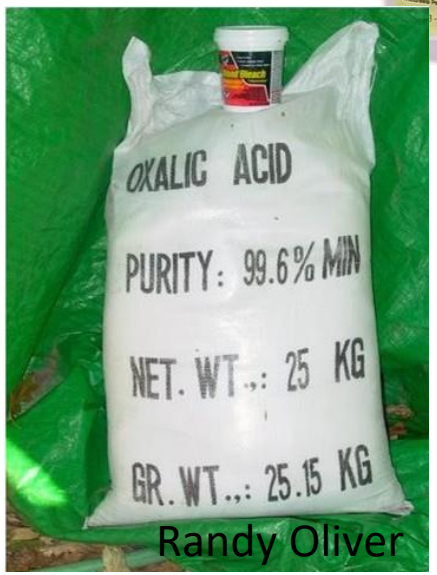


From Rosenkranz et al. 2010

What can beekeepers do?

Synthetic miticides

Bio-miticides



Randy Oliver

Field efficacy and potential effect on colony growth and survival

Bernardo Niño

Project Apis m.

Tricia Bohls

Collaborating beekeepers:
Leonard and Linda Pankratz
John Foster

Colony evaluations

- Varroa infestation levels pre, during and post-treatment
  - **Alcohol wash**
  - Mite drops
  - Brood uncapping

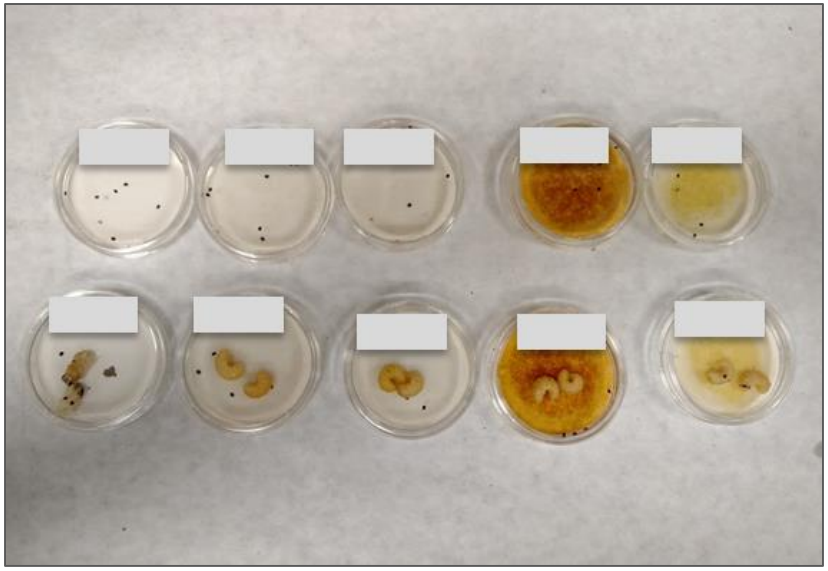
- Colony strength assessments
  - Adult bee population
  - Brood area
  - Pollen, honey/nectar

- Weekly weight records

2015 biopesticide trials

Field trials identified one potentially promising formulation, however, there were negative effects on colonies.

Promising laboratory data (essential oil)…



2016 trials

- **Evaluating five novel biopesticides/formulations**
  - **Including two a.i. concentrations of the essential oil**
- **Brood break with oxalic acid drench**

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1.) Longitudinal evaluation of honey bee colonies on different forage regimes

- Longitudinal evaluation of two different forage plantings on honey bee colony growth, various health parameters and survival (Dr. Elina Niño)
- Evaluation of mustard and wildflower plantings in almond orchards for attractiveness to bees (Dr. Neal Williams)
- Evaluation of the effects on gut microbiome and immune response (Dr. Quinn McFrederick and Dr. Kirk Anderson)

Project Apis m.

california almonds
Almond Board of California

2.) Using honey bees to deliver biocontrol agents for brown rot in California almond orchards

- Honey bees can become exposed to a myriad of agrochemicals in various crops which could have negative effects
  - E. g., fungicides (Pettis et al. 2013)

- Reducing reliance on conventional fungicides could greatly benefit honey bees, beekeepers and growers

Acknowledgements

The Niño Bee Lab

Patricia Bohls

Cameron Jasper

Stefanie de Heij

Bernardo Niño

Many undergraduates

Bee facility manager

Charley Nye

Members of the Grozinger Lab (PSU)

Members of the Tarpy Lab (NCSU)

Many undergraduates (PSU, NCSU)

Collaborators and beekeepers

Funding sources and donors

- Research program overview
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Organized education opportunities

Planning Ahead for Your First Hives

Sessions 3/11 & 3/18

Course Description:

We are very excited to be hosting "Planning Ahead for Your First Hives" short course at the Harry H. Laidlaw Jr. Honey Bee Research Facility at UC Davis. The short course will include lectures and hands-

Varroa Management Strategies

Sessions 5/13 & 5/27 2017

Course Description:

We are very excited to be hosting "Varroa Management Strategies" course at the Harry H. Laidlaw Jr. Honey Bee Research Facility at UC Davis. Current beekeeping challenges call for all beekeepers to have

Working Your Colonies

Sessions 3/12 & 3/19 2017

Course Description:

We are very excited to be hosting "Working Your Colonies" course at the Harry H. Laidlaw Jr. Honey Bee Research Facility at UC Davis. The short course will include lectures and hands-on exercises. This course is perfect for those who already have beekeeping experience and would like to obtain more knowledge and practical skills to move on to the next step of managing and working their own honey bee colonies.

Lecture modules will cover:

- Advanced Honey bee biology
- Honey Bee IPM
- Products of the Hive

Practical modules will cover:

- Queen wrangling
- Honey Extraction
- Combining colonies
- Splitting colonies
- Monitoring for varroa mites

Instructors: Bernardo Niño, Charley Nye, and Dr. Elina L. Niño

Logistics:

The course size may vary from 25 participants per session. Please bring your bee suit/veil if you own one! The $150 registration fee covers the cost of course materials, lunch and refreshments on the day of the short course. Participants are responsible for obtaining their own lodging. Short course will be held at the Harry H. Laidlaw Jr. Honey Bee Research Facility on UC Davis campus. For directions visit: http://elninobeelab.ucdavis.edu/map.html. Registration link below!

Session 1: https://registration.ucdavis.edu/Transaction/Checkout/269
Session 2: https://registration.ucdavis.edu/Transaction/Checkout/270

Queen Rearing Techniques Short Course

Two Sessions: April 15&16; April 22&23, 2017

Course Description:

We are very excited to be offering our Queen Rearing Techniques Short Course at the Harry H. Laidlaw Jr. Honey Bee Research Facility at UC Davis. This two-day course will include lectures on queen biology and rearing, as well as extensive hands-on exercises. This course is perfect for those who have some

Honey Bee Breeding Basics

Session: 6/11/2017

Course Description:

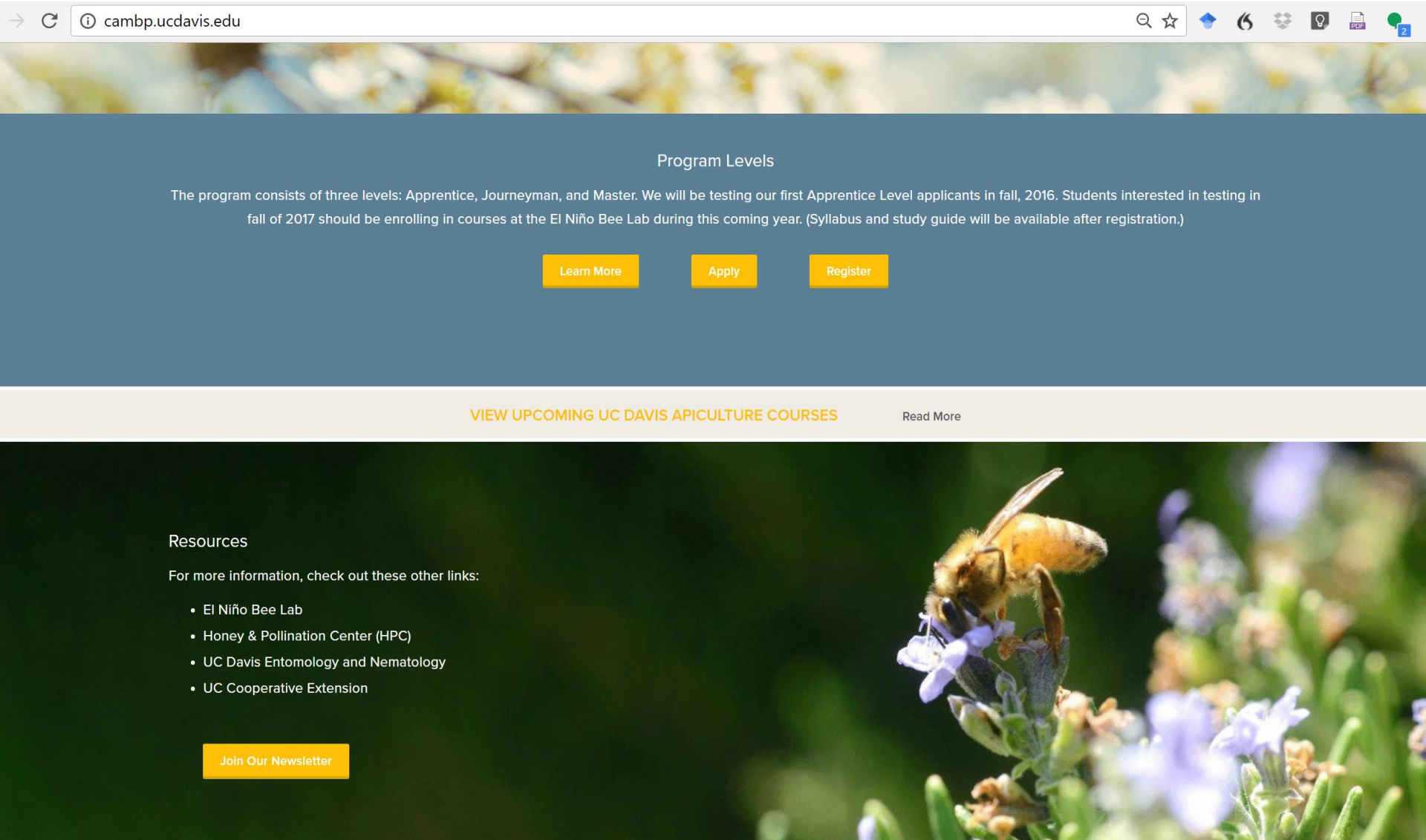
We are very excited to be hosting "Bee Breeding Basics" course at the Harry H. Laidlaw Jr. Honey Bee Research Facility at UC Davis. This course is an excellent complement to our Queen Rearing Techniques Short Course. During this one day course we will talk about the intricacies of honey bee genetics along

Using science-based information to educate stewards and ambassadors for honey bees and beekeeping.

Benefits

- **GIVING BACK**
  - **To the community through volunteering**
  - **To "science" through citizen science projects**
- **Becoming a better beekeeper**
  - **Access to a growing network of fellow Master Beekeepers**
  - **Access to our expertise (now developing "Field Days" content)**
  - **Access to resources – latest information for management practices**
  - **Discounts to classes offered by Niño Lab and Honey and Pollination Center**

How do I become a master beekeeper?



Three levels

- **Apprentice**
- **Journeyman**
- **Master Beekeepers**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CALIFORNIA MASTER BEEKEEPER PROGRAM

UC CE University of California Agriculture and Natural Resources Cooperative Extension

This certifies that

NAME OF PARTICIPANT

has successfully completed the

CALIFORNIA MASTER BEEKEEPER PROGRAM

Apprentice Level

2016

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Dept. of Entomology and Nematology, UC Davis

Amina Harris
Director, Honey and Pollination Center
at the Robert Mondavi Institute, UC Davis

Apprentice Level Exam

- **Written exam: 2 hours**
- **Practical exam: 25 minutes, one-on-one**
- **Second round of exams: September 2017 in Davis**
- **Journeyman level starts next year**

Many thanks to our supporters!

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One UCDAVIS College of Agriculture and Environmental Resources

THE HENRY J. KAISER FAMILY FOUNDATION

UCDAVIS Honey and Pollination Center at the Robert Mondavi Institute

Welcome to the University of California, Davis Department of ENTOMOLOGY

Gilroy and Santa Clara Valley Beekeepers Associations

MANN LAKE WE KNOW BEES AN EMPLOYEE OWNED COMPANY

JZ's-BZ's Co.

Pollinator Education Program (PEP)

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Scott and Liberty Munson donation


Thank you!