Why Does Bee Health Matter?
The Science Surrounding Honey Bee Health Concerns and What We Can Do About It
Honey Bees Are a Key Component to Sustainable Agriculture, Healthy Diets, the Global Food Supply, and the Economy

The Need

1/3 of global food production volume relies on pollinators to some degree

Source: Klein, 2007

80% of flowering plants are pollinated by honey bees and other insects

Source: Calderone, 2012

The Challenge

Pests & Disease

Poor Forage & Nutrition

Pesticide Exposure

Approx. 29% of honey bee population lost each winter, compared to 15-18% considered ‘acceptable loss’

Significant to beef and diary industries as cattle feed

Almonds  Apples  Broccoli  Strawberries  Alfalfa

*Significant to beef and diary industries as cattle feed
A diverse partnership taking a multi-factor approach
Council for Agricultural Science and Technology

Kent G. Schescke
Executive Vice President
2017
The CAST Mission

Through Our Network of Experts → We Assemble, Interpret, and Communicate → Credible, Science-based Information → To Policymakers, the Media, and the Public
The CAST Vision

A world where decision making related to agriculture and natural resources is based on credible information developed through reason, science, and consensus building.

“...what CAST does is very important to mankind.”
~Dr. Norman E. Borlaug
What Does CAST Do?

• CAST disseminates science-based information through:
  - Print materials
  - Online sources
  - Videos on website, YouTube, and SchoolTube
  - Spanish and Chinese translations of select publications
How Does CAST Do This?

With the help of many volunteer contributors:

• **50 Board Members** representing scientific societies, companies, nonprofits, and universities

• **70+ active task force members** working on CAST reports yet to be released

• Volunteer scientific experts as authors and reviewers—more than **350 volunteers** since 2007

- 65% academia
- 15% government
- 15% private companies
- 5% nonprofits
Primary CAST Objectives

• **Publishing** task force reports, commentaries, and issue papers written and peer reviewed by scientists from many disciplines

• **Distributing** CAST publications widely to nonscientists to enhance the education and understanding of the general public
Ag quickCASTs

• 1 page with live links to content in original documents
• Available free on CAST website
• Printable for distribution as handouts

The Science Source for Food, Agricultural, and Environmental Issues
Other Forthcoming Publications

• Genome Editing in Agriculture—Methods, Applications, and Governance (Ag Innovation Series)
• Omega-3 Fatty Acids: Health Benefits and Dietary Recommendations
• Scientific, Ethical, and Economic Aspects of Farm Animal Well-being
Friday Notes

- Published 48 times annually
- Lead articles on timely ag topics
- Dozens of ag news briefs from 100+ sources with live links to original articles
- An international news section
- Legislative updates from D.C.
Sun...Earth...Water...Mankind. In synergy with science and technology to create a sustainable world supported by plants and animals.

The CAST website has had visitors from every U.S. state, Canada provinces, and 181 countries.
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June 2017
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Bees visit flowers for food

Pollen = protein and lipids
Nectar = carbohydrates

Pollination Happens

Resulting in nutritious food for humans and beautiful floral landscapes
1M Acres of Almonds in California

No Bees, No Nuts
2M colonies of bees trucked to California for almond pollination
Honey is produced in every state. Leading honey-producing states are California, Florida, Minnesota, Montana, North Dakota and South Dakota.
Backyard Beekeeping
U.S.-managed Honey Bee Colony Loss Estimates

- Acceptable Level
- Total Winter Loss
- Total Annual Loss

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Rusty Patched Bumble Bee, *Bombus affinis*
Endangered Species List
Untying the Messy Knot

Honey Bee Problems

Varroa Parasite

Viruses

Other Diseases

Environmental Problems

Insecticides

Fungicides

Herbicides

Flowerless Landscape

Nutrition
Honey Bee Problems

- Varroa Parasite
  - Reduces bee’s lifespan
  - Compromises immune systems
  - Can lead to colony death, early winter

- Viruses
  - Deformed Wing Virus
  - Acute Bee Paralysis Virus
  - Israeli Acute Paralysis Virus
  - Black Queen Cell Virus
  - Sacbrood Virus
  - Lake Sainai Viruses
  - etc.

Increases bee’s susceptibility to other diseases and pesticides.
Miticide application in bee colonies to control Varroa

Beekeepers need novel approaches to improve bee health and decrease the frequency of miticide treatments
Tech-transfer Teams
Working for Beekeepers

Bee Informed Partnership, Inc.

Dennis vanEngelsdorp
The Mite Kit

Backyard Beekeepers: Join a national effort to gather data about *Varroa* levels and management

www.mitecheck.com
Breeding programs for bees’ natural defenses to increase health and survivorship and to reduce reliance on in-hive medications/miticides.

Social behaviors lead to social immunity: Hygienic Behavior and Resin/Propolis Collection.
Honey Bee Problems

Varroa Parasite

Viruses

Other Diseases

Environmental Problems

Insecticides

Fungicides Herbicides

Flowerless Landscape

Nutrition
Pesticide Residue in Pollen

Pyrethroids
Organophosphates
Carbamates

Neonicotinoids
Insect Growth Regulators
Organochlorines

Fungicides
Herbicides

Adjuvants

Herbicide Use
Honey bees, wild bees, and other pollinators reduced to feeding on scraps

- Z. Browning
Commercial beekeeper, ND
Honey constituents up-regulate detoxification and immunity genes in the western honey bee *Apis mellifera*

Wenfu Mao\(^a\), Mary A. Schuler\(^b\), and May R. Berenbaum\(^{a,1}\)

Departments of \(^a\)Entomology and \(^b\)Cell and Developmental Biology, University of Illinois at Urbana-Champaign, Urbana, IL 61801

Contributed by May R. Berenbaum, March 21, 2013 (sent for review September 8, 2012)

As a managed pollinator, the honey bee *Apis mellifera* is critical to the American agricultural enterprise. Recent colony losses have thus raised concerns; possible explanations for bee decline include *A. mellifera* has only 46 P450 genes (14). Honey bees metabolize phytochemicals found in honey and pollen as well as acaricides used in hives for management of Varroa destructor, an estopara.

- p-coumaric acid
- pinocembrin
- pinobanksin

Phytochemicals
Our Challenge
Pollinators AND Pesticides

Other Crops
Front Lawn
Golf Course
Roadside
Waterway

Drawing: Laura Corcoran
Education, Communication, and Innovation to Mitigate Insecticide, Fungicide, and Herbicide DRIFT
The Glorious Pollinator
Landscape Revival
Change in CRP Enrollment 2007 - 2016

Total: -12.97 million acres

Note: Data as of the end of April 2016.
Natural Areas
Roadsides
Oil Seed ($$) Cover Crops
Flowering Bee Lawns

• Reduce intensive inputs – water, fertilizer, mowing
• Bee forage!

Funded by MN Environment and Natural Resources Trust Fund
WE CAN UNTIE THIS MESSY KNOT

Honey Bee Problems

Varroa Parasite

Viruses

Other Diseases

Environmental Problems

Insecticides

Nutrition

Fungicides

Herbicides

Flowerless Landscape
Plant and Maintain Bee-Friendly Flowers
Mitigate Pesticide Contamination
Questions/Discussion

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For a free download of this CAST Commentary, visit the CAST website:

www.cast-science.org/publications

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Introduction

A colony of honey bees is an amazing organism when it is healthy; it is a superorganism in many senses of the word. As with any organism, maintaining a state of health requires cohesiveness and interplay among cells and tissues and, in the case of a honey bee colony, the bees themselves. The individual bees that make up a honey bee colony deliver to the superorganism what it needs: pollen and nectar collected from flowering plants that contain nutrients necessary for growth and survival. Honey bees have access to better and more complete nutrition, exhibit improved immune system function and behavioral defenses for fighting off effects of pathogens and pesticides.

Honey bees with access to better and more complete nutrition exhibit improved immune system function and behavioral defenses for fighting off effects of pathogens and pesticides.

Photo credit: Clint Otto - Sarah Jost (centering)