P. Alexander Burnham

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EDUCATION

University of Vermont **2017-Present**
Ph.D. in biology - (anticipated graduation date: 2021)
UVM - Vermont Complex Systems Center **2018-2019**
Graduate Certificate in Data Science & Complex Systems
University of Vermont **2015-2017**
B.S. in zoology - 2017

RESEARCH INTERESTS

My interests broadly include disease ecology, epidemiological modeling, statistical analysis, pollinator conservation and computer science. Advised by **Dr. Allison Brody and Dr. Nicholas Gotelli**, my graduate work aims to examine how RNA viruses and the microsporidian parasite (*Nosema* spp.) spread from one species of bee to another and how these two pathogens interact within the host. Using a combination of mathematical modeling and empirical work, I hope to better understand how disease spillover, temporal variation in disease load and prevalence influence patterns of co-infection in both native and managed bees.

GRANTS RECEIVED

- **NSF Graduate Research Fellowship Recipient (NSF-GRFP)** 2018
  ($127,000)
- Successfully funded project on temporal variation of RNA viruses and microsporidian parasites in bumble bees (Theodore Roosevelt Memorial Fund - $2500.00) 2018
- Successfully funded project on demonstrating the transmission route of RNA viruses from managed bees to wild pollinators (NAPPC grant through Honey Bee Health Coalition - $9980.00) 2018
- Successfully funded a project on effects of disease spillover due to migratory beekeeping practices (experiment.com - $5970.00) 2017
- APLE Research Award Recipient (UVM grant $500.00) 2015
- Awarded the Ronald Suiter Prize (funded American Beekeepers Federation conference attendance $1000.00) 2015

PEER REVIEW HISTORY

- Invited to review for Ecological Applications (2019)
- Invited to review for Ecology (2018)
- Invited to review for Ecological Applications (2018)
- Invited to review for Ecology (2018)

TEACHING EXPERIENCE

- Graduate Teaching Assistant for Ecology and Evolution laboratory (Fall 2017)
- Graduate Teaching Assistant for Biology 2 for major's laboratory (Spring 2017)
- Guest lecture in Entomology on pest management in honeybees (Fall 2018)
- Guest lecture in Evolutionary Biology on local adaptation (Spring 2017)
- Guest lecture at S. Burlington High school on experimental design (Spring 2017)
- Judge for VT Science Olympiad Div. C – Experimental Design (Spring 2019)
- Pollinator Specialist Class Guest – South Burlington Elementary (Summer 2019)
- Guest lecture in Intro to Beekeeping, University of Vermont (Summer 2019)

WORK EXPERIENCE

Graduate Work in Bumblebee Pathology **2016-Present**

- Mathematical modeling of *Nosema* prevalence in response to density
- Parasite competition experiments and models
- *Bombu*s survey to look at viral and parasite loads throughout the year
- *Bombus* pathogen survivability experiments due to overwintering stressors
- RNA virus and parasite coinfection experiments in bumble bee hosts
- Empirical and theoretical work on spillover and transmission
- Looking at correlations between parasite abundance, species type and geographic location

Subcontractor work with environmental consulting firms **2017-Present**

- Bumble bee Surveys in Harwich, MA assisting Stone Environmental catch, ID and catalogue samples to asses diversity and presence of *B. affinis* (2017)
- Bumble bee Surveys in Maine assisting VHB to catch, ID and catalogue, analyze data and construct report on samples to asses diversity and presence of *B. affinis* (2019-2020)

Field Assistant, Lab Tech & data analysist **2015-2017**

- Assisted in field surveys and sample collection at 32 field sites in Northern Vermont
- Assisted in bumblebee rearing and summer field experiment maintenance
- Extracted RNA from samples, measured concentration using spectrophotometry
- Made qPCR master-mixes, set up and ran qPCR plates to determine viral levels in specimens
- Data analyst for field and lab experiments pertaining to RNA viruses in bumble bees

Undergraduate Research in Bumblebee Parasitology **2015-2016**

- Dissected over 300 bumblebee specimens (documenting parasite loads)
- Counted *Nosema* (fungal) spores and tracheal mites in specimens
- Looking at correlations between parasite abundance, species type and geographic location

Collaborations with Hamilton College (Dr. Herman Lehman) 2016-Present

- Research looking at differential success of local and imported honeybee stocks
- Conducting mathematical modeling and data analyses for experiment
- Advising on drug synthesis to treat *Nosema ceranae* in infected honey bees
- Working on three manuscripts with this group

National Honeybee Survey (APHIS) – Assistant Coordinator 2015-Present

- Identify and contact beekeepers for participation in the survey
- Collect samples from 24 Vermont apiaries (over 200 colonies) for USDA labs
- Identified and documented hive maladies and parasites during hive inspections
- Present findings to local beekeeping clubs and organizations

Island Def Jam Recording Artist & EMI Songwriter 2009-2014

- Signed by L.A. Reid as lead guitar player of the band "Burnham"
- Released EP *Almost Famous* with Island Def Jam Records
- Radio interviews with Z100, Ryan Seacrest and Billboard
- Performed at promotions for Microsoft product releases (Xbox Kinect and Kin)
- Toured North America on "My World Tour" (Justin Bieber) and on two headlining tours
- Direct Support for Action Item on the "Stronger the Love" tour
- Signed to a publishing deal as a songwriter in the band "Burnham"
- Charted on Billboard top 100 and Radio Disney's top 10 with three singles
- Wrote and recorded with Ryan Tedder (OneRepublic), Benji Madden (Good Charlotte), Claude Kelly (Whitney Houston and Miley Cyrus), Toby Gad (Fergie and Beyoncé)

ACTIVITIES AND HONORS

- Member of Vermont Complex Systems Center 2018-Present
- Member of Vermont Beekeepers Association 2017-Present
- Member of TriBeta National Biology Honors Society 2016-Present
- Member of the UVM Bee Club 2015-Present
- APLE Research Award Recipient 2015
- UVM Merit Scholarship 2014-2017
- Invited to Golden Key International Honor Society 2016-2017
- UVM Dean's List 2014-2015
- CCV President's List Honors 2013-2014
- SAG-AFTRA member 2010-2014
- *International Songwriting Competition* Semifinalist 2014
- Song placed top 3 in the *John Lennon Songwriting Contest* 2013
- *International Songwriting Competition* Finalist 2013

MEDIA APPEARANCES RELATED TO WORK

Are commercial honeybees making wild bees sick? PBS News Hour, 6/26/2019, https://www.pbs.org/newshour/science/are-commercial-honeybees-making-wild-bees-sick

Diseased honeybees are spreading infections to wild bumblebees, Earth.com, 6/26/2019, https://www.earth.com/news/diseased-honeybees-wild-bumblebees/

Commercial honeybee apiaries may transmit viral infections to wild bumblebees through flowers. IFLScience!, 6/26/2019, https://www.iflscience.com/plants-and-animals/commercial-honeybee-apiaries-may-transmit-viral-infections-to-wild-bumblebees-through-flowers/

Why flowers may be partially to blame for the deaths of wild bumblebees. Inverse. 6/26/2019, https://www.inverse.com/article/57080-are-honeybees-getting-bumblebees-sick-by-drinking-from-their-flowers

How honeybees may infect bumblebees, UVM Today. 6/26/2019, https://www.uvm.edu/uvmnews/news/how-honeybees-may-infect-bumblebees?utm_source=Twitter.com&utm_medium=post&utm_term=&utm_content=&utm_campaign=UVM_Twitter_general

Honeybees infect wild bumblebees-through shared flowers. Phys.org. 6/26/2019, https://phys.org/news/2019-06-honeybees-infect-wild-bumblebeesthrough.html

Bees kept for honey are killing wild species by spreading disease, study suggests. Independent. 6/26/2019, https://www.independent.co.uk/environment/beekeepers-honeybees-wild-bumblebees-pollinator-decline-a8976101.html

The National Honey Bee Survey in Vermont. Bee Culture. 3/21/2017. http://www.beeculture.com/national-honey-bee-survey-vermont/

UVM scientists fight bee declines. Vermont Digger. 2016.

UVM researchers buzzing about the declining bee populations. MyChamplainValley.com http://www.mychamplainvalley.com/news/symposium-on-vt-bee-population-held

Highgate field becomes bee research site. The St. Albans Messenger. 7/30/2015.

SPEAKING ENGAGEMENTS

“Flowers as dirty doorknobs: Virus transmission through flowers depends on floral diversity“, Apimondia (Montreal, CA), September 2019

“Flowers as dirty doorknobs: Virus transmission through flowers depends on floral diversity“, Southern Adirondack Beekeeping Association (Saratoga, NY), July 2019

“Flowers as dirty doorknobs: Virus transmission through flowers depends on floral diversity“, Northeast Regional Conference on Complex Systems (Binghamton, NY), April 2019

"RNA virus transmission between bee species through shared flowers is diluted by floral diversity", American Bee Research Conference (Tempe, AZ), January 2019

"Demonstration of RNA virus transmission between bee species through shared flowers", NAPPC Conference (Washington DC), October 2018

"Temporal variation in bee disease affects patterns of coinfection", UVM Biology Seminar

(Burlington, VT), February 2018

"Temporal variation in bee disease affects patterns of coinfection", Vermont Beekeepers Association Winter Meeting (Essex, VT), January 2018

"Temporal variation & co-infection in honey bees", American Beekeeping Federation Conference & Tradeshow, (Reno, NV), January 2018

"Homesick- The Role of Migratory Beekeeping on Disease Spread", Vermont Beekeepers Association summer meeting (Middlebury, VT), July 2017

"Experimental design in honeybee research", South Burlington High School Big Picture Program (South Burlington, VT), June 2017

"Effects of local versus imported honeybee queens on disease resistance", UVM Biology Seminar (Burlington, VT), May 2017

"Local Adaptation: disease resistance in honeybees", Evolutionary Biology for non-majors (guest lecture), University of Vermont (Burlington, VT), April 2017

"The role of migratory bee operations in the spread of disease", Southern Adirondack Beekeepers Association (Saratoga, NY), January 2017

"Local Adaptation: disease resistance in honeybees", Vermont Beekeepers Association winter meeting (Essex, VT), January 2017

"Modeling *Nosema* in bumblebees: How mathematical models can be used to predict the spread of infectious disease", UVM Beekeepers Club (Burlington, VT), November 2016

"The threat of pathogens to native pollinators & National Honeybee Survey results", Pollinator Protection Committee meeting, VT Statehouse (Montpellier, VT), October 2016

"Bee pathogen workshop: Hands-on workshop for beekeepers to identify and quantify honey bee pests using laboratory methods", Bennington Beekeeping Club meeting (Bennington, VT), June 2016

"Prevalence of *Nosema bombi* in Vermont bumble bees and the importance of epidemiological modeling in bee research", UVM Biology Seminar (Burlington, VT), April 2016

PUBLICATIONS

Samantha A. Alger, **P.A. Burnham**, H.F. Boncristiani, A.K. Brody (2019). RNA virus spillover from managed honeybees (Apis mellifera) to wild bumblebees (Bombus spp.). PloS one 14 (6), e0217822

Andre J. Burnham, F. McLaughlin, **P.A. Burnham**, H.K. Lehman (2019). Local honey bees (*Apis mellifera)* have lower pathogen loads and higher productivity compared to non-local transplanted bees in North America. Journal of Apicultural Research, 1-8

Alger, S.A., **Burnham, P.A.** (2019). Commercially grown milkweed as habitat and forage for monarch butterflies and other pollinators, 2018 Milkweed Production Trials-Combined Report. University of Vermont Extension Northwest Crops and Soils Program

Burnham, P.A., Alger, S.A., H. Boncristiani & L. Hébert-Dufresne. (2019). Flowers as dirty doorknobs: Virus transmission through flowers depends on floral diversity. Northeast Regional Conference on Complex Systems Proceedings. Binghamton University, Binghamton, NY.

Alger SA, **Burnham P.A.,** Lamas ZS, Brody AK, Richardson LL. (2018). Home sick: impacts of migratory beekeeping on honey bee (*Apis mellifera*) pests, pathogens, and colony size. *PeerJ* 6:e5812 https://doi.org/10.7717/peerj.5812

Burnham P.A., Alger, S.A. & Z.S. Lamas. (2018). RNA viruses and *Varroa* mites: Temporal variation in honeybee pathogens influences patterns of coinfection. American Beekeeping Federation Conference & Tradeshow 2018 Proceedings. Grand Sierra Resort. Reno, NV

Burnham P.A. & Alger S.A. (2017). Results of the Vermont 2015 National Honeybee Survey. Vermont Pollinator Protection Committee. Report to the Vermont Legislature as Required by Act 83 of 2016 Session. 30-39.

MANUSCRIPTS IN REVIEW OR PREPARATION (INTENDED JOURNAL)

Alger, S.A. & **Burnham, P.A.** Role of flowers in RNA virus transmission between honey bees and bumble bees. (PLoS One) (in press)

P. Alexander Burnham, S.A. Alger, B. Case, L.H. Dufresne, Flowers as dirty doorknobs: Demonstration of virus transmission between *Apis meliffera* and *Bombus impatiens* through shared flowers (PNAS) (in prep.)