

## Michael H. Cortez

Assistant Professor

Department of Biological Science, Florida State University

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Tallahassee, FL 32306

**EDUCATION** **Ph.D. Applied Mathematics**, Cornell University, 2011 (Advisor: Stephen P. Ellner)  
**M.S. Applied Mathematics**, Cornell University, 2008  
**B.S. Chemistry and Mathematics**, Hope College, 2005

### EMPLOYMENT

2019– **Assistant Professor**, Department of Biological Science, Florida State University  
**Courtesy Appointment**, Department of Mathematics, Florida State University  
2014–2019 **Assistant Professor**, Department of Mathematics and Statistics, Utah State University  
**Faculty Associate**, Ecology Center, Utah State University  
2012–2014 **NSF Mathematical Sciences Postdoctoral Research Fellow**, School of Biology,  
Georgia Institute of Technology (Mentor: Joshua S. Weitz)  
2010–2012 **Postdoctoral Researcher**, School of Biology, Georgia Institute of Technology  
Affiliate of the School of Mathematics (Mentor: Joshua S. Weitz)

### AWARDS AND HONORS

2016–2020 **Early Career Fellow**, Ecological Society of America  
2016 **Washington, DC Faculty Fellow**, Utah State University  
2012–2014 **NSF Mathematical Sciences Postdoctoral Research Fellow**  
2011 **Prize for an outstanding paper in ecological theory**, Theoretical Ecology Section of  
the Ecological Society of America. Awarded for 2011 *Ecology Letters* paper  
2009 **Provost's Diversity Graduate Student Fellowship**, Merit-based fellowship that pro-  
vided one semester of tuition and stipend  
2005–2008 **Alfred P. Sloan Foundation Graduate Fellowship**, Merit-based fellowship that pro-  
vided three years of tuition and stipend  
2005 **summa cum laude**, Hope College, 2005  
2005 **Sigma Xi**, elected at Hope College  
2004 **Phi Beta Kappa**, Zeta chapter of Michigan  
2001–2005 **Hope Covenant Scholarship**, Merit-based, four-year scholarship to Hope College  
2001 **Eagle Scout Award**, Boy Scouts of America

### GRANTS & FUNDING

**Current Funding**  
2018–2021 National Science Foundation, Division of Environmental Biology  
"Collaborative Research: Development and empirical tests of a mechanistic multi-host,  
multi-pathogen theory"  
PIs: Michael H. Cortez and Meghan A. Duffy (University of Michigan).  
(Total award: \$735,288; Cortez: \$203,399)  
2019–2022 National Science Foundation, Division of Environmental Biology  
"Developing, unifying, and empirically testing theory for inducible and evolving defenses"  
PI: Michael H. Cortez. CoPI: Edd Hammill (Utah State University).  
(Total award: \$525,324)

## Prior Funding

- 2020 First Year Assistant Professor (FYAP) Program, Florida State University  
"When and why does increased host biodiversity lead to more disease?"  
PI: Michael H. Cortez. (Total award: \$20,000)
- 2012–2014 National Science Foundation Postdoctoral Research Fellowship in Mathematical Sciences  
"Understanding eco-coevolutionary dynamics through the use and development of fast-slow dynamical systems theory."  
PI: Michael H. Cortez. (Total award: \$150,00)

## PUBLICATIONS

### Notation

(U) indicates undergraduate student author

(G) indicates undergraduate student author

(P) indicates postdoc author

Underlining indicates my name or individuals under my mentorship

All other authors are colleagues and individuals not under my mentorship

1. M.H. Cortez and M.A. Duffy. The context dependent effects of host competence, competition, and the pathogen transmission mode on disease prevalence. *American Naturalist*, accepted for publication
2. P.A. Clay (P), M.H. Cortez, and M.A. Duffy. Dose relationships can exacerbate, mute, or reverse the impact of heterospecific host density on infection prevalence. *Ecology*, accepted for publication
3. G. Grosklos (G) and M.H. Cortez. 2021. Evolutionary and plastic phenotypic change can be just as fast as changes in population densities. *American Naturalist* 197: 47-59.
4. D.K. Sorenson (U) and M.H. Cortez. 2021. How intra-stage and inter-stage competition affect overcompensation in density and hydra effects in single-species, stage-structured models. *Theoretical Ecology* 14: 23-39.
5. P.B. Adler, E.P. White, and M.H. Cortez. 2020. Matching the forecast horizon with the relevant ecological processes. *Ecography* 43: 1729-1739.
6. M.H. Cortez and M.A. Duffy. 2020. Comparing the indirect effects between exploiters in predator-prey and host-pathogen systems. *American Naturalist* 196: E144-E159.
7. M.H. Cortez, S. Patel, and S. Schreiber. 2020. Destabilizing evolutionary and eco-evolutionary feedbacks drive eco-evolutionary cycles. *Proceedings of the Royal Society B: Biological Sciences* 287: 20192298.
8. G. Li (G), M.H. Cortez, J. Dushoff, and J.S. Weitz. 2020. When to be temperate: on the fitness benefits of lysis vs. lysogeny. *Virus Evolution* 6: veaa042
9. P.A. Clay (G), M.H. Cortez, M.A. Duffy and V.H.W. Rudolf. 2019 Priority effects within co-infected hosts alter prevalence relationships between parasites at the host population scale. *Oikos* 128: 571-583.
10. M.H. Cortez and M. Yamamichi. 2019. How (co)evolution alters predator responses to increased mortality: extinction thresholds and hydra effects. *Ecology* 100: e02789.
11. A. Doloman (G), Y. Pererva, M.H. Cortez, R.C. Sims, and C.D. Miller. 2019. Augmentation of granular anaerobic sludge with algalytic bacteria enhances methane production from microalgal biomass. *Fermentation* 5: 88.
12. J.S. Weitz, G. Li (G), H. Gulbudak, M.H. Cortez, and R.J. Whitaker. 2019. Viral fitness across a continuum from lysis to latency. *Virus Evolution* 5: vez006.
13. M.H. Cortez. 2018. Genetic variation and the drivers of eco-coevolutionary predator-prey cycles. *Ecological Monographs* 88: 353-371.
14. S. Patel (G), M.H. Cortez, and S.J. Schreiber. 2018. Partitioning the effects of ecology, evolution, and eco-evolutionary feedbacks on community stability. *American Naturalist* 191: 381-394.

15. M.H. Cortez and S. Patel (G). 2017. The effects of predator evolution and genetic variation on predator-prey population-level dynamics. *Bulletin of Mathematical Biology* 79: 1510-1538.
16. Z. Pu (G), M.H. Cortez, and L. Jiang. 2017. Predator-prey coevolution drives productivity-richness relationships in planktonic systems. *American Naturalist* 189:28-43.
17. M.H. Cortez. 2016. How the magnitude of prey genetic variation alters predator-prey eco-evolutionary dynamics. *American Naturalist* 188: 329-341.
18. M.H. Cortez. 2016. Hydra effects in discrete-time models of stable communities. *Journal of Theoretical Biology* 411: 59-67.
19. M.H. Cortez and P.A. Abrams. 2016. Hydra effects in stable communities and their implications for system dynamics. *Ecology*, 97: 1135-1145.
20. C.L. Searle (P), M.H. Cortez, K.K. Hunsberger (U), D.C. Grippi (G), I.A. Oleksy (U), C.L. Shaw (G), S. B. de la Serna (U), C.L. Lash (U), K.L.Dhir (U), and M. A. Duffy. 2016. Population density, not host competence, drives patterns of disease in an invaded community. *American Naturalist* 188: 554-566.
21. M.H. Cortez. 2015. Coevolution-driven predator-prey cycles: Predicting the characteristics of eco-coevolutionary cycles using fast-slow dynamical systems theory. *Theoretical Ecology* 8: 369-382.
22. P.A. Abrams and M.H. Cortez. 2015. The many potential indirect interactions between predators that share competing prey. *Ecological Monographs* 85: 625-641.  
Authors contributed equally
23. P.A. Abrams and M.H. Cortez. 2015. Is competition needed for ecological character displacement? Does displacement decrease competition? *Evolution* 69: 3039-3053.
24. L.F. Jover (G), C.O.G. Flores (G), M.H. Cortez, and J.S. Weitz. 2015. Multiple regimes of robust patterns between network structure and biodiversity. *Scientific Reports* 5: 17856.
25. M.H. Cortez and J.S. Weitz. 2014. Coevolution can reverse predator-prey cycles. *Proceedings of the National Academy of Sciences*, 111: 7486-7491.
26. B.P. Taylor (G), M.H. Cortez, and J.S. Weitz. 2014. The virus of my virus is my friend: ecological effects of virophage with alternative modes of coinfection. *Journal of Theoretical Biology* 354: 124-136.
27. M.H. Cortez. 2013. When does pathogen evolution maximize  $R_0$  in well-mixed host-pathogen systems. *Journal of Mathematical Biology* 67: 1533-1585.  
– Recommended by Faculty of 1000 (F1000)
28. M.H. Cortez and J.S. Weitz. 2013. Distinguishing between indirect and direct modes of transmission using epidemiological time series. *American Naturalist* 181: E43-54.
29. L.F. Jover (G), M.H. Cortez, and J.S. Weitz. 2013. Mechanisms of multi-strain coexistence in host-phage systems with nested infection networks. *Journal of Theoretical Biology* 332: 65-77.
30. M.H. Cortez. 2011. Comparing the qualitatively different effects rapidly evolving and rapidly induced defences have on predator-prey interactions. *Ecology Letters* 14: 202-209.
31. M.H. Cortez and S.P. Ellner. 2010. Understanding the effects of rapid evolution on predator-prey interactions using the theory of fast-slow dynamical systems. *American Naturalist* 176: E109-E127.
32. T.L. Bultman, T.J. Sullivan, M.H. Cortez and T.J. Pennings. 2009. Extensions to and modulation of defensive mutualism in grass endophytes in Defensive mutualism in microbial symbiosis, eds. J. F. White and M. S. Torres. CRC Press, p. 301 - 317.
33. M.H. Cortez, et al. 2007. Factors contributing to the accuracy of harmonic force field calculations in water. *Journal of Chemical Theory and Computation* 3: 1267-1274.
34. B. Alleman, M.H. Cortez, et al. 2003. Take me out to/of the ball game. *Rose-Hulman Undergraduate Math Journal* 4: 2.

**SUBMITTED  
MANUSCRIPTS**

1. K. Abbot, J. Blackwood, M.H. Cortez, A. Hastings, T.E.X. Miller, O. Prosper, T. Ramiadantsoa, M. Runge, & S. Twombly. The ever-increasing need for theory. Submitted. Author order is alphabetical.
2. M.H. Cortez. Using sensitivity analysis to identify factors promoting higher versus lower infection prevalence in multi-host communities. Submitted.
3. A. Barriero Felpeto, M.H. Cortez, M. Febrero-Bande, N. G. Hairston, Jr. Contrasting nutrient stoichiometric regimes have dramatic effects on the dynamics of a planktonic predator-prey system. Submitted.

**INVITED  
PRESENTATIONS**

2020

1. Department of Biology, University of Florida, Gainesville, FL
2. Department of Mathematics, University of Florida, Gainesville, FL

2019

1. Department of Biological Science, Florida State University, Tallahassee, FL
2. Department of Biology, University of Pittsburgh, Pittsburgh, PA
3. Department of Biology, University of Cincinnati, Cincinnati, OH
4. Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY

2018

1. SACNAS Annual Conference, San Antonio, TX
2. ESA Annual Conference, New Orleans, LA

2017

1. SIAM Conference on applications of dynamical systems, Snowbird, UT
2. Department of Ecology and Evolutionary Biology, UCLA, Los Angeles, CA
3. Department of Ecology, Evolution, and Natural Resources, Rutgers University, New Brunswick, NJ

2016

1. Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, Ontario, Canada
2. Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, MI
3. Department of Biology, Indiana University, Bloomington, IN
4. Department of Mathematics, University of Utah, Salt Lake City, UT

2015

1. Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, MI
2. ESA Annual Conference, Baltimore, MD
3. School of Mathematical and Statistical Sciences, Arizona State University, Tempe, AZ

2014 and earlier

1. Modeling Infectious Diseases Group, Center for Disease Control, Atlanta, GA (2014)
2. Department of Mathematics and Statistics, Utah State University, Logan, Utah (2014)
3. Department of Biology, Stanford University, Stanford, California (2014)
4. Biology Department, University of Massachusetts Boston, Boston, Massachusetts (2014)
5. Department of Applied and Computational Mathematics and Statistics, University of Notre Dame, South Bend, Indiana (2014)
6. Department of Mathematics, University of Idaho, Moscow, Idaho (2014)

7. Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, Ontario, Canada. (2014)
8. Department of Biological Science, Florida State University, Tallahassee, Florida (2014)
9. Department of Biology, University of Kentucky, Lexington, Kentucky (2013)
10. Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, Ontario, Canada (2013)
11. Department of Mathematics and Statistics, Queen's University, Kingston, Ontario, Canada (2013)
12. MBI Workshop 2: Rapid Evolution and Sustainability, Mathematical Biosciences Institute, Ohio State University, Columbus, Ohio (2013)
13. SACNAS Annual Meeting, San Antonio, Texas (2013)
14. Evo.Tech Seminar Series, Georgia Institute of Technology (2013)
15. SIAM Annual Conference, San Diego, California (2013)
16. Society of Mathematical Biology Annual Conference, Tempe, Arizona (2013)
17. 11th Annual EEID Conference, State College, Pennsylvania (2013)
18. School of Mathematics, Georgia Institute of Technology, Atlanta, Georgia (2012)
19. Society of Industrial and Applied Mathematics (SIAM) Annual Conference, Denver, Colorado (2009)

**CONTRIBUTED  
PRESENTATIONS**

1. Ecological Society of America Annual Conference, Portland, OR (2017)
2. Society of Mathematical Biology Annual Conference, Salt Lake City, UT (2017)
3. Society of Mathematical Biology Annual Conference, Atlanta, GA (2015)
4. Ecological Society of America Annual Conference, Minneapolis, MN (2013)
5. Ecological Society of America Annual Conference, Portland, OR (2012)
6. Society of Mathematical Biology Annual Conference, Knoxville, Tennessee (2012)
7. Ecological Society of America Annual Conference, Austin, TX (2011)
8. MBI Workshop for Young Researchers in Mathematical Biology, Mathematical Biosciences Institute, Ohio State University (2010)

**INTERNAL  
PRESENTATIONS**

1. Biology Colloquium, Department of Biological Science, FSU (2021)
2. Mathematical Biology Seminar, Department of Mathematics, FSU (2020)
3. Mathematics Colloquium, Department of Mathematics and Statistics, USU (2016, 2019)
4. Climate Adaptation Science and Ecology Center Interdisciplinary Research Forum, USU (2017)
5. Biological Frontiers Course, Department of Biological Science, FSU (2021)
6. Graduate student research seminar, Department of Mathematics and Statistics, USU (3 times in 2016-2018)
7. Math Bio Group, Department of Mathematics and Statistics, USU (13 times in 2014-2019)
8. USU Applied Math Club, Department of Mathematics and Statistics, USU (2014, 2017)

## MENTORSHIP Postdoctoral Researchers

**Jing Jiao**, November 2020-present  
PhD in Biology, University of Florida  
First author manuscript in preparation

## Graduate Students

**Miles Robertson**, accepted and confirmed to start in F2021  
Biology PhD candidate in Department of Biological Science, Florida State University  
Awarded a graduate fellowship through the NSF Graduate Research Fellowship Program (GRFP)

**Guen Grosklos**, F2016-F2018  
Applied Mathematics PhD candidate in Department of Mathematics and Statistics, Utah State University  
First author paper in *American Naturalist*

**Luis Jover**, F2011-F2014  
PhD candidate in Department of Physics, Georgia Institute of Technology  
Co-advised with Joshua Weitz  
Two first author papers in *Journal of Theoretical Biology* and *Scientific Reports*

**Bradford Taylor**, F2012-F2014  
PhD candidate in Department of Physics, Georgia Institute of Technology  
Co-advised with Joshua Weitz  
First author paper in *Journal of Theoretical Biology*

**Cesar Garcia Flores**, 2014  
PhD candidate in Department of Physics, Georgia Institute of Technology  
Co-advised with Joshua Weitz  
Co-author on paper in *Scientific Reports*

## Undergraduate Students

**Charles Gannon**, F2021-present  
Mathematical Biology Major, Florida State University

**Emily Mila**, S2020-S2021  
Mathematical Biology Major, Florida State University  
Status after graduating: Law student

**Darian Sorenson**, F2018-S2020  
Mathematics Major, Utah State University  
Status after graduating: PhD student at UC Davis  
First author paper in *Theoretical Ecology*

**Miles Roberston**, S2019  
Biology Major and Math-Stats Composite Major, Utah State University  
Status after graduating: PhD student at Florida State University

**Yido Yang**, F2012-S2013  
Biomedical Engineering Major, Institute of Technology

**REU Undergraduate Students**, Summer 2008  
Three Mathematics Majors, Hope College  
Co-mentored with Tim J. Penning

## Graduate Students Committees

**Monica Paniagua Montoya**, PhD candidate in Biology, FSU  
**Matthew Schumm**, PhD candidate in Biology, FSU  
**Guen Grosklos**, PhD candidate in Applied Mathematics, USU  
**Lacy Smith**, PhD candidate in Natural Resources, USU  
**Ian McGahan**, PhD in Applied Mathematics, USU, defended in 2020  
**Eden Furtak-Cole**, PhD in Applied Mathematics, USU, defended in 2017

## TEACHING

### Undergraduate Courses

Honors Biological Science II (BSC 2011)  
Florida State University, S2020  
Ordinary Differential Equations (Math 2280)  
Utah State University, F2018  
Linear Algebra (Math 2270)  
Utah State University, F2015-2017, S2016  
Calculus 2 (Math 1220)  
Utah State University, S2015.  
Theoretical Ecology (Bio 4422/6422)  
Co-taught with Joshua S. Weitz, Georgia Institute of Technology, S2012

### Graduate Courses

Theoretical Ecology (BSC 4933 & 5936)  
Florida State University, S2021  
Graduate Ordinary Differential Equations (Math 6910)  
Utah State University, S2019  
Methods in Applied Mathematics (Math 5410)  
Utah State University, F2016-2018  
Modeling Predator-Prey Interactions (Bio 4230 & Math 6910)  
Utah State University, S2016  
Analysis of biological models using fast-slow dynamical systems (Math 6910)  
Utah State University, S2016

## SERVICE

### Internal Service - Florida State University

Department of Biological Science Committees:  
Diversity, Equity, and Inclusion Committee, member (2020-present)  
Elections Committee, member (F2020-S2021)  
Faculty Evaluation Committee, member (S2021)  
Cell Biology Faculty Search Committee, member (F2019-S2020)  
Seminar Organizer  
Ecology and Evolution Seminar (F2020-S2021)  
University Committees:  
Ad hoc member for academic honor hearings (S2021)

### Internal Service - Utah State University

Department of Mathematics and Statistics Committees:  
Research Committee, member (2017-2019)  
Numerical Analyst Faculty Search Committee, member (F2016-S2017)  
Department Scholarship Review Committee, member (2017)  
Applied Mathematics Graduate Curriculum Committee, member (2015)  
Faculty Advisor

USU Men's Ultimate Frisbee Club (2014-2019)

## External Service

Associate editor (2017– present)

*The American Naturalist*

Conference local organizing committee

Society of Mathematical Biology annual meeting, member (2017)

Organized session

Society of Mathematical Biology Annual Conference, Tempe, Arizona (2013)

Grant reviewer

NSF Division of Mathematical Sciences, panelist (2018)

NSF Division of Environment Biology, ad hoc reviewer (2019)

University of Missouri University System, ad hoc reviewer (2014)

Manuscript reviewer

31 as an assistant professor; 49 total

Advances in Computational Mathematics (1), American Naturalist (4), Bulletin of Mathematical Biology (1), Differential Equations and Dynamical Systems (1), Ecology (5), Ecology and Evolution (1), Ecology Letters (6), Evolution (1), F1000 (1), Interface (1), Journal of Biological Systems (1), Journal of Mathematical Biology (1), Journal of Theoretical Biology (6), Methods in Ecology and Evolution (1), Natural Resource Modelling (2), Oikos (3), PLoS Computational Biology (1), PLoS ONE (2), Proceedings of the Academy of Sciences USA (1), Scientific Reports (1), Theoretical Ecology (6), Theoretical Population Biology (2), Theory in Biosciences (1)

Conference proceedings reviewer

Alife 13 conference proceedings (2012)

Mentor

Theory Section mentoring chain, member (2017)

Theory Section mentor (2015)

Volunteer poster and presentation judge

Society of Mathematical Biology annual conference (2017)

Ecological Society of American annual conference (2011-2013)

Georgia Tech Research and Innovation Conference (2012)

School of Biology Graduate Student Symposium, Georgia Institute of Technology (2011)