David E. Hufnagel

Contact Information

Virus and Prion Research Unit
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Education

Iowa State University, Ames, Iowa, USA

Ph.D., Bioinformatics and Computational Biology, December 2019.
Dissertation: Distinct Teosinte Hybrid Zones and Genomic Architectures of Hybridization.
Advisor: Dr. Matthew B. Hufford

Michigan State University, East Lansing, Michigan, USA

B.S., graduated with honors, December 2012.
Honors College

Selected Work Experience

National Animal Disease Center, USDA-ARS, Ames, Iowa, USA

ORISE Postdoctoral Research Fellow, Virus and Prion Research Unit, March 2020 - present

Iowa State University, Ames, Iowa, USA

Graduate Research Assistant, Department of Ecology, Evolution, and Organismal Biology, April 2014 - December 2019

- Used GBS SNP data of a broad sampling of hybrid teosinte to more deeply explore the origins, evolution, and genomic architectures of hybridization in hybrid teosinte populations in Mexico.
- Built a command-line tool, SequelTools, which works on any operating system to provide a variety of functionalities that assist researchers in working with PacBio Sequel raw sequence data including quality control, unbiased data reduction, and data normalization.
- Contributed to a project producing de novo PacBio genome assemblies for 25 founders of the maize Nested Association Mapping (NAM) population as well as the next version of the maize B73 reference genome. My responsibilities included quality control via read mapping, SNP calling, and phylogenetics.
- Completed a project exploring admixture among teosinte in putative hybrid zones, presenting these hybrids and their parental taxa as a model system for studying hybridization.
- Mentored an undergraduate assistant for two years. This experience improved my organizational and leadership skills in the context of advancing mutual research goals.
- Contributed to a project using ancient DNA samples to determine the ancestry of maize from the US Southwest, the timing of diffusion into the US, and local adaptation loci.

Michigan State University, East Lansing, Michigan, USA

Undergraduate Research Assistant/Programmer, Department of Plant Biology, June 2011 - July 2013

- Worked as project leader examining the characteristics of pseudogenes across 32 species of land plants.
- Contributed to the creation of the gene annotation tool MAKER-P.
- With colleagues, used our newly assembled Raphanus raphanistrum genome along with available genomes (Arabidopsis thaliana, A. lyrata and Brassica rapa) to answer three major questions:

    1. How has the evolution of genome structure in the Brassicaceae family been affected by whole genome duplication?

2. Are duplicate genes likely to pseudogenize immediately following duplication?
3. What functional gene categories are enriched among species that have undergone recent whole genome duplication?

Michigan State University, East Lansing, Michigan, USA

Undergraduate Research Assistant, Department of Horticulture, January 2009 - August 2011

- Mapped the easy peel (ep) locus to the molecular map of tomato revealing linkage to chromosome 8. The ep locus alters the general adhesion of the skin to the fruit.
- Worked with Dr. Barry under the Plant Genomics at MSU Summer Internship with research in two areas: 1) The cloning and sequencing of genes involved in terpene biosynthesis in Solanum species. 2) The cloning and sequencing of a candidate gene involved in fruit quality of tomato using several heirloom varieties.
- Gained proficiency in general lab procedures including the preparation of solutions, PCR, gel electrophoresis, DNA purification, DNA and RNA extraction and purification, RT-PCR, DNA cloning and DNA sequencing.

Publications

8. **Hufnagel D.E.***, Hufford M.B., and Arun S. Seetharam*. (2020) SequelTools: A Suite of Tools for Working with PacBio Sequel Raw Sequence Data. *BMC Bioinformatics*. (* co-corresponding authors) https://doi.org/10.1186/s12859-020-03751-8

7. Ou S., Liu J., Chougule K., Fungtammasan A., Seetharam A., Stein J., Llaca V., Manchanda N., Wei X., Chin C., **Hufnagel D.E.**, Pedersen S., Snodgrass S., Fengler K., Woodhouse M., Hannigan B., Dawe R.K., Hirsch C.N., Hufford M.B., and Doreen Ware. (2020) Effect of Sequence Depth and Length in Long-read Assembly of the Maize Inbred NC358. *Nature Communications* https://doi.org/10.1038/s41467-020-16037-7

6. Da Fonseca R.R., Smith B.D., Wales N., Cappellini E., Pontus S., Fumagalli M., Samaniego J.A., Caroe C., Avila-Arcos M.C., **Hufnagel D.E.**, Korneliussen T.S., Vieira F.G., Jakobsson M., Arriaza B., Willerslev E., Nielson R., Hufford M.B., Albrechtsen A., Ross-Ibarra J. and M. Thomas P. Gilbert. (2015) The origin and evolution of maize in the Southwest United States. *Nature Plants*. https://doi.org/10.1038/nplants.2014.3

5. Wu G., **Hufnagel D.E.**, Denton A.K. and Shin-Han Shiu. (2015) Retained duplicate genes in green alga *Chlamydomonas reinhardtii* tend to be stress responsive and experience frequent response gains. *BMC Genomics*. https://doi.org/10.1186/s12864-015-1335-5

4. Lehti-Shiu M.D., Uygun S., Moghe G.D., Panchy N., Fang L., **Hufnagel D.E.**, Jasicki H.L., Feig M. and Shin-Han Shiu. (2014) Molecular evidence for functional divergence and decay of a transcription factor derived from whole genome duplication in *Arabidopsis thaliana*. *Plant Physiology*. http://dx.doi.org/10.1104/pp.15.00689

3. Moghe G., **Hufnagel D.E.**, Tang H., Xiao Y., Dworkin I., Town C.D., Conner J.K., and Shin-Han Shiu. (2014) Consequences of whole-genome triplication as revealed by comparative genomic analyses of the wild radish *Raphanus raphanistrum* and three other Brassicaceae species. *The Plant Cell*. 26(5):1925-1937. https://doi.org/10.1105/tpc.114.124297

2. Campbell M.S., Law M., Holt C., Stein J.C., Moghe G.D., **Hufnagel D.E.**, Lei J., Achawanantakun R., Jiao D., Lawrence C.J., Ware D., Shiu S.H., Childs K.L., Sun Y., Jiang N., and Mark Yandell. (2014) MAKER-P: a Tool-kit for the rapid creation, management, and quality control of plant genome annotations. *Plant Physiology*. 164(2):513-24. https://doi.org/10.1104/pp.113.230144

1. Gonzales-Vigil E., **Hufnagel D.E.**, Kim J., Last R.L., and Cornelius S. Barry (2012) Evolution

of TPS20-related terpene synthases influences chemical diversity in the glandular trichomes of the wild tomato relative *Solanum habrochaites*. *The Plant Journal*. https://doi.org/10.1111/j.1365-313X.2012.05040.x

Government Reports

1. Anderson, T.K., Arendsee, Z.W., **Hufnagel, D.E.**, Young, K., Souza, C.K., Kimble, B., Brown, I., Essen, S., Collins, S., Byrne, A., Patapiou, P., Lewis, N., Vincent, A.L. 2020. OFFLU animal influenza report: February 2020 to September 2020. World Health Organization. p. 1-58.

Publications in Review and Preprints

1. **Hufnagel D.E.**, Kananen K., Glaubitz J.C., Sanchez-González J., Doebley J.F., and Matthew B. Hufford. Multiple Putative Teosinte Hybrid Zones Discovered in Central Mexico. *New Phytologist*. (in submission)

Selected Conference Presentations

Hufnagel, D.E., Arendsee, Z.W., Vincent, A.L., Anderson, T.K. December 2020. N1 Neuraminidase Evolution in Influenza A Virus Detected in U.S. Swine. NIAID Centers of Excellence for Influenza Research and Surveillance Annual Meeting. Virtual.

Souza, C.K., Kimble, B., Anderson, T.K., Arendsee, Z.W., **Hufnagel, D.E.**, Young, K.M., Lewis, N.S., Davis, T.C., Vincent, A.L. December 2020. Antigenic Characterization of Contemporary US Swine H3N2 Strains and Transmission From Swine to Ferrets as an Indication of Risk to Humans. NIAID Centers of Excellence for Influenza Research and Surveillance Annual Meeting. Virtual.

Kimble, B., Souza, C.K., Anderson, T.K., **Hufnagel, D.E.**, Arendsee, Z.W., Young, K.M., Lewis, N.S., Davis, T.C., Vincent, A.L. December 2020. Cross-reactivity of Contemporary US Swine H1 Viruses to Current Seasonal and Candidate Vaccine Viruses and Transmission to Ferrets as a Measure of Risk to Humans. NIAID Centers of Excellence for Influenza Research and Surveillance Annual Meeting. Virtual.

Arendsee, Z.W., Chang, J., **Hufnagel, D.E.**, Anderson, T.K., Vincent, A.L. December 2020. Visualizing Spatial and Temporal Trends in Influenza A Virus in US Swine with octoFLUshow. NIAID Centers of Excellence for Influenza Research and Surveillance Annual Meeting. Virtual.

Hufnagel D.E., Kananen K., and Hufford, M.B. March 2019. Differential Architectures of Hybridization Between Teosinte Subspecies Across Multiple Hybrid Zones. The 61st Annual Maize Genetics Conference. St. Louis, Missouri, USA

Hufnagel D.E., Kananen K., and Hufford, M.B. November 2017. Investigating Parviglumis- Mexicana Hybrid Populations in Central Mexico. 2017 Panzea Video Conference.

Hufnagel D.E., Kananen K., and Hufford, M.B. March 2017. Hybridization Between Parapatric Teosinte Populations Results in Three Unique Hybrid Groups in Mexico. The 59th Annual Maize Genetics Conference. St. Louis, Missouri, USA

Hufnagel D.E., Ross-Ibarra J., and Hufford, M.B. June 2015. Characterizing hybridization amongst subspecies of teosinte in the Central Plateau and Balsas River Basin of Mexico. The 36th Annual International Evolution Conference. Guarujá, Brazil

Hufnagel D.E., Ross-Ibarra J., and Hufford, M.B. March 2015. Characterizing Hybridization Amongst Subspecies of Teosinte. The 1st Annual BCBGSO Symposium. Ames, Iowa

Hufnagel D.E., Ross-Ibarra J., and Hufford, M.B. March 2015. Characterizing Hybridization amongst subspecies of teosinte. 2015 Panzea Video Conference.

Hufnagel D.E., Ross-Ibarra J., and Hufford, M.B. March 2015. Hybridization between highland and lowland teosinte populations in the Central Plateau and Balsas River Basin of Mexico. The 57th Annual Maize Genetics Conference. St. Louis, Missouri, USA

Professional Experience

Teaching

- 2019 (Spring) Teaching Assistant, Principles of Biology Laboratory II (BIOL212L 25 students), Iowa State University
- 2018 (Fall) Teaching Assistant, Principles of Biology Laboratory I (BIOL211L 25 students), Iowa State University
- 2017 (Fall) Teaching Assistant, Bioinformatic Analysis (BCBIO444 15 students), Iowa State University
- 2016 (Spring) Teaching Assistant, Molecular Phylogenetics (EEOB563: 15 students), Iowa State University
- 2016 (Spring) Teaching Assistant, Systems Biology (BCB570: 20 students), Iowa State University
- 2016 (Fall) Teaching Assistant, Principles of Biology Laboratory I, (BIOL211L 25 students), Iowa State University
- 2015 (Fall) Teaching Assistant, Principles of Biology Laboratory I (BIOL211L 25 students), Iowa State University
- 2014 (Fall) Teaching Assistant, Principles of Biology Laboratory I (BIOL211L 25 students), Iowa State University

Service

- 2017 Student Teacher, Skunk River Navy river cleanup and student teaching program which sends river biology data to the Iowa Department of National Resources.
- 2016-2017 BCBGSO Director of Social Activities, promoted social cohesion by hosting events. Also assisted in organizing the 3rd Annual BCBGSO Symposium.
- 2014-2015 BCBGSO Director of Outreach, founded and ran the annual UNIX and Python workshops training 35-70 students at a time over five workshops. Also assisted in organizing the 1st Annual BCBGSO Symposium.
- 2014-2015 Student Volunteer, Skunk River Navy river cleanup and student teaching program which sends river biology data to the Iowa Department of National Resources.
- 2012 Private Tutor, regularly tutored for Fundamental Genetics at Michigan State University
- 2012 Private Tutor, regularly tutored for Plant Genetics at Michigan State University
- 2011 Volunteer, Science Olympiad, Institute for Interdisciplinary STEM Education
- 2009 Private Tutor, regularly tutored for Organic Chemistry at Michigan State University
- 2009 Volunteer, Science Olympiad, Institute for Interdisciplinary STEM Education

Reviewer for

Scientific Reports, and PLOS One.

Doctoral committee

Dr. Matthew B. Hufford (advisor), Dr. Kris DeBrabanter, Dr. Xiaoqui Huang, Dr. Carolyn J. Lawrence-Dill, and Dr. Jonathan F. Wendel.

Postdoctoral Advisor

Tavis K. Anderson (National Animal Disease Center, USDA-ARS).

Professional Societies and Awards

National Postdoctoral Association (2020-present)

ISU BCB Graduate Student Organization Leadership and Service Award (2015)

Society for the Study of Evolution (2015)

Plant Sciences Institute Fellowship (2013-2017)

Bioinformatics and Computational Biology Travel Award (2014)

Iowa State University Brown Fellowship (2014)

Honor Society (2013-present)

Gilmore Award (2012)

Steven T. and Esther M. Spees Scholarship (2011)

Dr. Ronald C. Hamelink Scholarship (2011)

Pamela Ann Merry Scholarship (2010)

Plant Genomics at MSU Summer Internship (2010)

Lyman Briggs College Undergraduate Research Support Program (2009)

Michigan Competitive Scholarship (2008-2012)

Programming Proficiencies

- Python: Took one course dedicated to Python, and two partially dedicated to the subject. Use regularly in my work.
- UNIX: Use regularly in my work.
- R: Use regularly in my work.
- Bash: Learned by building the program SequelTools, now I use it regularly in my work.
- C++: Took two courses at MSU dedicated to C++ and software design.
- Java: Self-taught with fundamental skills. Used for BCB568 at ISU.
- awk: Self-taught with basic skills.

References

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