Dr. Chloe Pak Drummond

CONTACT

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EDUCATION & TRAINING

The Pennsylvania State University, University Park, PA	Entomology	Postdoctoral Fellow 2020-2022
The Pennsylvania State University, University Park, PA	Entomology	Postdoctoral Scholar 2018-2020
University of Wisconsin-Madison, Madison, WI	Botany	Ph.D. 2018
Oberlin College and Conservatory, Oberlin, OH	Biology, Piano	B.A. and B.M. 2012

CLASSROOM TEACHING EXPERIENCE (* taught online)

Instructor of Record

Comparative Techniques in Comparative Genomics and Transcriptomics *	(17 students, graduate with undergrad)	Spring 2022
Fundamentals of Evolutionary Genomics *	(9 students, graduate)	Spring 2020

Teaching Assistantships

Evolutionary Biology	(120 students, discussions)	Spring 2017
Vascular Flora of Wisconsin	(45 students, lab/field)	Spring 2016
Botany for Non-Majors	(120 students, labs)	Summer 2014
Plant Systematics	(45 students, lab)	Falls 2013 – 16
Introduction to Botany	(200 students, labs)	Spring 2013

Guest Classroom Lectures

Evolutionary Biology	(120 students, lecture)	Spring 2017
Ethnobotany	(20 students, workshop)	Summers 2016 – 17

Research Mentees

2021 – present Shuhan Yin (Penn State undergraduate; secondary metabolite response to light in tall bilberry)
College of Agriculture Undergraduate Research Award, Summer 2021/ Sp 22
2020 – 2021 Ian Chamberlain (Penn State undergraduate; evolution of anthocyanin pathway genes)
2018 Arthi Bala (Penn State undergraduate; bioinformatics)
2018 – 2019 Mark Porter (Penn State undergraduate; sundew response to nitrogen)
2015 – 2017 Christopher Setzke (UW-Madison undergraduate; monkshood phylogeography)

Teaching Professional Development

Delta Teaching Program (2013 – 2017)
Completed pedagogical coursework. Designed and conducted a teaching-as research internship in a Plant Systematics course: assessed teaching strategy and student learning of tree-thinking and evolution concepts, and implemented and assessed an intervention to improve student learning.

Online Course Development on Teaching Evolution (2013 – 2014)

Co-developed a teaching evolution online curriculum for high school teachers. Professional development for graduate students, postdocs, faculty, and high school teachers, using backwards design in course development and end-of-semester teacher feedback for iterative improvement. A collaborative effort between the Crow Institute for the Study of Evolution, the Institute for Biology Education, and the UW-Madison School of Education.

RESEARCH EXPERIENCE

Current	USDA-NIFA *Postdoctoral Fellow: T Renner, Entomology Dept., Penn State* Assessing the impact of latitude and elevation on the regulation of berry and leaf secondary metabolites in tall bilberry. **Mentoring undergraduates Ian Chamberlain and Shuhan Yin (See presentations)**
2018-2020	*Postdoctoral Research: T Renner, Entomology Dept., Penn State* Genomic evolution and regulation of carnivory in the sundew genus, *Drosera*. **Mentored undergraduates Mark Porter and Arthi Bala**
2012-2018	*Ph.D.: KJ Sytsma, Botany Dept., UW-Madison* Phylogeography of western North American - Great Lakes region disjunct plants **Mentored undergraduate Christopher Setzke (See publications)**
2015-2018	*Research Assistant: KJ Sytsma and BT Drew, Botany Dept., UW-Madison* *Salvia* phylogeny and circumscription using anchored phylogenomics and population tree estimation with plastome and nuclear data. **(See publications)**
2014	*Collaboration: D Baum, B Larget, and CAné, Botany Dept., UW-Madison* Statistical tests of common ancestry using primate morphology to assess likelihood of common ancestry. **(See publications)**
2014	*Research Assistant: KM Cameron, TJ Givnish, KJ Sytsma and DM Waller, Botany Dept., UW-Madison.* NSF Dimensions of Biodiversity, phylogeny and barcoding of Wisconsin flora.
2012-2013	*Research Assistant: KJ Sytsma and JD Sulman, Botany Dept., UW-Madison.* *Sparganium* biogeographic analysis using RASP and S-DIVA. **(See publications)**
2010-2012	*Undergraduate researcher: MJ Moore, Biology Dept., Oberlin College* Evolution of gypsum endemism within Nyctaginaceae, reconstructing a multi-gene chronogram of the larger Caryophyllales order. **(See publications)**

Research Professional Development

2021	Volunteer at Penn State PAC Herbarium
2013-2018	Reorganized and co-curated the Botany Department student herbarium as Botany 400 TA UW-Madison
2018	Software Carpentry Workshop through the Advanced Computing Initiative UW-Madison
2018	Data Carpentry Workshop through the Advanced Computing Initiative UW-Madison
2013	Bioinformatics workshop with Norman Wickett and Matthew Johnson Chicago Botanic Garden.

PEER-REVIEWED PUBLICATIONS (coauthors: *undergraduate student)

Kriebel, R, BT Drew, **CP Drummond**, JG González-Gallegos, F Celep, MM Mahdjoub, JP Rose, C-L Xiang, G-X Hu, JB Walker, EM Lemmon, AR Lemmon, and KJ Sytsma. 2019. Tracking the temporal shifts in area, biomes, and pollinators in the radiation of *Salvia* (sages) across continents: leveraging Anchored Hybrid Enrichment and targeted sequence data. American Journal of Botany 106:573-597.

Spalink, D, R Kriebel, P Li, MC Pace, BT Drew, JG Zaborsky, J Rose, **CP Drummond**, MA Feist, WS Alverson, DM Waller, KM Cameron, TJ Givnish, and KJ Sytsma. 2018. Spatial phylogenetics reveals evolutionary constraints on the assembly of a large regional flora. *American Journal of Botany* 105: 1938-1950.

Smith, SA, JW Brown, Y Yang, R Bruenn, **CP Drummond**, SF Brockington, JF Walker, N Last, NA Douglas, MJ Moore. 2017. Disparity, Diversity, and Duplications in the Caryophyllales. New Phytologist 217:836-854.

Drew, BT, JG González-Gallegos, C-L Xiang, R Kriebel, **CP Drummond**, JB Walker, KJ Sytsma. 2017. *Salvia* united: the greatest good for the greatest number. Taxon 66:133-145.

Baum DA, C Ané, B Larget, C Solís-Lemus, LST Ho, P Boone, **CP Drummond**, M Bontrager, SJ Hunter, W Saucier. 2015. Statistical evidence for common ancestry: application to primates. Evolution 70:1354-1363.

Sulman JD, BT Drew, **C Drummond**, E Hayasaka, KJ Sytsma. 2013. Systematics, biogeography, and character evolution of *Sparganium* (Typhaceae): Diversification of a widespread, aquatic lineage. American Journal of Botany 100:2023-2039.

MANUSCRIPTS IN PROGRESS (coauthors: *undergraduate student)

Drummond, CP, T Renner. Genomic insights into the evolution of plant biochemical defense. Invited review *Current Opinions in Plant Biology.* (under review)

Drummond, CP, T Cochrane, KJ Sytsma. Western North American plants disjunct in the Great Lakes Region – 40 years after Marquis and Voss. (to be submitted)

Drummond, CP, *C Setzke, MA Kuchenreuther, KJ Sytsma. Untangling the pseudoparallel phylogeographic patterns of a North American disjunct distribution in three angiosperm case studies. (manuscript in preparation)

Albert, VA, K Fukushima, J Salojarvi, S Rajaraman, T Lan, QW Tan, **CP Drummond**, T Renner. Comparative genome evolution and the evolution of carnivory in *Drosera*. (manuscript in preparation)

Toczydlowski, R, **CP Drummond**, B Kartzinel, S Goldstein. Optimizing Stacks for high throughput computing clusters. (manuscript in preparation)

PUBLISHED ABSTRACTS & PRESENTATIONS (coauthors: *undergraduate student)

Scientific Research

Drummond, C.P., *I. Chamberlain, T. Renner. The case of the blues, reds, and purples: flavonoid biosynthesis and evolution in *Vaccinium* L. Botany Meeting, Virtual, 2021.

Drummond, C.P., K. Bocklund, V.A. Albert, K. Fukushima, J. Salojarvi, S. Rajaraman, T. Lan, QW. Tan, T. Renner. The mystery behind sundew carnivory: how do they dew that? **Judges Prize Lightning Talk**, Postdoctoral Research Exhibition, University Park, PA. 2019.

Drummond, C.P., V.A. Albert, K. Fukushima, J. Salojarvi, S. Rajaraman, T. Lan, Q.W. Tan, T. Renner. Co-option and carnivory in the Caryophyllales. Botany Meeting, Tucson AZ. 2019.

Renner, T., **V.A. Albert**, C.P. Drummond, QW. Tan, K. Fukushima, S. Schuster, L. Herrera-Estrella, E. Ibarra-Laclette, M. Mata-Rosas, S. Rajaraman, T. Michael, V. Albert, J. Salojarvi. Deep-time morphological stasis in the carnivorous plant genus Drosera despite different trajectories of genomic upheaval. International Conference on Polyploidy, 2019.

Drummond, C.P., M. Kuchenreuther, K.J. Sytsma. Great Lakes Region-western North American disjunct plants: a review of the distribution and three phylogeographic case studies. Botany Meeting, Rochester, MN. 2018.

Drummond, C.P. and K.J. Sytsma. The temporal puzzle of North American disjunct plants. Poster, Evolution Meeting, Portland, OR. 2017.

Drummond, C.P. and K.J. Sytsma. Pattern and process: the phylogeography of two western North America-Great Lakes disjuncts. Evolution Seminar Series, Madison, WI. 2017.

Drummond, C.P. and K.J. Sytsma. A comparison of two Western North America-Great Lakes disjuncts using phylogeography, population genetics, and niche modeling. Botany Meeting, Savannah, GA. 2016.

Drummond, C.P. and K.J. Sytsma. The case of the western North America-Great Lakes disjuncts. Poster, Botany Meeting, Alberta, Canada. 2015.

Drummond et al. 2012. The age and origins of arid adaptations and gypsum endemism in Nyctaginaceae inferred using relaxed molecular dating. Poster, Botany Meeting, Columbus, OH. 2012.

Education Research

Lees, T., **C.P. Drummond**, D.M. Seay, J.M. Garber, G.G. Lohay, P. Eswara. Case study in using Canvas to pivot and host a postdoctoral research exhibition online. Poster, National Postdoc Association Conference, virtual. 2021.

Drummond, C.P. Persistence of student evolution misconceptions in a plant systematics course. Poster, Teaching and Learning Symposium, Madison, WI. 2017.

Perna N., … **C.P. Drummond** et al. J.F. Crow Institute – On Teaching Evolution. Poster, Teaching and Learning Symposium, Madison, WI. 2014.

GRANTS & FELLOWSHIPS

Current sources of support or ongoing research

2020-2022 **USDA-NIFA Postdoctoral Fellowship**
Assessing the impact of latitude and elevation on the regulation of berry secondary metabolites in tall bilberry using comparative transcriptomics and metabolomics and phylogeography.
Undergraduate students are mentored under this grant.

Previous grants, honors, and awards funding research

2017	Tulipa et Paeonia Award (Botany Dept., UW-Madison)
2016, 2017	Hugh Iltis Award (Botany Dept., UW-Madison)
2015	Botanical Society of America, Graduate Student Research Award
2015	American Society of Plant Taxonomists, Graduate Student Research Grant
2014	NSF Graduate Research Fellowship, Honorable Mention
2014	American Philosophical Society, Lewis and Clark Field Scholar
2014, 2015	Flora Aeterna Fellowship and Award (Botany Dept., UW-Madison)
2013	Judith Croxdale Award for Women in Science (Botany Dept., UW-Madison)
2013, 2016	Davis Research Grant (Botany Dept., UW-Madison)
2012	Biological Sciences Scholars Award (Botany Dept., UW-Madison)

AWARDS

2019	Judges Award for Best Lightning Talk (Penn State Postdoctoral Society)
2017	Teaching Assistant Award for Exceptional Service (UW-Madison)

INVITED RESEARCH TALKS

2021	Eastern Michigan University Biology Seminar, Virtual
2020	UW-Madison Evolution Seminar Series, Madison, WI
2018	New York Botanical Garden Science and Humanities Lecture Series, Bronx, NY

COMMUNITY INVOLVEMENT & OUTREACH

2015 – 2021 *Master Planting Science Team* and *Digging Deeper*
A Botanical Society of America NSF-funded outreach initiative connecting scientists with K-12 science classrooms online. Mentoring groups of students in

plant science classrooms and leading as a mentor-teacher liaison, helping students structure, run, and analyze inquiry-based projects, and promoting scientific thinking.

2020 *Millennium Scholars Presentation*
Spoke with first-year Millennium Scholars at Penn State about research opportunities and my journey in STEM.

2019 *Science Communication Conference*
Presented my research on carnivorous plants at a booth at the Science Communication Conference, which was hosted at Penn State. Communicated my research to an audience of science writers.

2018, 2019 *The Great Insect Fair*
A day-long public outreach event hosted by PSU Department of Entomology. Hosted an activity booth, "Amazing Adaptations," that explored carnivorous plants of Pennsylvania and carabid beetles.

2018 *Think Outside the Beaker*
An afterschool science program through the Eberly College of Science. Worked with Renner Lab members to co-develop and host an afterschool science activity on natural selection.

2018 *PLANTS*
A Botanical Society of America NSF-funded program to increase the participation of undergraduates from underrepresented groups at the annual Botany meeting. Mentored an undergraduate before, during and after the meeting.

2014 – 2016 *Chair of Education Outreach for the J.F. Crow Institute for the Study of Evolution*
This cross-departmental institute at UW-Madison is focused on evolution research, teaching, and education outreach.

2014, 2016 *Wisconsin Society of Science Teachers conference*
Developed and facilitated workshops for K-12 teachers on tree-thinking, molecular evolution activities, evolution concepts and misconceptions.

2013, 2016 *Darwin Day*
Organized and hosted a free, annual public evolution celebration with guest lectures, movie screenings, teacher workshops and forums, and activities for kids and families.

2013 – 2014 *Engage Children in Science Service-Learning Course*
Engage Children in Science, a course to promote science education in local afterschool programs in Madison. Independently led an afterschool science club, encouraging kids to develop their science skills and scientific thinking by providing fun activities at Lincoln Elementary School.

2014 *Wisconsin Science Festival/Science Expeditions/Family Science Nights*
Hosted evolution activity booths for K-12 kids and families as part of annual UW-Madison science outreach programs.

2012, 2013 *Expanding Your Horizons*
A national program to promote women in science. Developed and lead workshops for middle school girls, introducing them to botany and evolution research.

2012 *Grandparents University*
A UW-Madison alumni cross-generational outreach initiative. Co-taught a 2-day evolutionary biology workshop for grandparents and their grandchildren.

SERVICE TO ACADEMIC COMMUNITY

2020 – present Department of Entomology Committee on Climate and Diversity

2019 – present	Peer review for: Systematic Biology, Journal of Systematics and Evolution, New Phytologist, BMC Genomics, American Journal of Botany
2019 – present	Penn State Postdoctoral Society Executive Council Member, Penn State University
2020	Planning Committee for Annual Penn State Postdoc Research Exhibition
2016	Graduate-Faculty Liaison, Dept. of Botany, UW-Madison
2016	Ad-hoc Committee on Inclusive Governance, Dept. of Botany, UW-Madison
2015 – 2016	Finance Committee, Dept. of Botany, UW-Madison
2012 – 2015	Development Committee, Dept. of Botany, UW-Madison

SOCIETY SERVICE & MEMBERSHIPS

2017 – present	Society for the Study of Evolution (SSE)
2013 – present	Botanical Society of America (BSA)
2012 – present	American Society of Plant Taxonomists (ASPT)
2019 – 2020	American Institute for Biological Sciences (AIBS)

RELEVANT BIOINFORMATICS SKILLS

Command Line; Bash scripting; Genomic and transcriptomic data wrangling and analysis on HTC/HPC facilities; R-Studio