

J M Budke

Esau Postdoctoral Fellow

University of California, Plant Biology Department

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FIELDS OF SPECIALIZATION

Evolutionary Developmental Biology, Structure-Function Relationships, Maternal Effects,
Systematics, Morphology, Anatomy, Botany, Bryology, Science Communication.

EDUCATION

- 2011 **Ph.D. Ecology and Evolutionary Biology**, University of Connecticut
“Examining the gametophytic calyptra and its role in sporophyte development of the moss *Funaria hygrometrica* Hedw.” *Advisors:* Dr. Bernard Goffinet & Dr. Cynthia S. Jones
- 2005 **M.S. Botany**, University of Connecticut
“Phylogenetic analysis of the Timmiaceae (Bryophyta: Musci) inferred from sequence data and a developmental study of the peristome-forming region of *Timmia megapolitana* (Timmiaceae)” *Advisors:* Dr. Bernard Goffinet & Dr. Cynthia S. Jones
- 2003 **B.S. Botany**, Miami University, Oxford, OH

POSTDOCTORAL EXPERIENCE

- 2013 - Present: *Katherine Esau Postdoctoral Fellow, University of California, Davis* (\$150,000)
Exploring calyptra function and the influence of auxin and HD-ZIP III transcription factors on sporophyte development using non-model moss taxa *Faculty Sponsor:* Dr. Neelima R. Sinha
- 2011 - 2012: *Postdoctoral Researcher, University of Connecticut*
Analyzing calyptra cuticle anatomy across members of the Funariaceae
NSF Grant, B. Goffinet: Rapid radiation and sporophyte evolution in the Funariaceae

PUBLICATIONS

Peer-Reviewed

- 2013 **Budke JM**, Goffinet B, Jones CS. Dehydration protection provided by a maternal cuticle improves offspring fitness in the moss *Funaria hygrometrica*. *Annals of Botany* 111: 781-789.
- 2013 Liu Y, Forrest LL, Bainard JD, **Budke JM**, Goffinet B. Organellar genome, nuclear ribosomal DNA repeat unit, and microsatellites isolated from a small-scale of 454 GS FLX sequencing on two mosses. *Molecular Phylogenetics and Evolution* 66: 1089-1094.
- 2012 **Budke JM**, Goffinet B, Jones CS. The cuticle on the gametophyte calyptra matures before the sporophyte cuticle in the moss *Funaria hygrometrica* (Funariaceae). *American Journal of Botany* 99: 14-22. **Winner of the Grady L. Webster Publication Award**

- 2012 Wynne MA*, **Budke JM**. Examining the ability of calyptrae to produce protonema in *Funaria hygrometrica*. *Evansia* 29: 61-64. (* undergraduate student mentee)
- 2012 Liu Y, **Budke JM**, Goffinet B. Phylogenetic inference rejects sporophyte based classification of the Funariaceae (Bryophyta): rapid radiation suggests rampant homoplasy in sporophyte evolution. *Molecular Phylogenetics and Evolution* 62: 130-145.
- 2011 **Budke JM**, Goffinet B, Jones CS. A hundred-year-old question: is the moss calyptra covered by a cuticle? A case study of *Funaria hygrometrica*. *Annals of Botany* 107: 1259-1277.
- 2011 Goffinet B, **Budke JM**, Newman LC*. Micromitriaceae: A new family of highly reduced mosses. *Taxon* 60: 1245-1254. (* undergraduate student mentee)
- 2011 Wickett NJ, Forrest LL, **Budke JM**, Shaw B, Goffinet B. Frequent pseudogenization and loss of the plastid-encoded, sulfate transport gene *cysA* throughout the evolution of liverworts. *American Journal of Botany* 98: 1263-1275.
- 2009 Larraín J, Herrera F, **Budke JM**, Goffinet B. Phylogenetic affinities and conservation status of the Chilean endemic *Costesia spongiosa* (Bryophyta: Gigaspermaceae). *The Bryologist* 112: 279-286.
- 2007 **Budke JM**, Jones CS, Goffinet B. Development of the enigmatic peristome of *Timmia megapolitana* (Timmiaceae; Bryophyta). *American Journal of Botany* 94: 460-467.
- 2006 **Budke JM**, Goffinet B. Phylogenetic analysis of Timmiaceae (Bryophyta: Musci) based on nuclear and chloroplast sequence data. *Systematic Botany* 31: 633-641.
- 2005 **Budke JM**, Hickey RJ, Heafner KD. Analysis of morphological and anatomical characteristics of *Isoetes* using *Isoetes tennesseensis*. *Brittonia* 57: 167-182.
- 2003 Luebke NT, **Budke JM**. *Isoetes tennesseensis* (Isoëtaceae), an Octoploid Quillwort from Tennessee. *American Fern Journal* 93: 184-190.

Point of View

- 2015 **Budke JM**. Postdocs: Improving our Visibility in the Research Workforce. *Plant Science Bulletin* 61(2): 40-44.
- 2014 Cain B*, **Budke JM***, Wood KJ, Sweeney NT, Schwessinger B. How postdocs benefit from building a union. *eLife* 3: e05614. (* equal co-first authors)

Book Review

- 2013 **Budke JM**. Common Mosses of the Northeast and Appalachians *Plant Science Bulletin* 59(3): 131-132.

Submitted Manuscripts

Busta L, **Budke JM**, Jetter R. June 2015. Identification of β -hydroxy fatty acid esters and primary, secondary-alkanediol esters in cuticular waxes of the moss *Funaria hygrometrica*. *Phytochemistry*

Manuscripts in Preparation

Budke JM, Goffinet B. Comparative cuticle development reveals thicker maternal calyptra cuticles on taller sporophyte offspring in the Funariaceae.

AWARDS

- 2015 Startup Allocation for computing time "Identification and elucidation of gene regulatory networks influencing sporophyte development in the non-model moss *Physcomitrium pyriforme*." from Extreme Science and Engineering Discovery Environment (XSEDE) supported by National Science Foundation
- 2014 Postdoctoral Scholar Association Travel Award to International Association of Bryology World Conference in Cape Horn Biosphere Reserve, Chile (\$400)
- 2013 Grady L. Webster Structural Botany Publication Award - "For the most outstanding paper published in the *American Journal of Botany* in the field of structural and developmental botany over the two-year period prior to the award year." (\$1000)
- 2011 Vernon I. Cheadle Student Travel Award, Botanical Society of America (\$500)
- 2010 Katherine Esau Award for the Best Student Paper in Developmental & Structural Botany, Botanical Society of America: *Beneath the calyptra's veil: Exploring cuticle anatomy during moss sporophyte development* (\$500)
- 2010 Developmental & Structural Section Student Travel Award, BSA (\$150)
- 2007 Conant Botanical Images Student Travel Award: Second Place (\$250)
- 2005 Graduate Research Fellowship, National Science Foundation: Honorable Mention
- 2003 Young Botanist Award, Botanical Society of America: Special Achievement
- 2003 Outstanding Woman Senior in Science, Engineering, and Technology, Miami Valley Association for Women in Science (AWIS)

RESEARCH GRANTS

- 2009 International Association of Bryologists: Stanley Greene Award (\$1100)
Botanical Society of America: Graduate Student Research Award (\$500)
American Microscopical Society: Graduate Student Research Award (\$700)
Henry N. Andrews Endowment Fund: University of Connecticut EEB (\$1000)
- 2007 Ronald Bamford Endowment Fund: University of Connecticut EEB (\$800)
- 2006 Ronald Bamford Endowment Fund: University of Connecticut EEB (\$1100)
- 2004 Ronald Bamford Endowment Fund: University of Connecticut EEB (\$1275)
- 2002 Academic Challenge Fund: Miami University Botany (\$1030)
W. S. Turrell Travel Grant: MU Herbarium, #181 co-author C. Craig (\$1319)
- 2001 W. S. Turrell Travel Grant: MU Herbarium, #179 co-author K. Gustafson (\$695)

GRADUATE FELLOWSHIPS

- 2011 Graduate Summer Research Fellowship, Univ. of Conn. Graduate School (\$2274)
- 2010 Doctoral Dissertation Fellowship Award, Univ. of Conn. Graduate School (\$2000)
- 2008 East Asia Pacific Summer Institute Fellowship - EAPSI, NSF (\$5637)
NIBB, Okazaki, Japan - Hosts: Dr. M. Hasebe and Dr. Y. Hiwatashi

INVITED PRESENTATIONS

- 2015 Lester Newman Seminar Series – Department of Biology, Portland State University
Budke JM, Maternal effects: offspring protection from dehydration improves fitness in mosses.
- 2013 Postdoctoral Research Seminar Series - University of California, Davis
Budke JM, Maternal effects in mosses: A maternal cuticle prevents dehydration and improves offspring fitness.
- 2008 Connecticut Outdoor Environmental Education Association Annual Conference
Budke JM, Miniature Mosses Workshop: Teaching environmental educators how to integrate moss biology into their outdoor education programs.

RESEARCH EXPERIENCE

- 2015: Curatorial Assistant, University of California – Davis, JM Tucker & B Crampton Herbaria
Identifying bryophyte collections of ecologist Dr. Jack Major from AK, CA, CO, OR, UT
- 2009 – 2011: Research Assistant, University of Connecticut
Culturing Funariaceae for DNA extraction and morphological character scoring
NSF Grant, B. Goffinet and C. S. Jones: Reduction and reversal in the Funariaceae
- 2008, Summer: Laboratory Workshop on *Physcomitrella patens*, NIBB, Okazaki, Japan
Developmental processes, gene targeting, bioimaging, and bioinformatics
- 2008, Spring: *Physcomitrella* Genome Workshop, University of Freiburg, Germany
Sequence analysis using the Physcomitrella genome browser and BLAST tools
- 2007, Spring: Research Assistant, University of Connecticut
Surveying for the presence/absence of *cysA* and *cysT* across liverworts
NSF Grant (ATOL), B. Goffinet: Assembling the Liverwort Tree of Life
- 2004, Summer: Research Assistant, University of Connecticut
Establishing a protocol to grow dung moss (Splachnaceae) from spore isolates
NSF Grant, B. Goffinet: Phylogenetic and geographic patterns in moss diversity
- 2002 - 2003: Dean's Scholar in the College of Arts and Science, Miami University
Screening ISSR markers to examine population genetics in *Isoetes canadensis*
Advisors: Dr. Linda E. Watson and Dr. R. James Hickey
- 2002, Summer: Howard Hughes Internship, Miami University
Using PCR to isolate a single copy gene (*cycloidea*) across the Asteraceae
Advisor: Dr. Linda E. Watson
- 2001, Summer: Undergraduate Summer Scholar, Miami University
Quantification and assessment of variation in anatomical leaf characteristics in *Isoetes tennesseensis* Advisor: Dr. R. James Hickey
- 1998, Summer: Howard Hughes Internship, University of Cincinnati, Cincinnati Zoo and Botanical Gardens, Center for Conservation and Research of Endangered Wildlife (CREW)
Tissue culture and cryopreservation of tropical herbs for the frozen garden
Advisors: Dr. Valerie C. Pence and Bernadette L. Plair

TEACHING EXPERIENCE

Adjunct Lecturer: *University of California - Davis*

Everybody Eats: Threats to Your Favorite Foods Fall 2014 & Spring 2015

Designed and taught an original course as **instructor of record** for ACCESS-R.

A UC Davis program to improve retention of first-generation to college and students from underrepresented groups in the sciences. Team-taught with Dr. H. Atamian, Spring 2015.

Awarded a \$500 mini-grant for supplies, both quarters.

Guest Lectures

University of California - Davis

Seminar in Plant Development – Topic: Moss Developmental Genetics Winter 2015

Seminar in Plant Biology – Topic: Preparing for the NSF GRFP Fall 2014

iAMSTEM program – Topic: Science Communication Summer 2014

Western Connecticut State University, Biological and Environmental Sciences

Genetics – Topic: Transformation of Non-Model Species Spring 2014

University of Connecticut, Cooperative Extension Center, Master Gardener Program

Biology and Identification of Mosses and Liverworts Oct 2012

University of Connecticut, Ecology and Evolutionary Biology

The Summer Flora – Topic: Bryophytes Summer 2011

Plant Anatomy – Topic: Shoot apical meristems Fall 2010

Bryology and Lichenology – Topic: Morphogenesis Spring 2006

Teaching Assistant: *University of Connecticut, Ecology and Evolutionary Biology*

Advanced Courses

Phylogenetics Spring 2009

Plant Anatomy Fall 2008

Evolution of Green Plants Spring 2008

Developmental Plant Morphology Fall 2007

Bryology and Lichenology Spring 2006

Introductory Courses

Biology II (for majors) Fall 2003 – Fall 2006 (5 semesters)

Introduction to Botany Fall 2004

TEACHING MATERIALS

Peer reviewed brochure to teach plant biology concepts to students using mosses.

Swanson J, Budke JM, and Goffinet B. 2012. A visit to the miniature forest: insights into the biology and evolution of bryophytes in Northeastern Connecticut. Available through the *PlantED Digital Library*.

Peer reviewed laboratory exercises to teach the concept of chemical competition in plants.

Swanson J, Budke JM, and Goffinet B. 2012. Chemical competition in plants using the moss *Sphagnum*. *PlantED Digital Library*. <http://planted.botany.org/> Featured in the *Plant Science Bulletin* 60(4): 198, 2014.

Moss Culturing Protocol for high school teacher workshop at MOSS 2012 conference.

Mosses and the Plant Life Cycle by LE Parker*, JM Budke, and B Goffinet. (* undergraduate mentee)

TRAINING IN EDUCATION

College Teaching Seminar

Winter 2014

University of California - Davis, Center for Excellence in Teaching and Learning

UNDERGRADUATE STUDENT MENTORING

University of California, Davis

Kristina Khuu - Major: Biological Sciences June 2015 – Present
Molecular phylogenetics of the Fissidentaceae.

Eunice Magat - Major: Genetics Apr 2014 – Present
Creating DNA constructs for studying polar auxin transport in *Physcomitrella patens*.

Sinja Taavitsainen - Major: Microbiology Apr 2014 – Present
Creating DNA constructs for studying polar auxin transport in *Funaria hygrometrica*.

Stefanie Komar - Major: Biological Sciences, emphasis in Plant Biology Feb 2013 – Jul 2014
Creating DNA constructs for genetic transformation of non-model mosses.
Stanley and Jacqueline Shilling Award, College of Biological Sciences (\$2000)
Subsequently: Research Technician, Arcadia Biosciences

PLANTS program - Botanical Society of America (Preparing Leaders and Nurturing Tomorrow's Scientists: Enhancing Diversity in Plant Science), Junior Mentor – 2012

University of Connecticut

Lindsey Parker - Major: Biology Jan – Dec 2012
Culturing Funariaceae mosses and stimulating laboratory-grown hybrid sporophytes
Subsequently: Doctor of Pharmacy Professional Program, University of Connecticut

Xing Chen - Major: Pre-Pharmacy Jan – Dec 2012
Optimizing lab protocols for analyzing moss genomes using flow cytometry.
Subsequently: Doctor of Pharmacy Professional Program, University of Connecticut

Deborah Lee - Major: Physiology and Neurobiology Jan – Dec 2012
Examining anatomical differences between polyploid races in the Funariaceae.

Pavitra Dwivedi - Major: Molecular Cellular Biology May 2010 – May 2012
Culturing Funariaceae mosses and meiotic chromosome staining.
Subsequently: Master's Student in Epidemiology, Boston University

Melissa Wynne - Major: Allied Health Sciences Aug 2008 – Dec 2011
Examining calyptra senescence in *Funaria hygrometrica*.
Office of Undergraduate Research Grant (\$500)
2010 Frontiers in Undergraduate Research: Poster presentation
Subsequently: Cytogenetics Technologist, Sloan Kettering Cancer Center

Leah Newman - Major: Biological Sciences Aug 2008 – May 2010

Studying *Micromitrium* using DNA sequence data.

Summer Undergraduate Research Fellowship (\$3500)

2009 Frontiers in Undergraduate Research: Poster presentation

Subsequently: Master's Student in Applied Genomics, University of Connecticut

Lauren Hensley - Major: Biological Sciences Jan – May 2008

Culturing Funariaceae mosses using sterile techniques.

PUBLIC AND COMMUNITY OUTREACH

Moss Plants and More: Commentary on All Things Bryological Oct 2007 – Present

Monthly updated online bryology blog. Communicating science to the public.

<http://mossplants.fieldofscience.com>

Featured in Plant Cuttings: News in Botany. *Annals of Botany* 10: iv-vi, 2012.

Statistics as of Jul 1, 2014: Total visits = 122,413; Average visits per day = 26

On Twitter @MossPlants = 520 followers

Kindergarten class at American Lakes School, Sacramento, California Apr 10, 2014

In collaboration with S. Komar, we designed and led students through two hands-on classroom activities exploring the relationships between plant structures & functions.

Discovery Museum Science & Space Center – Volunteer with AWIS Feb 22, 2014

Helping families navigate activities about dinosaurs, fossils, rocks, and crystals.

FIELD BOTANY EXPERIENCE

Botanical Outreach

Outdoor Presentations on Mosses (12 total) and Ferns (1) Summers 2005 – 2012

Leading botanical explorations at local nature centers and state parks in Connecticut.

Connecticut Bioblitz Summers 2005, 2007, 2009

24-hour biological survey of a park with scientists, students, and the public.

All Taxa Biodiversity Inventory (ATBI) Summers 2001 – 2003

Great Smoky Mountains National Park: Fern Foray Participant

Plant Collection Trips

Multiple locations in eastern Kansas and central Missouri, USA Mar 12-16, 2012

Collecting developing sporophytes of ephemeral mosses with B Allen & J Atwood.

Limestone Rise Nature Preserve, Knox, New York, USA 2004 – 2005

Visited every two weeks to collect phenology data for the moss *Timmia megapolitana*.

Vermont, New York, USA & Quebec, Canada Oct 19-28, 2003
Collecting *Timmia megapolitana* for systematic analyses of the Timmiaceae.

PowWow Pond, East Kingston, New Hampshire, USA May 3-8 & Jun 27-29, 2002
Collecting *Isoëtes canadensis* for population genetic analysis with M Barker & C Craig.

Hiwassee River, Polk Co., Tennessee, USA Three weekends in Jun & Jul 2001
Collecting new species of aquatic quillwort *Isoëtes tennesseensis* Luebke & **Budke**
with P Cox, J Shaw, E Lickey, K Gustafson, K Heafner.

Bryology Forays

SoBeFree: Spring Outing; Botanical Excursion; Foray, Retreat, & Escape to the Environment
San Bernardino Mountains, California Mar 27-30, 2015
Santa Cruz County, California Mar 28-31, 2014
A. Leroy Andrews Foray, Woodstock Valley, Connecticut Sept 18-20, 2009
Blomquist Foray, Haywood County, North Carolina Oct 4-6, 2002

Field Course Participation

Ecotourism with a Hand Lens in the Cape Horn Biosphere Reserve Jan 10, 2015
Exploring ways of defining, studying, communicating, and conserving both botanical and biocultural diversity in the Omora Ethnobotanical Park.
Coordinators: Dr. Ricardo Rozzi and Dr. Francisca Massardo

Tropical Ferns and Lycophytes, Organization for Tropical Studies Jan 10-23, 2008
Intensive, field introduction designed to build the diverse skills needed for floristic, taxonomic, phylogenetic, and ecological research on tropical ferns and lycophytes.
Coordinators: Dr. Robbin Moran and Dr. Eddie Watkins

Tropical Flora of the Bahamas, Miami University May 11-23, 2002
Exploring local plants from ecological & evolutionary perspectives.
Instructors: Dr. Michael Vincent and Dr. R. James Hickey

PROFESSIONAL SERVICE

Manuscript Reviewer: *American Fern Journal, American Journal of Botany, Annals of Botany, Journal of Biogeography, Plant Biology, Plant Physiology, Protoplasma, The Bryologist.*

Panel Discussion Participant:

Postdoctoral Fellowship Writing: Learning from Colleagues Feb 25, 2014
Sponsored by the postdoc union (UAW 5810) at University of California - Davis

Academic Service:

2015 - Present Postdoctoral Union - UAW 5810: Sergeant-At-Arms, Executive Board Member
2013 - Present American Bryological and Lichenological Society: Member-at-Large

- 2013 - Present Judging Committee - Esau Award (Chair in 2015), BSA Conference
- 2015 Judging Committee - Grady Webster Award, Botanical Society of America
- 2014 Botanical Society of America, Strategic Planning Committee: Participant
- 2013 - 2015 Postdoctoral Union - UAW 5810: UC Davis Campus Unit Chair
- 2013 Judge - Triarch Botanical Images student travel award, BSA Conference
- 2010 Local Representative for the American Fern Society, BSA Conference
- 2004 - 2011 EEB Graduate Student Association at the University of Connecticut
 - 2009 - 2011, Co-organizer of the Graduate Student Spring Symposium
 - 2006 - 2007, President; 2004 - 2006, Treasurer
- 2004 Northeast Ecology & Evolution Conference - Housing & Recruitment
- 2003 Botany Dept. Chair Search Committee at Miami Univ. Undergrad. Representative

Member: Botanical Society of America, Association for Women in Science, Microscopy Society of America, American Society of Plant Taxonomists, International Association for Plant Taxonomy, American Bryological and Lichenological Society, International Association of Bryologists.

CONFERENCE PRESENTATIONS (PRESENTER UNDERLINED)

- 2015 Budke JM, Busta L, Jones CS, Goffinet B. Beneath the veil of the calyptra: exploring cuticle anatomy during moss sporophyte development in the Funariaceae. International Association of Bryologists Conference.
- 2013 Busta L, Budke JM, Jetter R. Cuticular Waxes from the Gametophyte, Sporophyte, and Calyptra of the Moss *Funaria hygrometrica*. Annual Meeting of the Phytochemical Society of North America. (*Awarded Best Student Presentation*)
 - Liu Y, Medina R, Wilding N, Budke JM, Hedderson T, Goffinet B. The evolutionary history of *Physcomitrella patens*: phylogenetic inferences from 4 loci within the Funariidae. BSA Annual Meeting
- 2012 Budke JM, Jones CS, Goffinet B. Sporophyte development and calyptra cuticle function in *Funaria hygrometrica*. MOSS 2012
 - Goffinet B, Y Liu, N Wilding, Budke JM. Phylogenetic inferences in the Funariaceae: inferences from 10 versus 4 loci. 3rd International Symposium on Molecular Systematics of Bryophytes
- 2011 Budke JM, Goffinet B, Jones CS. Experimental manipulation of the moss calyptra: The effect of cuticle removal and desiccation on sporophyte development in *Funaria hygrometrica*. BSA Annual Meeting
 - Liu Y, Budke JM, Goffinet B. Phylogenetic inference rejects sporophyte-based classification of the Funariaceae (Bryophyta): a rapid radiation suggests rampant homoplasy in sporophyte evolution. BSA Annual Meeting
 - Liu Y, Budke JM, Goffinet B. Phylogenetic inference suggests rampant homoplasy in sporophyte evolution in the Funariaceae. MOSS 2011

- 2010 **Budke JM**. Examining the gametophytic calyptra and its role in moss sporophyte development using the cord moss (*Funaria hygrometrica*). Society for Integrative and Comparative Biology Annual Meeting
Budke JM, Goffinet B, Jones CS. Beneath the calyptra's veil: Exploring cuticle anatomy during moss sporophyte development. BSA Annual Meeting
Liu Y, **Budke JM**, Goffinet B. Phylogenetic relationships of *Physcomitrella* and other Funariaceae based on inferences from 10 genes. BSA Annual Meeting
- 2007 **Budke JM**, Wickett NJ, Goffinet B. Multiple losses of the *cysA* gene from the chloroplast genome of liverworts (Marchantiophyta). BSA Annual Meeting
- 2006 **Budke JM**, Goffinet B. Phylogenetic analyses of Timmiaceae (Bryophyta: Musci) inferred from nuclear and chloroplast sequence data. BSA Annual Meeting
- 2005 **Budke JM**, Jones CS, Goffinet B. Peristome development in *Timmia megapolitana* in relation to systematics and evolution of the Bryophyta. BSA Meeting
- 2004 **Budke JM**. Peristome development in *Timmia megapolitana*. Northeast Ecology and Evolution Conference
- 2003 **Budke JM**, Hickey RJ, Heafner KD. Morphological characterization of North America's first octoploid *Isoetes*. BSA Annual Meeting
Hickey RJ, **Budke JM**. The sella and its derivatives in *Isoetes*. BSA Annual Meeting
- 2002 **Budke JM**, Hickey RJ, Heafner KD. Morphological characterization of North America's first octoploid quillwort. Association of Southeastern Biologists Annual Meeting