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INTERESTS:

- Fungal Biochemistry - discovery of natural products and signals from fungi, bacteria, nematodes, and plants through organic chemistry methods.
- Implementation of fungal natural products into the market as future pharmaceuticals or agrochemicals for disease management.
- Uncovering complex microbial interactions with their hosts and other microbes.
- Identification and characterization of new fungal species.

EDUCATION:

2014 –2019: University of Wisconsin – Madison, Madison, Wisconsin, USA

- Doctor of Philosophy in Plant Pathology, supervised by Dr. Jean-Michel Ané

2009 –2012: Louisiana State University, Baton Rouge, Louisiana, USA:

- Master of Science in Plant Health (Plant Pathology), supervised by Drs. M. Catherine Aime and Raymond W. Schneider
- Minor in Plant and Molecular Biology

2004 –2008: Louisiana State University, Baton Rouge, Louisiana, USA:

- Bachelor of Science in Biological and Agricultural Engineering.

HISTORY of EMPLOYMENT and INTERNSHIPS:

2021– present: Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA

R&D Associate Staff Research Scientist - Fungal Biologist and Biochemist

2019 –2021: Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA: Post-Doctoral Researcher on Plant-Microbe Interfaces, supervised by Dr. Jessy Labbé

2013 – 2014: Louisiana State University, Department of Environmental Sciences, Baton Rouge, Louisiana, Research Assistant supervised by Drs. Edward Overton, Buffy Meyer, and Scott Miles.

2012 – 2013: Chulalongkorn University, Bangkok, Thailand, Fulbright Research Scholar in Faculty of Botany, supervised by Dr. Pongtharin Lotrakul

2011: Summer Internship: AVRDC: The World Vegetable Center, Tainan, Taiwan

2006: Summer Internship: Jacobs Engineering, Baton Rouge, LA.

2002 – 2005: Summer Internships, United States Forest Service: Louisiana State University, Baton Rouge and Fort Benning, Columbus, Georgia, Biological Technician supervised by Drs. J.P. Jones and Lori Eckhardt.

PUBLICATIONS:

Peer-Reviewed Journals:

- 13) Carrel AA, Clark M, Jawdy S, Muchero W, Alexandre G, Labbé JL, **Rush TA**. A consortium of ectomycorrhizal fungi and a beneficial bacterium differentially regulates carbon sequestration and exometabolites production across *Populus trichocarpa* genotypes. Abstract was accepted to a special issue in *Frontiers in Plant Science*. Finalized manuscript will be submitted in October 2022
- 12) **Rush TA**, Tannous J, Lane M, Gopalakrishnan Meena M, Carrell A, Cottaz S, Ané JM, Keller NP, Jacobson D, Kainer D, Pelletier D, Abraham P, Giannone R, Labbé J. Fungal LCOs: Modulators of metabolite production and bacterial development. *Under review in mSystems*
- 11) Gopalakrishnan Meena M, Lane M, Tannous J, Carrell AA, Ané JM, Keller NP, Labbé J, Abraham P, Giannone R, Kainer D, Jacobson D, **Rush TA**. A guidance into the fungal metabolomic abyss: Network analysis for revealing relationships between exogenous compounds and their outputs. *Under review in PLOS Computational Biology*.
- 10) Villalobos Solis MI, Engle NL, Spangler MK, Cottaz S, Fort S, Maeda J, Ané JM, Tschaplinski TJ, Labbé J, Hettich RL, Abraham PE, **Rush TA**. Expanding the biological role of lipo-chitooligosaccharides and chitooligosaccharides in *Laccaria bicolor* growth and development. *Frontiers in Fungal Biology*, doi: [10.3389/ffunb.2022.808578](https://doi.org/10.3389/ffunb.2022.808578)
- 9) **Rush TA**, Shrestha HK, Meena MG, Spangler MK, Ellis JC, Labbé JL, Abraham PE (2021). Bioprospecting *Trichoderma*: A systematic roadmap to screen genomes and natural products for biocontrol applications. *Frontiers in Fungal Biology*. doi: [10.3389/ffunb.2021.716511](https://doi.org/10.3389/ffunb.2021.716511)
- 8) Drott MT, **Rush TA**, Satterlee TR, Giannone RJ, Abraham PE, Greco C, Venkatesh N, Skerker JM, Glass NL, Labbé JL, Milgroom MG, Keller NP (2021). Population-specific patterns in the pan-secondary metabolome of *Aspergillus flavus* inform ecological and evolutionary inferences of related species. *Proceedings of the National Academy of Science*. <https://doi.org/10.1073/pnas.2021683118>
- 7) Lawrence T, Carper D, Margaret S, Alyssa C, **Rush TA**, Minter S, Weston D, Labbé JL (2020). amPEPpy 1.0: A portable and accurate antimicrobial peptide prediction tool. *Bioinformatics* <http://dx.doi.org/10.1093/bioinformatics/btaa917>
- 6) **Rush TA**, Albu SA, Kijpornyongpan T, Aime MC (2020). *Farysia magdalena* sp. nov. and description of the anamorph of *Anthracoystis heteropogonicola* from the Americas. *Mycological Progress* 19:921-934. doi.org/10.1007/s11557-020-01610-7

- 5) **Rush TA**, Puech-Pagès V, Bascaules A, Jargeat P, Maillet F, Haouy A, QuyManh-Maës A, Carriel CC, Khokhani D, Keller-Pearson M, Tannous J, Cope KR, Garcia K, Maeda J, Johnson C, Kleven B, Choudhury QC, Labbé J, Swift C, O'Malley MA, Bok JW, Cottaz S, Fort S, Poinot V, Sussman MR, Lefort C, Nett J, Keller NP, Bécard G, Ané JM (2020) Lipo-chitooligosaccharides as regulatory signals of fungal growth and development. *Nature Communications* 11, 3897. doi.org/10.1038/s41467-020-17615-5
- 4) Cope KR, Bascaules A, Iriving TB, Venkateshwaran M, Maeda J, Garcia K, **Rush TA**, Ma C, Labbé J, Jawdy S, Steigerwald E, Setzke J, Fung E, Schnell K, Wang Y, Schlieff N, Bücking H, Strauss SH, Jargeat P, Bécard G, Puech-Pagès V, Ané JM (2019) The ectomycorrhizal fungus *Laccaria bicolor* produces lipochitooligosaccharides and uses the common symbiosis pathway to colonize *Populus* roots. *The Plant Cell* 31: 2386-2410. [doi/10.1105/tpc.18.00676](https://doi.org/10.1105/tpc.18.00676)
- 3) **Rush TA**, Golan J, McTaggart A, Kane C, Schneider RW, Aime MC (2019) Variation in the Internal Transcribed Spacer (ITS) region of *Phakopsora pachyrhizi* and implications for molecular diagnostic assays. *Plant Disease* 103(9): 2237-2245. doi.org/10.1094/PDIS-08-18-1426-RE
- 2) **Rush TA**, Aime MC (2013) The genus *Meira*— phylogenetic placement and description of a new species. *Antonie van Leeuwenhoek - Journal of Microbiology* (5): 1097-106. <http://link.springer.com/10.1007/s10482-013-9889-1>
- 1) Kaur R, **Rush TA**, Ferrin DM, Aime MC (2011) First report of *Puccinia thaliae* rust on *Canna indica* in Louisiana. *Plant Disease*, Vol. 95, No. 3:353. doi.org/10.1094/PDIS-03-10-0209

Conference Proceedings:

Appidi MR, Mudbhari S, Bible A, Cope KR, **Rush TA**, Carper DL, Jawdy S, Giannone RJ, Kalluri UC, Morrell-Falvey J, Hettich RL, Abraham PE. “Development of experimental approaches to achieve spatially resolved plant root-associated -omics using an agar-plate system.” Presentation and abstract submitted to *American Society of Plant Biologist* conference on July 2022.

Appidi MR, Mudbhari S, Cope KR, **Rush TA**, Carper DL, Jawdy S, Giannone RJ, Kalluri UC, Hettich RL, Abraham PE. “Development of a method for spatially resolved root exometabolomics using a plant-agar system” Presentation and abstract submitted to *Mass Spectrometry and Allied Topics* conference on June 2022.

Gopalakrishnan Meena M, Lane MJ, Tannous J, **Rush TA**. Predicting production of known, putative, and unknown microbial metabolites through network analysis. *31st Fungal Genetics Conference*, March 15-20, 2022.

Rush TA, Villalobos Solis MI, Tannous J, Gopalakrishnan Meena M, Lane MJ, Engle NL, Carrell AA, Spangler MK, Ané JM, Keller N, Cottaz S, Fort S, Jacobson DA, Kainer D, Pelletier DA, Tschaplinski T, Hettich RL, Giannone RJ, Abraham PE, Labbé JL. Beyond the symbiosis: Novel modulating roles of lipochitooligosaccharides and chitooligosaccharides in the development of fungi and nearby microbes. *31st Fungal Genetics Conference*, March 15-20, 2022.

Rush TA, Shrestha HK, Meena MG, Spangler MK, Ellis JC, Labbé JL, Abraham PE. (2021) Bioprospecting *Trichoderma*: A systematic roadmap to screen genomes and natural products for biocontrol applications. *9th Annual Oak Ridge Postdoctoral Research Symposium, July 28-29, 2021*.

Rush TA, Prates ET, Demerdash ON, Ellis C, Shah M, Tannous J, Jacobson D, Labbé JL, Doktycz M (2020) Plant-Microbe Interfaces: Characterizing the perception of Lipochitooligosaccharides signaling in fungi. *2021 Biological System Sciences Division Principal Investigator's Meetings, February 22-25, 2021*.

Rush TA, Meena MG, Tannous J, Abraham P, Giannone R, Labbé J (2020) Lipochitooligosaccharides (LCOs) are biotic stress factors in *Aspergillus fumigatus*. *The 14th Annual Vanderbilt Postdoctoral Association Symposium, October 29, 2020, Nashville, TN (virtual)*.

Rush TA, Spangler M, Entler M, Choudhury Q, Giannone R, Abraham P, Labbé JL (2020) Friend or Foe? Deciphering microbial communications that influence community structure and function. *8th Annual Oak Ridge Postdoctoral Research Symposium, July 21-22, 2020*.

Labbé J, **Rush TA**, Choudhury Q, Entler M, Spangler M, Tuskan J, Tschaplinski T (2020) Understanding the exchangeable chemical signals that influence fungal interactions. *15th European Conference on Fungal Genetics, February 17-20, 2019, Rome, Italy*.

Rush TA, Bascaules A, Jargeat P, Malliet F, Cope KR, Johnson C, Kleven B, QuyManh-Maës A, Choudhury QJ, Labbé JL, Swift C, O'Malley MA, Bok JW, Cottaz S, Fort S, Nett J, Keller NP, Puech-Pagès, Bécard G, Ané JM (2019) Unexpected production of rhizobium signaling molecules across the Fungal Kingdom. *30th Fungal Genetics Conference, March 12-17, 2019, Pacific Grove, California*.

Rush TA, Pringle A, Bankeeree W, Dominguez EG, McTaggart A, Sanchez H, Chong PL, Prasongsuk S, Punnapayak H, Seelanan T, Lotrakul P (2018) The discovery and characterization of *Ustilaginomyces* yeasts reveal enzymatic activities, resistance to antifungal drugs, and species complexes. *11th International Mycological Congress July 15-21, 2018, San Juan, Puerto Rico*.

Rush TA, MacGuidwin AE (2016) Impact of concurrent infection by *Pratylenchus penetrans* and *Fusarium verticillioides* on corn seedlings. *Journal of Nematology* 48(4): 366.

Rush TA, Kennedy B, McTaggart A, Heller G, Toome M, Hartman GL, Schneider RW, Aime MC (2012) The extent of the variability of the internal transcribed spacer region within *Phakopsora pachyrhizi*. *Phytopathology* 102:S103.

Warr MR, **Rush TA**, Schneider RW (2012) Genetic relationships among subpopulations of competitive nonpathogenic strains of *Fusarium oxysporum* and *F. oxysporum* f. sp. *lycopersici*. *Phytopathology* 102:S132.

Albu S, **Rush TA**, Aime MC (2012) Description of two anamorphic yeasts in the Ustilaginales. *Inoculum* 63:8.

Rush TA, Schneider RW, Aime MC, Hartman GL, Hambleton S, Ward NB (2011) Assessing the validity of diagnostic quantitative PCR assays for *Phakopsora pachyrhizi* and *P. meibomia*. *Phytopathology* 101:S157.

Rush TA, Aime MC (2011) The genus *Meira*— phylogenetic placement and description of a new species. *Inoculum* 62:39.

Rush TA, Schneider RW, Hartman GL, Hambleton S, Ward NA, Aime MC (2011) Validation of Diagnostic Assays for *Phakopsora pachyrhizi* in the United States. *Inoculum* 62:45.

Rush TA, Aime MC (2010) Placement of the yeast genus *Moniliella* in the Ustilaginomycotina and description of a novel *Moniliella* species. *Inoculum* 61:72.

GRANTS AWARDED (as a first or co-authored):

- 1) Joint Genome Institute Community Science Program (JGI-CSP) 2021 Proposal 507101: Metatranscriptomic study of ectomycorrhizal fungi communities of *Populus* and *Pinus* across a diversity gradient. 2021 to present.
- 2) United Soybean Board: \$90,000 USD. Development of a DNA-Based Detection Protocol for *Phakopsora pachyrhizi*, the Soybean Rust Pathogen, with Enhanced Reliability. Canceled due to Fulbright Scholarship 2012-2013.
- 3) United Soybean Board: \$11,700 USD. Evaluation and Improvement of the DNA-Based Detection System for *Phakopsora pachyrhizi*, the Soybean Rust Pathogen. 2010-2012.
- 4) Louisiana Board of Regions: \$8,000 USD. Does *Phakopsora pachyrhizi* have an alternate host in Taiwan? Summer of 2011.

AWARDS and HONORS:

- 1) The 14th Annual Vanderbilt Postdoctoral Association Symposium — Best Poster 2020
- 2) University of Wisconsin-Madison, Department of Bacteriology, Herman A. Smythe Award for Research Excellence: 2019
- 3) Genetics Society of America: Asperfest — Best Poster 2019
- 4) Genetics Society of America Travel Award: 2019
- 5) Mycological Society of America Travel Grant: 2018
- 6) Walter Stevenson International Travel Award, University of Wisconsin – Madison: 2016
- 7) Borlaug Summer Institute on Global Food Security Award: 2016
- 8) The 17th Biological Graduate Student Congress, Chulalongkorn University, Best Oral Presentation: 2012
- 9) American Phytopathological Society Student Travel Grant: 2011
- 10) Mycological Society of America Travel Grant: 2010
- 11) Mycological Society of America — Best Student Poster Award: 2010
- 12) Dean's List: 2004 and 2007

FELLOWSHIPS and SCHOLARSHIPS:

- 1) Ford Foundation Pre-Doctoral Fellowship: 2015-2018

- 2) Science and Medicine Graduate Research Scholarship, University of Wisconsin - Madison: 2014-2019
- 3) O.N. Allen Scholarship, University of Wisconsin – Madison: 2014
- 4) Fulbright Research Scholarship at Chulalongkorn University in Bangkok, Thailand: 2012-2013
- 5) Louisiana State University - Sigma Xi Grant Assistantship: 2010
- 6) Wiley D. Poole Memorial Scholarship, Department of Biological Engineering, Louisiana State University: 2008.
- 7) Taylor Opportunity Program for Students Scholarship: 2004-2008.

OUTREACH and SERVICE

- 1) **What's eating my plants? 2014 – 2019:** I visit local middle and high schools to encourage students to study science in Madison, WI
- 2) **Darwin Day and Wisconsin Science Festival 2017 – 2019:** I am a volunteer where the aims were to inspire and engage the public in the enterprise of science and discovery.
- 3) **Teaching Assistant for Plant Pathology 123: Plants, People, and Parasites Fall 2015.** I taught two laboratory sessions to 60 students. Also, I helped create exams and graded them.

PRESENTATIONS at CONFERENCES or SEMINARS

- 1) Lipo-chitoooligosaccharides – signals that play a role in fungal behavior. Invited Webinar presented at International Institute of Tropical Agriculture and International Centre of Insect Physiology and Ecology on July 22, 2022, Nairobi, Kenya.
- 2) Understanding the exchangeable chemical signals that influence fungal community organization. Seminar presented at the Plant-Microbe Interfaces group – Oak Ridge National Laboratory on July 14, 2021 in Oak Ridge, TN, virtual seminar.
- 3) Are lipo-chitoooligosaccharides common microbial signals that regulate community organization? Seminar presented at the Microbial Group – Oak Ridge National Laboratory on April 8, 2021 in Oak Ridge, TN, virtual seminar.
- 4) Expanding the roles of Lipo-chitoooligosaccharides (LCOs) – from a unique symbiotic signal to a ubiquitous microbial communication signal. Seminar presented to the Molecular Biosciences Ph.D. program on March 4, 2021 at Middle Tennessee State University, virtual seminar.
- 5) Friend or Foe? Deciphering microbial communications that influences community structure and function. Seminars were presented at the Microbial Group and Plant-Microbe Interfaces Group – Oak Ridge National Laboratory on March 12, 2020, and August 12, 2020 in Oak Ridge, TN, virtual seminar.
- 6) Lipo-chitoooligosaccharides: from specific rhizobial signals to nearly ubiquitous fungal quorum sensing molecule. Exit seminar for Ph.D. defense presented on May 2, 2019, at University of Wisconsin – Madison, WI.
- 7) Exploring rewards and sanctions in the ectomycorrhizal symbiosis. A seminar presented on September 2017 at University of Wisconsin – Madison, WI.
- 8) Interaction between *Fusarium verticillioides*, *Pratylenchus penetrans* and corn. A seminar presented on December 2016 at University of Wisconsin – Madison, WI.

- 9) Systematics of tropical *Aureobasidium pullulans* and its use as a biological control agent. A presentation presented at 5th Annual Mid-Year Enrichment Workshop on March 2013 in Bangkok, Thailand.
- 10) Validation of Diagnostic Assays for *Phakopsora pachyrhizi* in the United States. A presentation presented at the 17th Biological Graduate Student Congress on February 2013 in Bangkok, Thailand.
- 11) Determining the Use of *Aureobasidium pullulans* as a Biological Control Agent on *Burkholderia glumae*. A seminar presented at Chulalongkorn University on November 2012 in Bangkok, Thailand.
- 12) Determining the variation within *Phakopsora pachyrhizi* samples in the southern USA. A presentation presented at the Southern Soybean Disease Workshop on March 2012 in Pensacola, FL.
- 13) Searching for alternative hosts of *Phakopsora pachyrhizi* and validation of diagnostics assays to detect and discriminate among pathogens. A seminar presented at Louisiana State University on December 2011 in Baton Rouge, LA.
- 14) Does Soybean Rust Pathogen (*Phakopsora pachyrhizi*) have an alternate host in Taiwan? An invited presentation given at the National Taiwan University on July 2011 in Taipei, Taiwan.
- 15) Topics on Soybean Rust. An invited roundtable discussion on soybean rust given at National Taichung University on July 2011 in Taichung, Taiwan.
- 16) Does Soybean Rust Pathogen (*Phakopsora pachyrhizi*) have an alternate host in Taiwan? A seminar given at the World Vegetable Center (AVRDC) on June 2011 in Shanhua, Tainan, Taiwan.
- 17) Assessing the Validity of Diagnostic Quantitative PCR Assays for *Phakopsora pachyrhizi* and *P. meibomia*. A presentation presented at the Southern Soybean Disease Workshop on March 2011 in Pensacola, FL.
- 18) The decline of commercial and natural pine populations due to rust diseases. A seminar presented at Louisiana State University on October 2010 in Baton Rouge, LA.
- 19) Design and Fabrication of Device for Measurement of Running Shoe Degeneration. A poster presentation, presented with three other colleagues at Louisiana State University on May 2008 in Baton Rouge, LA.

MEDIA OUTPUT for SCIENTIFIC PROMOTION ARTICLES:

- 1) **Rush, T.A.** and Aiyara, P. 2017. Yeast-like fungus. The Royal Photographic Society – International Images for Science 2017. Pg. 70. **This photo was featured in multiple museums throughout the United Kingdom**
- 2) **Rush, T.A.** 2013. Fulbright to Thailand: Discovering fungi's secrets capabilities in Southeast Asia, featured article on the Fulbright Research Program Website.

UNDERGRADUATE and GRADUATE STUDENTS MENTORED:

- 1) Bethany Kennedy – Louisiana State University: 2010-2012
- 2) Michelle Warr – Louisiana State University: 2010-2012
- 3) Marcus Russell – University of Wisconsin – Madison: 2015
- 4) Ellen Sheehy – University of Washington, St. Louis and University of Wisconsin – Madison: 2017
- 5) Samuel Ahler – University of Wisconsin – Madison: 2017-2018

- 6) Alex Santos Webb – University of Wisconsin – Madison: 2018
- 7) Maggie Spangler – Oak Ridge National Laboratory/University of Tennessee-Knoxville: 2019 to present.
- 8) Cole Sawyer – Oak Ridge National Laboratory/University of Tennessee-Knoxville: 2019 to present.

JOURNAL REVIEWER:

- 1) Chemosphere
- 2) Current Microbiology
- 3) FEMS Microbiology Ecology
- 4) Plant Disease
- 5) Frontiers in Microbiology
- 6) Frontiers in Fungal Biology