BMB 960 Sect 301 "Plant Biotechnology Research Forum"
This is an advanced seminar focusing on reading of the literature and student presentations on topics related to plant biotechnology. Topic areas include the use of systems-level and metagenomic approaches to better understand plant biology, particularly as it relates to the bioprospecting and engineering of plants, cyanobacteria and microalgae for modern problems in human health and environmental sustainability. The course is part of the training program in plant biotechnology 'Plants for Health and Sustainability' (https://plantmetabolism.natsci.msu.edu/), though students not participating in the training program are encouraged to take the course.

Goals for the course include increasing competence in reading scientific literature and oral presentation skills, and to prepare students for engagement in the affiliated Annual Plant Biotechnology Symposium (https://plantmetabolism.natsci.msu.edu/events/symposium/). IMPORTANT: Attendance of the Symposium will be a required portion of the course.

During each class, two students will give presentations based on 2-3 published works. The topics and papers will be selected based upon the topics to be discussed at the research symposium, and thus will vary each year. The course will meet once each week for 6-8 weeks. The actual day/time/location of the course is TBD, based upon availability of the participating students during the first half of Fall Semester. While the instructors will provide the students with suggested topics and papers, students are encouraged to go beyond the suggested publications.

If you are not a declared Biochemistry graduate student, you will need to submit the online override request form (http://bmb.natsci.msu.edu/undergraduate/override-request-form/) and then contact the instructor (Dr. Robert Last - lastr@msu.edu) for permission to enroll. Enrollment will be limited to 15 students.Schedule

The last class meeting will be used for talking about the Annual Symposium on Plant Biotechnology for Health and Sustainability, which will occur during the first half of October. We hope that each student will participate actively in the symposium.

Format: During each class meeting two students will make **30' presentations** each class period, based upon the assigned topics. We suggest that you read the papers that we listed to get you started and please feel free to include other papers and book chapters in your reading and presentation.

The suggested overall format is:
5-10' of introduction, suitable for students familiar with molecular techniques but approachable for students with a variety of backgrounds.
15-20' of discussion of key experiments, making sure to highlight both basic biological insight and applications when appropriate.
5-10' of conclusions including ideas for future experimental and engineering approaches, insights and ideas for your research that the work gave you or anything else that might be of interest to the class members.

Grading will be based upon class participation (30%) and the research presentation (70%).

Course materials will be made available to enrolled students at D2L.msu.edu.

Speaker	Info	Title	References
Dr. Doug Allen	St. Louis, MO Donald Danforth Plant Sciences Center DAllen@danforthcenter.org	Using Isotopic Labeling & Flux Analysis to Understand Plant Metabolism	Ma, F., Jazmin, L. J., Young, J. D., & Allen, D. K. (2014). Isotopically nonstationary 13 C flux analysis of changes in Arabidopsis thaliana leaf metabolism due to high light acclimation. Proceedings of the National Academy of Sciences, 111(47), 16967–16972. doi:10.1073/pnas.1319485111 Allen, D. K. (2016). Quantifying plant phenotypes with isotopic labeling & metabolic flux analysis. Current Opinion in Biotechnology, 37, 45–52. doi:10.1016/j.copbio.2015.10.002 Allen, D. K. (2016). Assessing compartmentalized flux in lipid metabolism with isotopes. Biochimica et Biophysica Acta (BBA) - Molecular and Cell Biology of Lipids, 1861(9), 1226–1242. doi:10.1016/j.bbalip.2016.03.017
Dr. Robin Buell	MSU	Outcomes from the Nati	Executive summary of the report is at: http://www.nap.edu/read/23395/chapter/2#9
Dr. Sean Cutler	UC Riverside sean.cutler@ucr.edu	ABA Receptors and Plant Drought Tolerance	Park, S. ., Fung, P., Nishimura, N., Jensen, D. R., Fujii, H., Zhao, Y., … Cutler, S. R. (2009). Abscisic acid inhibits type 2C protein Phosphatases via the PYR/PYL family of START proteins. Science, 324, . doi:10.1126/science.1173041 Park, S.-Y., Peterson, F. C., Mosquna, A., Yao, J., Volkman, B. F., & Cutler, S. R. (2015). Agrochemical control of plant water use using engineered abscisic acid receptors. Nature, 520(7548), 545–548. doi:10.1038/nature14123 Okamoto, M., Peterson, F. C., Defries, A., Park, S. ., Endo, A., Nambara, E., … Cutler, S. R. (2013). Activation of dimeric ABA receptors elicits guard cell closure, ABA-regulated gene expression, and drought tolerance. Proceedings of the National Academy of Sciences, 110(29), 12132–12137. doi:10.1073/pnas.1305919110
Dr. Maren Friesen	MSU	A tangled (root) bank: Interplay between plant-plant interactions, plant-microbe, and microbe-microbe interactions	http://www.annualreviews.org.proxy1.cl.msu.edu/doi/full/10.1146/annurev-ecolsys-102710-145039 http://onlinelibrary.wiley.com.proxy1.cl.msu.edu/doi/10.1111/nph.12173/full http://www-ncbi-nlm-nih-gov.proxy1.cl.msu.edu/pmc/articles/PMC3525954/
Dr. Ulrich Mueller	Department of Plant Biology University of Texas at Austin umueller@austin.utexas.edu	Optimization of Artificial Selection on Rhizosphere Microbiomes of Plants; Applications for Greenhouse and Subsistence Farming	Engineering Microbes to Improve Plant Growth Mueller & Sachs, Trends Microbio, 2015
Dr. John Ohlrogge	MSU ohlrogge@cns.msu.edu	How did nature engineer the highest surface lipid accumulation among plants? Repurposing the cutin pathway for triacylglycerol synthesis.	Simpson J, Ohlrogge J (2016) A Novel Pathway for Triacylglycerol Biosynthesis is Responsible for the Accumulation of Massive Quantities of Glycerolipids in the Surface Wax of Bayberry (Myrica pensylvanica) Fruit. The Plant Cell TPC2015-00900 (DOI:10.1105/tpc.15.00900) Simpson J, Thrower N, Ohlrogge J (2016) How did nature engineer the highest surface lipid accumulation among plants? Exceptional expression of acyl-lipid associated genes for the assembly of extracellular triacylglycerol by Bayberry (Myrica pensylvanica) fruits. BBA - Molecular and Cell Biology of Lipids (DOI: 10.1016/j.bbalip.2016.01.022)
Dr. Brian Pfleger	Department of Chemical Engineering University of Wisconsin pfleger@engr.wisc.edu	Constructing Synthetic Biology Toolboxes for Non-model Organisms	http://www.ncbi.nlm.nih.gov/pubmed/25216157 http://www.ncbi.nlm.nih.gov/pubmed/26854666 http://www.ncbi.nlm.nih.gov/pubmed/24632195
Dr. Ryan Philippe	Director, Research and Development ManusBio, Cambridge MA rphilippe@manusbio.com	Engineering a plant biosynthetic pathway for sustainable production of a natural sweetener	(1) Philippe, R. N., De Mey, M., Anderson, J., & Ajikumar, P. K. (2014). Biotechnological production of natural zero-calorie sweeteners. Current Opinion in Biotechnology, 26, 155–161. http://doi.org/10.1016/j.copbio.2014.01.004 (2) Biggs, B. W., De Paepe, B., Santos, C. N. S., De Mey, M., & Kumaran Ajikumar, P. (2014). Multivariate modular metabolic engineering for pathway and strain optimization. Current Opinion in Biotechnology, 29, 156–162. http://doi.org/10.1016/j.copbio.2014.05.005
Dr. Philip Poole	Department of Plant Sciences University of Oxford, UK philip.poole@plants.ox.ac.uk	Microbial Colonisation of the Rhizosphere	-Geddes, B. A., Ryu, M-H., Mus, F., Garcia Costas, A.Peters, J.W., Voigt, C. A., Poole, P. (2015). Use of plant colonizing bacteria as chassis for transfer of N2-fixation to cereals. Current Opinions in Biotechnology 32:216-222. -Tkacz A, Cheema J, Chandra G, Grant A, & Poole PS (2015) Stability and succession of the rhizosphere microbiota depends upon plant type and soil composition. ISME J. 9: 2349-2359 Turner, T. R., Karunakaran , R, Walshaw, J., Heavens, D., Alston, M., Swarbreck,D., Osbourn, A., Grant,A., and Poole, P.S. (2013) Comparative metatranscriptomics reveals kingdom level changes in the rhizosphere microbiome of plants. ISME J., 7, 2248–2258 Ramachandran, V., A. K. East , R. Karunakaran, J. A. Downie & P. S. Poole, (2011) Adaptation of Rhizobium leguminosarum to pea, alfalfa and sugar beet rhizospheres investigated by comparative transcriptomics. Genome Biol. 12:R106
Dr. Ashley Shade	MSU shade.ashley@gmail.com	Plant-microbiome interactions and synthetic microbial communities in biotechnology	Großkopf, T., & Soyer, O. S. (2014). Synthetic microbial communities. Current Opinion in Microbiology, 18, 72–77. doi:10.1016/j.mib.2014.02.002 Lebeis, S. L. (2014). The potential for give and take in plant-microbiome relationships. Frontiers in Plant Science, 5, . doi:10.3389/fpls.2014.00287
Dr. Ailing Zhou	Syngenta Crop Protec Research Triangle Park, NC ailing.zhou@sygenta.com	From university to industry: Navigating the agricultural biotechnology workplace	Nuccio, M. et al. (2015) Expression of trehalose-6-phosphate phosphatase in maize ears improves yield in well-watered and drought conditions. Nature Biotechnology 33, 862–869 Nuccio, M., Xi, C., Conville J., Zhou A. and Liu, X. (2015) Plant Trait Gene Expression Cassette Design. Recent Advancements in Gene Expression and Enabling Technologies in Crop Plants 41-77, New York, NY: Springer Kramer C. et al. (2016) Evolution of risk assessment strategies for food and feed uses of stacked GM events. Plant Biotechnology Journal 1–15