BPSC 193 Senior Seminar in Plant Biology

Winter 2018 Syllabus

Time: 6:10 – 8:00 PM Thursdays
Room: Batchelor Hall 2158

Instructors:
Dr. Timothy Close, Batchelor Hall 4157, timothy.close@ucr.edu
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Office hours TBA

Course description: This course is designed to be a capstone for undergraduates in the Plant Biology major. The course will emphasize thinking across hierarchical levels and understanding plant structure-function relationships by synthesizing material from courses students have taken at all scales. There will be lectures by faculty on such topics as structural, physiological, and developmental adaptions to stress; scaling, and impacts of changes at the genetic level on ecosystems, and vice versa; and effects of global change that feed back to the species and genetic level. Students will be required to do readings from the literature that relate to the lectures, to present oral critical analyses of these readings, and to participate in discussions. An essay exam will be given at the end of the course. Letter Grade only.

Course requirements:

- Attend weekly lecture (1 hr) and participate in discussion based on assigned readings (20% of grade).
- Prepare two oral presentations based on articles associated with weekly topics from the syllabus. The student will lead the discussion by presenting oral critical analyzes of selected articles. Other class members will participate in discussion based on their readings of those articles (50%).
- Take a 2-hr written essay comprehensive exam that will cover topics from readings, lectures and discussions. The exam will require thinking across scales rather than memorization (30%).

Academic Integrity:

- It is the policy of UCR and this class that every student must take responsibility for his/her own learning, represent him/herself truthfully, claim only work that is his/her own, acknowledge the use of others' words and ideas, and engage honestly in all academic assignments. Thank you for adhering to this policy!

BPSC 193 Schedule

Class will meet weekly during a two hour time period. During the first hour a lecture will be given by a faculty member. During the second hour students will summarize readings for that session, followed by group discussion.

Date	*Topic*	*Readings Articles*
Jan 11 (Nabity)	Drivers of evolution: Structure-function changes enabling adaptation to the terrestrial environment	Chp 1, Bernacchi & VanLoocke 2015
Jan 18 (Nabity)	Photosynthesis: molecular and structural aspects	Chp 4 (4.1-4.3)
Jan 25 (Nabity)	Plant adaptation: Impacts of changes at the species level	Chp 7 (7.2-7.4) + Blois et al. 2013
Feb 1 (Nabity)	Plant adaptation: Impacts of changes at the population and community level	Chp 8 (8.1-8.2) + Corlett & Westcott 2013
Feb 8 (Nabity)	Co-evolution and adaptation in interactions, from genes to ecosystems	Chp 8 (8.4-8.5 + Parmesan & Hanley 2015
Feb 15 (Close)	Evolution and adaptation in reproductive strategies: molecular and structural aspects	Chp 5, 6 (5.5, 5.6, 6.4) + articles
Feb 22 (Close)	Domestication from genetic variation to global agriculture	Chp 9 + articles
Mar 1 (Close)	Biotechnology: accelerating the process of domestication	Chp 9 + articles
Mar 8 (Close)	Genomics of local adaptation	Articles
Mar 15 (Close)	Germplasm: seeds for the future	Articles
Saturday, Mar 17	**FINAL EXAM** Saturday, March 17, 11:30 AM - 2:30 PM	

BPSC 193 Readings

Instructor-led readings: We will use select readings from Smith et al. Plant Biology 2010. Garland Publishing ISBN 978-0-8153-4025-6 (available on reserve in the Science Library or you can purchase a copy).

Other readings related to lectures are from journal articles and available on iLearn:

- Bernacchi C, VanLoocke A. 2015. Terrestrial ecosystems in a changing environment: a dominant role for water. Annu Rev Plant Biol 66:599-622.
- Blois J, Zarnetske PL, Fitzpatrick MC, Finnegan S. 2013. Climate change and the past, present, and future of biotic interactions. Science 341:499-504
- Corlett RT, Westcott DA. 2013. Will plant movements keep up with climate change? TREE 8:482-488
- Parmesan C, Hanley ME. 2015. Plants and climate change: complexities and surprises. Annals of Botany 116:849-864.

Student-led readings: Two Student Presenters each week will choose from the listed articles
Week 2: photosynthesis

- Busch FA, Sage RF, Farquhar GD. 2017. Plants increase CO2 uptake by assimilating nitrogen via the photorespiratory pathway. Nature Plants 4:46-54
- Karki, S., Rizal, G. and Quick, W.P. 2013. Improvement of photosynthesis in rice (Oryza sativa L.) by inserting the C4 pathway. Rice 6: 28.

Week 3: acclimation vs adaptation

- Cai C, et al. 2017. Do all leaf photosynthesis parameters of rice acclimate to elevated CO_2, elevated temperature, and their combination, in FACE environments? Global Change Biology DOI: 10.1111/gcb.13961
- Watson-Lazowski A, et al. 2016. Plant adaptation or acclimation to rising CO2? Insight from first multigenerational RNA-seq transcriptome. Global Change Biology 22;3760-3773.

Week 4 phenology and range expansion

- Liancourt, P., L. A. Spence, D. S. Song, A. Lkhagva, A. Sharkhuu, et al. 2013. Plant response to climate change varies with topography, interactions with neighbors, and ecotype. Ecology 94:444-453.
- Lustenhouwer N et al. 2017. Rapid evolution of phenology during range expansion with recent climate change. Global Change Biology DOI:10.1111/gcb.13947

Week 5: interactions

- Burkle, L.A., J.C. Marlin and T.M. Knight. 2013. Plant-pollinator interactions over 120 years: loss of species, co-occurrence and function. Science 339:1611-1615
- Ylanne H, Stark S, Tolvanen A. 2015. Vegetation shift from deciduous to evergreen dwarf shrubs in response to selective herbivory offsets carbon losses: evidence from 19 years of warming and simulated herbivory in the subarctic tundra. Global Change Biology
- Spasojevic MJ, Harrison S, Day HW, Southard RJ. 2014. Above- and belowground biotic interactions facilitate relocation of plants into cooler environments. Ecology Letters 17;700-709.

Week 6: reproduction

- Bowman JL, Smyth DR, and Meyerowitz EM. 1991. Genetic interactions among floral homeotic genes of *Arabidopsis.* Development 112: 1-20
- Bowman JL, Smyth DR, and Meyerowitz EM. 2012. The ABC model of flower development: then and now. Development 139: 4095-4098

Week 7: domestication

- Butelli, E et al. 2012. Retrotransposons control fruit-specific, cold-dependent accumulation of anthocyanins in blood oranges. The Plant Cell 24: 1242–1255.
- Simons KJ, Fellers JP, Trick HN, Zhang Z, Tai Y-S, Gill BS, Faris JD. 2006. Molecular characterization of the major wheat domestication gene Q. Genetics 172:547-555.

Week 8: biotechnology

- Koehorst-van Putten HJ, et al. 2012. Field testing and exploitation of genetically modified cassava with low-amylose-free startch in Indonesia. Transgenic Research 21:39-50.
- Kanchiswamy CN, Malnoy M, Velasco R, Kim J-S and Viola R. 2015. Non-GMO genetically edited crop plants. Trends in Biotechnology 33: 489-491.
- Ozuna CV, Barro F. 2017. Safety evaluation of transgenic low-gliadin wheat in Sprague Dawley rats: An alternative to the gluten free diet with no subchronic adverse effects. Food and Chemical Toxicology 107: 176-185.

Week 9: local adaptation

- Pais et al. 2017. Ecological genomics of local adaptation in Cornus florida L. by genotyping by sequencing. Ecology and Evolution 7: 441-465.
- Turner et al. 2005. The pseudo-response regulator Ppd-H1 provides adaptation to photoperiod in barley. Science 310: 1031-1034.

Week 10: germplasm

- Christine H. Foyer, Hon-Ming Lam, Henry T. Nguyen, Kadambot H. M. Siddique, Rajeev K. Varshney, Timothy D. Colmer, Wallace Cowling, Helen Bramley, Trevor A. Mori, Jonathan M. Hodgson, James W. Cooper, Anthony J. Miller, Karl Kunert, Juan Vorster, Christopher Cullis, Jocelyn A. Ozga, Mark L. Wahlqvist, Yan Liang, Huixia Shou, Kai Shi, Jingquan Yu, Nandor Fodor, Brent N. Kaiser, Fuk-Ling Wong, Babu Valliyodan, Michael J. Considine. 2016. Neglecting legumes has compromised human health and sustainable food production. Nature Plants 2, Article number 16112.
- Nora P. Castañeda-Álvarez, Colin K. Khoury, Harold A. Achicanoy, Vivian Bernau, Hannes Dempewolf, Ruth J. Eastwood, Luigi Guarino, Ruth H. Harker, Andy Jarvis, Nigel Maxted, Jonas V.Müller, Julian Ramirez-Villegas, Chrystian C. Sosa, Paul C. Struik, Holly Vincent, Jane Toll. 2016. Global conservation priorities for crop wild relatives. Nature Plants 2, Article number 16022.

Week 11 written exam (reading for exam)