Plant Growth and Development
BOT 6566

Instructor: Dr. Bernard Hauser **Email:** bahauser@botany.ufl.edu **Phone:** 352-392-0009
Office Hours: Monday 1 pm in 516A Bartram Hall or by zoom

Lectures: 2 lectures per week online and asynchronous.
Literature Discussion: 1 hour per week (online with a synchronous time to be arranged)

Course Description: Plant development is a challenging and stimulating course that covers the mechanisms for the control of plant growth and key developmental innovations permitting plants to flourish in their native environments. Key developmental innovations that individual organisms and tissues reveal will be explored from the literature. The topics and classic papers to be covered in this course are listed below.

Grading:	**Points**
Exam I	100 (33%)
Exam II	100 (33%)
Literature discussion	50 (16.5%)
Literature critique and talk	50 (16.5%)
Total	300

First exam – (100 points) will be online (120 minutes) on October 22-23.
Second Exam (100 points)
Take home exam will be distributed December 7.
Answers due December 12.

Literature Discussion (5 pts per paper, up to 50 points)
Literature discussion will usually occur on Fridays. Each paper will be accompanied by questions to be answered about each article that is discussed. More than 10 papers will be discussed during the semester, but these points are capped at 50.

Literature Critique and a Short Talk (critique = 35 points, talk = 15 points)
Topics Assigned and Dates Chosen September 5.
Papers due in class by Monday, October 29.
Dates of the Oral Presentations will be assigned by the instructor.

Literature Critique
Choose one to three key research articles in the area you were assigned. The chosen papers should be classic papers—they do not need to be recent publication, but they should have altered the way this research area was viewed. Your critique on the assigned subject in plant development should:

1. briefly introduce the topic,
2. explain the key findings and assertions the authors of the chosen paper make,
3. determine whether the authors satisfactorily substantiate their conclusions,
4. identify defects in the paper (every paper has something wrong with it), and
5. explain what is (was) the next step.

If more that one paper is chosen please relate the findings of each of the papers. Grading the paper and will be primarily based on the substance of the paper, but points will also be given for style and grammar. The text of the paper should be 5-7 pages long (double spaced).

Classroom Presentation

The talk should provide background for this area of research and review the highlights of the papers (10-15 minutes). Plan on using Powerpoint to present this information. You may want to include handouts with references and figures. Also provide students with at least two review questions so they can be sure they learned the material.

Optional Text: Leyser, O. and Day, S. *Mechanisms in Plant Development*

References: Davies, P.J. *Plant Hormones & Their Role in Plant Growth & Development*.
Esau, K. *Anatomy of Seed Plants*.
Stephen Howell *Molecular genetics of plant development*
Sinnott, E. W. *Plant Morphogenesis*.
Srivastava, L., *Plant Growth & Development*
Steeves, T.A., Sussex, I. M. *Pattern in Plant Development*.

University Support Services

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Resources are available on campus to help students meet academic goals and solve personal problems, which interfere with their academic performance. Resources include:

1. UF Counseling and Wellness Center, 3190 Radio Road, 352 392-1575, personal and career counseling.
2. Student Mental Health, Student Health Care Center, 392-1171.
3. Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling. https://www.crc.ufl.edu/

Disability Notice: Students with disabilities enrolled in this course and who may need disability-related classroom accommodations are encouraged to make an appointment to see me before the end of the second week of the term. All discussions will remain confidential, although the Student Accessibility Services office may be consulted to discuss appropriate implementation of any accommodation requested.

Plant Growth & Development

Classroom Topics
Introduction and Concepts – plants vs. animals, terms
Concepts – fields, compartments, patterns, gradients
Chemical basis of morphogenesis
Discussion--Morphogenesis of cells
Cell wall and cytoskeleton
Meristems
Modeling plant growth
Hormones and auxin
Leaf Meristems
Clonal analyses of growth and meristems
Shoots – plastochrons, phyllotaxy
Shoots – apical dissection
Roots – growth and development
Roots – meristems
Regulation of polarity in *Fucus* and zygotes
Leaf polarity – differentiation and morphogenesis
Embryo patterning
Gibberellin
ABA
Ethylene
Cytokinin
Plant photoreceptors
Senescence
Stomatal patterning
A model for local control of global phenomena
Development of multicellularity—evolution of multicellular organisms
Colony vs multicellular organisms: volvox and *Dictyostelium*
Development in coenocytic organisms and parallels for endosperm
Floral meristem induction and initiation spacing
Cell/cell interactions – plasmodesmata and the super-cellular plant
Specialization of cells: Anabaena heterocysts
Volvox gonidia and inversion
Regulation of development by methylation
Regulation of development by RNAi
Parent of origin effects on seed development
Chromatin changes regulating aging and development

Potential Discussion papers:

Beerling, D. J., Osborne, C. P. and Chaloner, W. G. (2001). Evolution of leaf-form in land plants linked to atmospheric CO2 decline in the Late Palaeozoic era. *Nature* **410**, 352-354.

Boualem, A., Fergany, M., Fernandez, R., Troadec, C., Martin, A., Morin, H., Sari, M. A., Collin, F., Flowers, J. M., Pitrat, M. et al. (2008). A conserved mutation in an ethylene biosynthesis enzyme leads to andromonoecy in melons. *Science* **321**, 836-8.

Cleary, A. L. and Smith, L. G. (1998). The Tangled1 gene is required for spatial control of cytoskeletal arrays associated with cell division during maize leaf development. *Plant Cell* **10**, 1875-1888.

Foard, D. E., Haber, A. H. and Fishman, T. N. (1965). Initiation of lateral root primordia without completion of mitosis and without cytokinesis in uniseriate pericycle. *American Journal of Botany* **52**, 580-.

Friedman, W. E. (1995). Organismal duplication, inclusive fitness theory, and altruism: understanding the evolution of endosperm and the angiosperm reproductive syndrome. *Proc Natl Acad Sci U S A* **92**, 3913-7.

Haig, D. (2000). The kinship theory of genomic imprinting. *Annual Review of Ecology and Systematics* **31**, 9-32.

Hernandez, M. L., Passas, H. J. and Smith, L. G. (1999). Clonal analysis of epidermal patterning during maize leaf development. *Developmental Biology* **216**, 646-658.

Lenhard, M., Bohnert, A., Jurgens, G. and Laux, T. (2001). Termination of stem cell maintenance in *Arabidopsis* floral meristems by interactions between *WUSCHEL* and *AGAMOUS*. *Cell* **105**, 805–814.

Lohmann, J. U., Hong, R. L., Hobe, M., Busch, M. A., Parcy, F., Simon, R. and Weigel, D. (2001). A molecular link between stem cell regulation and floral patterning in *Arabidopsis*. *Cell* **105**, 793–803.

Nemhauser, J. L., Hong, F. and Chory, J. (2006). Different plant hormones regulate similar processes through largely nonoverlapping transcriptional responses. *Cell* **126**, 467-75.

Nowack, M. K., Shirzadi, R., Dissmeyer, N., Dolf, A., Endl, E., Grini, P. E. and Schnittger, A. (2007). Bypassing genomic imprinting allows seed development. *Nature* **447**, 312-5.

Poethig, R. S. (1987). Clonal analysis of cell lineage patterns in plant development. *Amer. J. Bot.* **74**, 581-594.

Poethig, R. S., Coe, E. H. J. and Johri, M. M. (1986). Cell lineage patterns in maize embryogenesis: a clonal analysis. *Develop. Biol.* **117**, 392-404.

Reinhardt, D., Mandel, T. and Kuhlemeier, C. (2000). Auxin regulates the initiation and radial position of plant lateral organs. *Plant Cell* **12**, 507-518.

Reinhardt, D., Pesce, E. R., Stieger, P., Mandel, T., Baltensperger, K., Bennett, M., Traas, J., Friml, J. and Kuhlemeier, C. (2003). Regulation of phyllotaxis by polar auxin transport. *Nature* **426**, 255-260.

Smith, L. G., Hake, S. and Sylvester, A. W. (1996). The *tangled-1* mutation alters cell division orientations throughout maize leaf development without altering leaf shape. *Development* **122**, 481-489.

Turing, A. M. (1952). The chemical basis of morphogenesis. *Phil. Trans. R. Soc. Lond. B.* **237**, 37-72.

van den Berg, C., Willemsen, V., Hage, W., Weisbeek, P. and Scheres, B. (1995). Cell fate in the *Arabidopsis* root meristem determined by directional signalling. *Nature* **378**, 62-65.

van den Berg, C., Willemsen, V., Hendriks, G., Weisbeek, P. and Scheres, B. (1997). Short-range control of cell differentiation in the Arabidopsis root meristem. *Nature* **390**, 287-289.