Plant Developmental Genetics

TuTh 2:30-4:00, LS202, 3 credits
Prerequisite: Fundamentals of Biology II: Genetics (Biol 2970) or permission of the instructors

Instructors:
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Course description

This course will introduce advanced biology students to fundamental research concerning plant developmental genetics, modern genetic analysis and model experimental organisms. The latter include higher plants, simple photosynthetic eukaryotes and photosynthetic prokaryotes.

A basic knowledge of plant development is essential for students to understand how genetic and molecular investigations of plant form and function are conducted. Detailed studies of gene regulation, cell structure, biochemistry and physiology, which often focus on individual cell types, tissues or organs can best be kept in proper context if one also has a sound understanding of the whole organism. Production of transgenic plants, the basis for the plant biotechnology industry, is also a practical outcome of understanding and manipulating plant development. Thus the initial portion of the course is designed to provide students with enough background in plant development to understand and better explore the wealth of modern research in these areas.

Development is the visible elaboration of genetic plans encoded in DNA. The second portion of the course focuses on the methods used to identify and understand gene functions using classical and molecular genetic analyses. The availability of chromosomal DNA sequence data from genome sequencing projects and availability of mutations in essentially every gene is revolutionizing both basic and applied plant science. Understanding and making use of such genetic and genomic resources is also discussed in this section of the course.

Grading

There will be two exams, each worth 35% of the final grade. The remaining 30% of the grade will be based on homework assignments (20%) and a short (15-20 minute) oral presentation discussing a model system or experimental topic of the student's choosing (10%). There will be no final exam.

If you are ill and need to miss an exam you will need a note from the student health center stating that you were too ill to take the test. No make-up exams will be given. Homework assignments turned in late (after 5 P.M. on the due date) will be penalized 20% per day (i.e. the maximum score for an assignment that is up to one day late will be 80%).

Reading

There is no textbook for this course. Reading assignments will be handed out in class. The following textbooks may serve as useful background reading:
Plant Physiology, by Taiz and Zeiger. Botany, by Moore, Clark and Stern. Genetic Analysis, by Griffiths, Miller, Suzuki, Lewontin, and Gelbart. Molecular Cell Biology, by Lodish, Baltimore, Berk, Zipursky, Matsudaira, Darnell. Molecular Genetics of Plant Development, by Howell.

SYLLABUS

I. Development (Running/Pikaard)

1. Th 8/31 No class

2. Tu 9/5 Course overview; Plant life cycle, gametogenesis, pollen tube growth and guidance, double fertilization (Pikaard)

3 Th 9/7 Embryogenenesis, establishment of meristems (Pikaard)

4. Tu 9/12 Mutations affecting pattern formation (Pikaard)

5. Th 9/14 Post-embryonic pattern formation; cell lineages, cell fate (Pikaard)

6. Tu 9/19 Pattern formation cont'd: clonal analysis, lack of a germline (Pikaard)

7. Th 9/21 Photomorphogenesis (Pikaard)

8. Tu 9/26 Meristem establishment and maintenance (Running)

9. Th 9/28 Phase change (juvenile to adult) and changes in meristem identity (Running)

10.Tu 10/3 Flower development: organ identity (Running)

11. Th 10/5 Flower development: patterning (Running)

12. Tu 10/10 Leaf development (Running)

13. Th 10/12 Root development (Running)

14.Tu 10/17 **First mid-term exam**

II. Genetic analysis (Richards/Pikaard)

15. Th 10/19 Review of Mendelian genetics- nomenclature & crosses; forward & reverse genetics; Genetic maps and markers

16. Tu 10/24 Synteny, genome evolution, and genetic redundancy

17. Th 10/26 The impact of plant development on plant genetics; Plant genetic model systems

18. Tu 10/31 Forward genetics entrée: Mutagenesis- chemical, physical and T-DNA

19. Th 11/2 Transposon mutagenesis

20. Tu 11/7 Analyzing mutations: mapping, complementation, etc.

21. Th 11/9 Epistasis analysis, genetic analysis of pathways

22. Tu 11/14 Suppressor/enhancer screens

23. Th 11/16 Natural variation & Map-based gene isolation

24. Tu 11/21 Reverse genetics, T-DNA insertion mutants, "gene machines", gene silencing

25. Th 11/23 Thanksgiving holiday

26. Tu 11/28 Epigenetic phenomena-transcriptional and post-transcriptional silencing (Pikaard)

27. Th 11/30 Epigenetic mechanisms in development (Pikaard)

28. Tu 12/5 **second mid-term exam**

29. Th 12/7 Student presentations

30. Tu 12/12 Student presentations

31. Th 12/14 Student presentations