UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DISCIPLINE/DEPARTMENT: Biology **IMPLEMENTATION DATE:** Jan. 1994

Revised:

Biology 304	Anatomy and Physiology of Plants II	4
SUBJECT/NUMBER OF COURSE	**DESCRIPTIVE TITLE**	**UCFV CREDITS**

CALENDAR DESCRIPTION: This course looks at changes in anatomy and function during the plant life cycle. In lecture and laboratory, we will look at how plants perceive the environment. We will follow how they respond anatomically and physiologically to environmental signals and stresses.

RATIONALE:

COURSE PREREQUISITES: BIO 303

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	**Lecture**	**60**	**hrs**	**Student Directed Learning**	**hrs**
	Laboratory	**45**	**hrs**	**Other - specify:**	
	Seminar		**hrs**		
	Field Experience		**hrs**		
				TOTAL	**105 HRS**

MAXIMUM ENROLMENT: 24

Is transfer credit requested? **9** **Yes** **:** **No**

AUTHORIZATION SIGNATURES:

Course Designer(s): Edith Camm, Ph.D.

Chairperson: Curriculum Committee

Department Head: Ernest Kroeker, Ph.D.

Dean: K. Wayne Welsh

PAC: Approval in Principle _____ **(Date)**

PAC: Final Approval: January 1, 1994 **(Date)**

OUTLN95/01/dd

Biology 304
NAME & NUMBER OF COURSE

SYNONYMOUS COURSES:

(a) replaces N/A
(course #)

(b) cannot take N/A for further credit
(course #)

SUPPLIES/MATERIALS:

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

Plant Physiology 4th edition. Salisbury, F. and Ross, C. Wadsworth Publishing.

OBJECTIVES:

At the end of this course, students will be able to:

1. Show the effects on plant growth and development of growth regulators and environmental factors (in particular, light).
2. Trace known steps in the signal transduction pathways between environmental signals and the ultimate response by the plant.

METHODS:

Lecture, demonstration, discussion, audio-visual presentation, and laboratory exercises.

STUDENT EVALUATION PROCEDURE:

Midterm exam	20%
Lab assignments	40%
Final exam	40%

Biology 304

NAME & NUMBER OF COURSE

COURSE CONTENT

Part I: Cell Growth, Division, Differentiation

1. Introduction to plant development: Tool Set: Methods of studying gene expression relevant for plant physiologists (Chapter 24)
2. Patterns of growth and development. Measuring growth; cell enlargement (Chapter 16).
3. Cell wall synthesis and breakdown, cell wall proteins, and the role in cell enlargement.
4. Cell division cell cycle (Chapter 16).
5. Determinate and Indeterminate growth; Meristems (Chapter 16).
6. Mechanisms controlling gene expression which result in differentiation; Signal Transduction Pathways.

Part II: Growth Regulators in Plant Development with Emphasis on Signal Transduction Pathways

7. Auxins: History, Biosynthesis, Transport (Chapter 17)
8. Auxins and Cell Enlargement. Auxin receptors (Chapter 17)
9. Gibberellins: History, Biosynthesis, Transport (Chapter 17)
10. Gibberellins and Gene Action (Chapter 17)
11. Cytokinins; History, Biosynthesis, Transport (Chapter 18)
12. Cytokinins and Cell Division (Chapter 18)
13. Abscisic acid; History, Biosynthesis, Transport (Chapter 18)
14. Abscisic acid; gene-regulated and non-gene regulated effects.
15. Ethylene; History, Biosynthesis, Transport, interaction with IAA (Chapter 18)
16. Jasmonic acid as an example of other regulatory compounds (Chapter 18.3-.4)

Part III: How Does Light Act as a Signal to Regulate Plant Development?

17. Phytochrome: Discovery and properties of the molecule. Effect on the whole plant (Chapter 20).
18. Phytochrome: Recent work effect at the cellular level. An example of a signal transduction pathway (Chapter 20).
19. Photoperiodism and flowering. Includes a discussion of transformation of the vegetative axis into the floral axis.
20. The evidence for the role of phytochrome in photoperiodism (Chapter 23).
21. Recent work on phytochrome and blue light receptors.

Part IV: Interaction of Endogenous and Environmental Factors on Plant Development and Physiology

22. Movement in plants, including gravitropism (Chapter 19).
23. Temperature effects in growth and development (Chapter 22).
24. A two-lecture block on the seed: fertilization, development, maturation, germination and dormancy (Chapter 22; also Bewley and Black). Includes a tie-in to the role of plant hormones.
25. Above continued.
26. Plant senescence. Triggers and process. Includes a tie-in to the role of plant hormones.
27. A three-lecture block on stress. Includes recent work on stress-induced genes. Water stress: Mechanisms and regulation of water stress resistance.

COURSE CONTENT (cont'd.)

Part IV (cont'd)

28. Stress: Physiological changes during tissue freezing. Mechanisms and control of frost injury.
29. Stress: Physiological of chilling and high temperature stresses.
30. Review session.

LABORATORY EXPERIMENTS

Students have the option of designing their own experiment for all or part of the term.

1. **Tobacco Tissue Culture: Transformation, Plant Growth Regulators and Developmental Response** (Requires observations every week.) Students transform tobaco leaf discs with Agrobacterium rhizogenes and examine the effect of different concentrations of growth regulators on transformed and native tissue.

2. **Auxin and Root Initiation** (Requires observations every week.) Using bean cuttings, students observe the different effects of auxin on root number and root elongation. Includes anatomical observations.

3. **Gibberellin and %-amylase induction in barley seeds.** The growth regulator gibberellin acts as an enzyme inducer in barley seeds.

4. **Light Quality and Germination of lettuce seedlings.** Students are introduced to the phytochrome system by manipulating germination of light-sensitive lettuce seeds.

5. **Acid Efflux patterns during tropistic curvatures in sunflower and corn seeds.**

6. The effect of cytokinins on leaf senescence. Students choose a plant system in which to examine retardation of senescence by application of different amounts of cytokinins.

7. **Gene Induction during Development.** Students look at plant development in two systems: the germination of bean seeds, and the adjustment to osmotic stress in onion cells. In both cases, they will examine protein profiles by SDS-Page. The development of various enzymes associated with germination will be examined on tissue prints of nitrocellulose. Students will look for the presence of adaptation-related plant proteins cross reacting with antibodies to animal fibronectin on both tissue prints and in western blots. The use of tissue prints will permit tissue - specific localization of gene expression.