

Integrative Biology 51 – Origins and Evolution of Food Plants

Instructor: Eric Harris

Description: The course will review major groups of food plants from an evolutionary and historical perspective, by examining the origins from wild relatives to current distribution and varieties today. Examples will be reviewed from a diversity of crops from around the world, such as grains, pulses, vegetables, fruits, nuts and others (e.g., caffeine-producing plants). General concepts covered will include plant morphology, evolutionary processes (domestication, hybridization, polyploidy, diversification) and relevant ecology (e.g., pollination biology, pest and pest control). Focus will include California agriculture and crops as illustrated through field trips.

Instructional Format:

- **Lecture:**
 - 2 hours per week (2 x 1 hrs/lecture) if offered during fall or spring sessions
 - 4 hrs per week if offered during 8-week summer session
- **Field Trips:**
 - Field trips are mandatory. Alternative approach/assignments to be incorporated if instruction is online. Field trips will include:
 - One trip to the UC Botanical Garden to review food plants and their relatives.
 - Two field trips to review food crops in California, including examples from the Central Valley (e.g., almonds, walnuts, cherries, tomatoes) and Salinas Valley (e.g., strawberries, lettuce, broccoli).
- **Onsite/Virtual:**
 - The syllabus is designed with assumption that instruction will be done in-person. However, the topics could be adapted to a virtual format if needed (e.g., due to status of COVID-19). A hybrid option could also be explored that allows students to attend in-person and also have students attend remotely.

Grade:

- Online quizzes (x 5) – 20%
- Field trip assignments (x 3) – 15%
- Term paper – 15%
- Midterm – 25%
- Final exam – 25%

Readings: A reader will be developed for the course. Readings will be selected from a variety of sources, including examples from the popular literature (e.g., Diamond, 1999; Pollan, 2002), as well as the scientific literature. Assigned readings will be selected for lower-division undergraduate level, though lectures may also draw from additional sources or more advanced reading level (e.g., lectures may incorporate the approach provided in Hancock's text, *Plant Evolution and the Origin of Crop Species*, which is more appropriate for upper-division level). The core of the class will be reviewing food plant diversity according to plant families, and references/reading for that part of the course will also be supported by descriptions and vignettes for particular species (e.g., from Smartt & Simmonds *Evolution of Crop Plants*; Van Wyk's *Food Plants of the World*, etc.).

Learning Objectives: By the end of the course, students will have the ability to:

- understand evolutionary processes responsible for food plant diversity
- recognize the common and scientific names for common food plant species
- identify evolutionary relatives and geographic origins of food plant species
- describe parts of food plants using botanical terminology
- understand crop needs (e.g., pollination, pest control) from an ecological and evolutionary perspective
- recognize main California crops and understand their cropping systems

Syllabus:

Lecture	Course Section	Topic
1	Intro & General Concepts	Introduction to Food Plants
2		What is a Plant? I: Evolution and Diversity
3		What is a Plant? II: Morphology
4		What is a Plant? III: Names & Classification
5		Evolutionary Process I: Variation and Inheritance
6		Evolutionary Process II: Natural and Artificial Selection
7		Origins of Agriculture
8		Plant Domestication
9	Food Plant Origins and Diversity	Cereals (Poaceae)
10		Evolutionary Process III: Genetics of Domestication
11		Legumes (Fabaceae)
12		Fruits, Nuts and Berries: The Rose Family (Rosaceae)
13		The Carrot and Parsley Family (Apiaceae)
14		Variations on a Theme: The Mustard Family (Brassicaceae)
15		Melons, Squashes, and Gourds (Cucurbitaceae)
16		<i>Midterm</i>
17		Nightshades: A focus on South America (Solanaceae)
18		Bulbs (Amaryllidaceae)
19		Lettuce, Artichokes and More: The Aster Family (Asteraceae)
20		Nuts (Betulaceae, Fagaceae, Juglandaceae)
21		Citrus (Rutaceae)
22		Tropical Fruits and Nuts (Anacardiaceae, Sapindaceae, Various)
23		Tropical Monocots (Arecaceae, Bromeliaceae, Musaceae)
24		Caffeine Producing Plants
25	US & California	Plant Domestication in the US
26		Before California Agriculture: Wild Harvest
27		California Agriculture
28	Wrap-Up	New Technologies and Approaches in Agriculture
29		<i>Final Exam</i>

References:

- Denison, R. Ford. *Darwinian Agriculture: How Understanding Evolution Can Improve Agriculture*. Hardcover ed. Princeton, N.J.: Princeton University Press, 2012.
- Diamond, Jared M. *Guns, Germs, and Steel: The Fates of Human Societies*. New York: Norton, 1999.
- Hancock, James F. *Plant Evolution and the Origin of Crop Species*. 3rd ed. Wallingford, Oxfordshire, UK ; Cambridge, MA: CABI, 2012.
- Hsu, Elisabeth, and Stephen Harris, eds. *Plants, Health and Healing: On the Interface of Ethnobotany and Medical Anthropology*. Epistemologies of Healing, v. 6. New York: Berghahn Books, 2010.
- Judd, Walter S. *Plant Systematics: A Phylogenetic Approach*. Fourth edition. Sunderland, MA: Sinauer Associates, Inc, 2016.
- Motley, Timothy J., Nyree Zerega, and Hugh Cross, eds. *Darwin's Harvest: New Approaches to the Origins, Evolution, and Conservation of Crops*. New York: Columbia University Press, 2006.
- Pollan, Michael. *The Botany of Desire: A Plant's-Eye View of the World*. Paperback ed. Random House Trade Paperbacks. New York, NY: Random House, 2002.
- Simpson, Michael George. *Plant Systematics*. 3. edition. Amsterdam Heidelberg: Elsevier Academic Press, 2018.
- Smartt, J., and N. W. Simmonds, eds. *Evolution of Crop Plants*. 2nd ed. Harlow: Longman Scientific & Technical, 1995.
- Van Wyk, Ben-Erik. *Food Plants of the World: Identification, Culinary Uses and Nutritional Value*. Second edition. Wallingford, Oxfordshire, UK ; Boston, MA: CABI, 2019.
- Weinberg, Bennett Alan, and Bonnie K. Bealer. *The World of Caffeine: The Science and Culture of the World's Most Popular Drug*. New York: Routledge, 2001.