NYU | DEPARTMENT OF BIOLOGY

BIOL-UA 560 Plant Science and Biotechnology

Instructor:
Kenneth Birnbaum

Course Description:
Plant biology is relevant to any scientist whose work requires an understanding of food security, climate change, genetic engineering, and drug discovery. This course focuses on the organismal and molecular biology of plants with an emphasis on subjects that have a direct impact on imminent societal challenges. For example, the extension of plant-microbe symbioses is the subject of a multi-million dollar Gates Foundation project to address climate change by lowering energy intensive nitrogen inputs. Other efforts seek the introduction of C4 photosynthesis to new crops in order to stabilize food production in the hot, dry climates that lie ahead. Plant secondary compounds and now plant-based antibody production are important tools in modern medicine. The course does not aim to debate these often controversial approaches but rather to provide a scientific basis to understand them. The material will incorporate and reinforce concepts in genetics and molecular biology. The course will also emphasize development of rigorous scientific communication skills needed for a careers in research and medicine rather than in-class testing. Writing assignments will include a personal essay of scientific interests and a scientific summary of primary research that will be developed into a short research proposal and final presentation.

Pre-requisites:
Molecular and Cell Biology I (BIOL-UA 21) or
Fundamentals of Ecology (BIOL-UA 63)

Textbook and Required Materials:
Plant Physiology. Fourth Edition (get it used from a secondary bookseller). Lincoln Taiz; Eduardo Zeiger. Sinauer Associates, Massachusetts.

Grading:

Class participation and discussion	20%
Personal Essay	20%
Research Summary	20%
Research Project	20%
Research Presentation	20%

Topics:
Introduction to Plant Growth and Anatomy. Indeterminate Growth through the Plant Meristem
Plant Transformation and Mutagenesis
Manipulating Plant Genomes. CRISPR Technology in Agriculture and Domestication. (DJ)
Jumping Genes. McClintock, Transposons, and Dynamic Plant Genomes
Auxin and the Role of Plant Hormones in Growth and Patterning
Modern Agriculture and the Role of Agricultural Inputs
Maintaining Stem Cells in the Indeterminate Meristem: Homologies from Shoot and Root
Self-Organization 1: The Yin Yang of Auxin Cytokinin Signaling in Plant Patterning. In-class dissection of the figures from Bishop et al.
Self-Organization 2: The SHORT ROOT/SCARECROW Pathway in Plants.
A Near Universal Model of Flower Development The ABC (DE) Model of Floral Organ Identity and the CRISPR Tomato
Symbiosis – Mycorrhizal Fungi and Rhizobium (BG)

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A Primer on Composing an Effective Slide Presentation (RR)
Plant Metabolism in Higher CO2 Environments.
Secondary Plant Compounds and Plant-Derived Medicinals; Using Plants to Make Antibodies
Photosynthesis, C4 vs. C3 Metabolism, and the Role of the SHR/SCR Pathway in Kranz Anatomy
(COR)
Applications of CRISPR in Plants