

Course Goal: Develop a solid foundational understanding of genetics and evolution; taught in the context of plant breeding, plant genetics, and plant biotechnology.

Text books:

Principles of Genetics, 6th edition (a.k.a. S&S). D.P. Snustad and M.J. Simmons. Wiley and Sons, Inc. 2012 ISBN: 9780470903599

Principles of Plant Genetics and Breeding 2nd edition, Acquaah, Wiley-Blackwell. 2012. ISBN: 9780470664766

Section I Topics:

Mitosis, meiosis, life cycle of plants

Basic principles of inheritance

Extensions of mendelism; epistasis, allelism, pleiotropy

Linkage, crossing-over, genetic mapping

Variation in chromosome number and structure; consequences of polyploidy, aneuploidy and chromosome rearrangement

Methods of reproduction in plants and implications for genetic and breeding strategies

Homework and in-class exercises includes gathering and evaluation of genetic data, statistical tests, linkage mapping, and videos and demonstrations related to flowering

Section II Topics:

Population Genetics

Quantitative Genetics

Crop domestication and sources of germplasm

Genotype x environment interactions

Breeding methods

- General terminology and concepts
- Hybrid crops and heterosis
- Cross-pollinated crops
- Self-pollinated crops
- Asexually propagated crops

Homework and in class exercises include calculating and understanding variances; principles of selection and other factors that alter allele frequency; breeding methods; recurrent selection with fast plants. Book report on "Tomorrow's Table"

Section III Topics:

Transcription, translation; molecular genetics of genes to phenotypes

Methods in molecular biology: Cloning, sequencing, PCR, -omics

Plant tissue culture; transgenic plant production; transgene regulation and stewardship

Epigenetics

Integrative case studies

Homeworks and in class exercises include plant tissue culture demonstration and a problem set related to research using transgenic plants.

Book reports on specified books related to the role of plant breeding and genetics in addressing world hunger and sustainability offer an extra credit opportunity.