

CSS/BIO PL 642 MINERAL NUTRITION: FROM PLANTS TO HUMANS

Spring 2007
M/W/F 1.25-2.15 pm

Course Web Site <http://www.css.cornell.edu/courses/642/>

- Location:** Mondays/Fridays: Bradfield Hall, Room 110; Wednesdays: Emerson Hall, Room 133
- Instructors:** Olena K. Vatamaniuk (Bradfield Hall, Room 608; okv2@cornell.edu; Phone: 5-8049)
Leon V. Kochian (US Plant Soil and Nutrition Lab, Room 237; lvk1@cornell.edu; Phone: 5-2454)
Ross M Welch (US Plant Soil and Nutrition Lab, Room 106; rmw1@cornell.edu; Phone: 5-1132)
- Office Hours:** Olena K. Vatamaniuk: Wednesday 3-4 pm or by appointment; Bradfield Hall, Room 608; okv2@cornell.edu; Phone: 5-8049
Leon V. Kochian: Wednesday 3-4 pm or by appointment; US Plant Soil and Nutrition Lab, Tower Road, Room 237; lvk1@cornell.edu; Phone: 5-2454
- Prerequisites:** Undergraduate course in plant physiology (BioPL 342 or equivalent). It is recommended that the student had undergraduate courses in molecular biology, biochemistry and physical chemistry.
- Texts Used:** Mineral Nutrition of Higher Plants, 2nd edition, Horst Marschner, Academic press, 2005 (Mann Library reserve).
Physicochemical and Environmental Plant Physiology, 3rd Edition, Park S. Nobel, Academic Press, 2005 (Mann Library reserve).
Biochemistry and Molecular Biology of Plant, Bob B. Buchanan, Wilhelm Gruissem and Russell L. Jones, American Society of Plant Physiology, 2000 (Mann Library reserve).
Lehninger Principles of Biochemistry, 4th Edition, David M. Nelson, Michael M. Cox, W.H. Freeman & Company, 2005 (Mann Library reserve, Chapter 10, 11 are on Ereserve, available *via* the Blackboard course site).
Original manuscripts (Electronic reserve, available *via* the Blackboard course site).

Course Rationale, Description and Goals: The mineral composition of each plant organ is determined by a sequence of events that begin with bioavailability of mineral nutrients in soils and membrane transport in the roots, proceeds *via* xylem-mediated translocation to vegetative organs, and concludes with the deposition of minerals in one or more cellular compartments. These processes are integrated and regulated by plants to ensure that adequate, not toxic quantities of mineral nutrients, are available to determine proper growth, development and yield. Given that plant foods contain almost all mineral nutrients that are essential for human nutrition, nutritional health and well-being of humans are dependent on plant foods.

This course will explore the molecular, biochemical, biophysical and physiological mechanisms of acquisition of mineral nutrients from the soil, translocation of these nutrients through the plant, molecular mechanisms and genetics of responses to nutrient stresses (e.g. nutrient deficiency and heavy metal toxicity, effects of acid soil on nutrient availability and metal toxicity). Selected lectures will focus on the relation between the nutrient status of plants and human nutrition and health. Guest lectures will be given by Cornell Professors that are the experts in soil-plant interactions, in the role of arbuscular mycorrhizal fungi in phosphorus nutrition of plants, in the role of specific micronutrients and interaction of essential and non-essential metals. In addition, students will learn modern, the state-of-art techniques that are used for analyses of mineral status of plants and evaluation of soil health.

Course Format: This is a three-credit course that will consist from lectures, in-lab learning of selected, state-of-art techniques, and student-led presentations of assignments.

Grading: Letter grading will be based on one midterm exam (25%), in-class presentation of assignments (25%) and the final exam (50%).

Assessment: The exams will be essays in nature and will consist, but not limited, to questions based on the interpretation and/or design of original experiments; will require the student to integrate concepts learned in class settings with supplementary reading (placed on reserve in Mann Library and on electronic reserve in Blackboard course site). The Mid-Term Exam will have a take-home format will cover the material from its part of the course.

Assignments: Each student will write a research paper and give a research-paper-based 20-min presentation about the mineral nutrient selected from the tentative lecture schedule. This assignment will involve analyses of the current status of knowledge in the literature about selected minerals. The student should send the information about the mineral nutrient of choice *via* email before March, 3, 2007. Assignments are to be submitted electronically 2-days prior in-class presentations. In-class presentations will be posted on the course web page.

Grading: Letter grading will be based on one mid-term exam (25%), in-class presentation of assignments (25%) and the final exam (50%).

Academic Integrity: The Cornell University has a Code of Academic Integrity. The work, submitted for take-home exams is expected to be the result of the individual effort. For the take-home exams, students may consult their notes, texts and web resources. However, discussion of take-home questions with anyone is not permitted. Please consult the Student Handbook or appropriate WebPages:

<http://cuinfo.cornell.edu/Academic/AIC.html>