

**MINERALS IN NUTRITION (HUN 6356) (3 credits); Spring Semester 2025**  
**Class Meetings: Tuesday, Thursdays, 1:00-2:15 p.m.; APL, room 0101**

**FOCUS:** (Patho)Physiological aspects of the essential minerals. Including consideration of: **1)** Dietary sources, intestinal absorption, transport and distribution, storage, and excretion of minerals; **2)** Homeostatic and molecular regulation of mineral metabolism; **3)** Pathophysiological outcomes associated with deficiencies and excesses of minerals; **4)** Interactions among the essential minerals; **5)** Connections between minerals and human disease; **6)** Current, cutting-edge research on minerals.

**LEARNING OBJECTIVES:**

- Explain the mechanisms by which dietary minerals are absorbed from food and supplements
- Describe homeostatic and molecular regulation of mineral metabolism
- Summarize the relationship between mineral intake/metabolism and chronic disease in humans
- Evaluate mineral-related research as it relates to human physiology and pathophysiology
- Design a mineral-based research project with physiological/pathophysiological significance

**Instructor:** James F. Collins, Ph.D., Professor; Food Science & Human Nutrition Department

**Location/Contact Info:** FSHN Bldg., Rm 441A; phone: 294-3749; email: jfcollins@ufl.edu

**Office Hours:** Most anytime, please email me and we can set up a specific time to meet

**Required Readings (which will form the basis of our class discussions):** The instructor will assign readings for each class, which may include classical and newer, cutting-edge basic and clinical science research papers, review articles and meta-analyses. Assigned readings will be posted on Teams in advance.

**Recommended Resources:**

- 1) **Modern Nutrition in Health and Disease.** 12<sup>th</sup> edition, 2025. Eds. Katharine L. Tucker et al. Burlington, MA; Jones and Bartlett Learning. ISBN:97812842644632.
- 2) **Present Knowledge in Nutrition.** 11<sup>th</sup> edition, 2020. Volume 1, Basic Nutrition and Metabolism. Eds. Bernadette P. Marriott et al. London, United Kingdom; Academic Press. ISBN: 9780323661621.
- 3) **Linus Pauling Institute, Micronutrient Information Center** (<https://lpi.oregonstate.edu/mic>)
- 4) **NIH Office of Dietary Supplements (ODS)** (<https://ods.od.nih.gov/factsheets/list-all/#B>)

**Class Meetings:** Classes will be discussion oriented, relating to posted PPT files and associated reading assignments, or to translational or basic-science papers from the primary literature. Dr. Collins will make the materials available to the students in advance and will also select the research papers to be covered. Attendance is encouraged and expected. **No makeup exams or quizzes will be given** (unless an emergency can be documented by the student; in this case, giving a makeup will be at the discretion of the instructor). No late assignments will be accepted. All missed assignments will be given a score of '0'.

<b><u>Assessment</u></b>	<b><u>Points</u></b>
Exam 1	100
Exam 2	100
Research Project	100 (Aims pg. [15]; presentation [25]; write up [60])
Quizzes	50 (5 x 10 points each)
Leading Research Paper Discussion	25 points
In-class Participation	25 points
<b><u>TOTAL POINTS AVAILABLE</u></b>	<b><u>400</u></b>

**Grade Determination (points):** A = 400-360; B+ = 359-352; B = 351-320; C+ = 319-312; C = 311-280; D = <280

Exams: Exams will be taken in class and will consist of a series of free response/discussion questions. The topics covered on exams will relate to the material discussed in class (in PPTs), assigned readings and research articles reviewed. The scope of answers to exam questions is at the discretion of each individual student, but they should be of sufficient length and rigor to adequately address the topic.

Research Project: Each student will select a **minerals-related research topic** of interest and prepare a mock grant application. The topic may (or may not) directly relate to the students' thesis/dissertation research topic. It would, however, probably be advantageous to model the proposal after the student's research project (e.g., using similar experimental techniques and models). The focus of the project should have relevance to human health and disease. Investigations using animal models of human disease will be considered acceptable, if a strong and cogent rationale is provided (i.e., why if this species [e.g., mice] a good model for this human condition?). It is advisable that each student meet with Dr. Collins to discuss potentially acceptable topics. The scope of the project should allow completion in 2 years, and it should be conceptually modeled after an NIH R21 grant (<https://grants.nih.gov/grants/funding/r21.htm>). This is an exploratory type of grant (i.e., high risk, high reward) that does not require preliminary data, just good ideas. Project topics will initially be discussed in class on **Jan. 21<sup>st</sup>** and specific aim pages will be peer-reviewed on **Feb. 4<sup>th</sup>**. Final specific aims pages will be turned in (or emailed) to the instructor by **Feb 20<sup>th</sup>**, and final grant proposals will be due by **April 8<sup>th</sup>**. Research proposals will be presented by students on the last 3 days of class.

*Proposal Formatting Requirements:* Arial, 11-point font; margins 0.5 inches on all sides; single spaced; printed on one side. The paper must include the following sections:

- 1) Cover page with student's name, UF ID and title of grant proposal
- 2) Specific Aims page (pg. 1)- format will be discussed in class
- 3) Background and Significance (pg. 2)
- 4) Approach (pgs. 3-5), should include the following sections:
  - i) Experimental approaches and models used utilized to test central hypothesis
  - ii) Anticipated results (be thoughtful)
  - iii) Potential pitfalls (what could go wrong? - something usually does!)
  - iv) Alternative hypotheses and related experimental approaches (if, for example, the central hypothesis is disproven)
- 5) References (pg. 6)- no more than 20

*Grant Proposal Presentation:* Each student will present their research project to the class on the designated day. Each student will have 20 minutes for their presentation with 5-10 minutes for questions/discussion. The presentations should include the following elements: rationale for choosing topic; background and significance leading to the central hypothesis to be tested; the experimental approach, including methods and the model systems to be utilized; anticipated results and possible alternative hypotheses/approaches; and potential impact and future studies.

Student-Lead Research Paper Discussions: Each student will be assigned a research paper and will lead a discussion on the paper in one class session. The papers will be selected by the instructor and assignments will be made at the beginning of the semester, by random drawing.

Quizzes: Five quizzes will be given at the beginning of class on random days throughout the semester. Quizzes will be based upon information provided on PowerPoint slides and/or assigned readings for a given day. These unannounced quizzes are intended to incentivize you to prepare for class in advance.

## Class Schedule\*

	<u>DATE</u>	<u>TOPIC</u>
	<b>JAN</b>	14 (T) † Course Intro
		16 (R) Minerals: Basic Biochemical, Metabolic and Nutritional Aspects
		21 (T) Writing Research Grants / Discussion of Research Project Topics
		23 (R) GI Tract Physiology / Mineral Absorption
		28 (T) Iron
++Research Paper++		30 (R) Iron
**Review Article**	<b>FEB</b>	4(T) Iron >>>Peer review of specific AIMs pages<<<
		6 (R) Copper
++Research Paper++		11 (T) Copper
++Research Paper++		13 (R) Copper
		18 (T) Zinc
++Research Paper++		20 (R) Zinc >>>Specific AIMs pages due by 1:00 p.m.<<<
++Research Paper++		25 (T) Zinc
		27 (R) <b>Exam 1</b>
	<b>MAR</b>	4(T) Calcium
++Research Paper++		6 (R) Calcium
		11(T) Phosphorus / Magnesium
++Research Paper++		13 (R) Manganese
		18 (T) NO CLASS (SPRING BREAK)
		20 (R) NO CLASS (SPRING BREAK)
		25 (T) Electrolytes (Sodium, Potassium, Chloride)
++Research Paper++		27 (R) Selenium
	<b>APR</b>	1 (T) Selenium
++Research Paper++		3(R) Iodine
++Research Paper++		8 (T) Fluoride / Chromium >>>Grant Proposals due by 1:00 p.m.<<<
		10 (R) <b>Exam 2</b>
		15 (T) Grant Proposal Presentations
		17 (R) Grant Proposal Presentations
		22 (T) Grant Proposal Presentations

\*Subject to change

†T = Tuesday; R = Thursday

Papers to be reviewed:

**Jan 30)** Nemeth et al. Heparin regulates cellular iron efflux by binding to ferroportin and inducing its internalization. *Science* 2004 Dec 17;306(5704):2090-3. doi: 10.1126/science.1104742

**Feb 4)** Stoffel et al. Assessing Human Iron Kinetics Using Stable Iron Isotopic Techniques. *Clinical Pharmacokinetics* (2024) 63:1389–1405. <https://doi.org/10.1007/s40262-024-01421-z>

**Feb 11)** Garza et al. Elesclomol elevates cellular and mitochondrial iron levels by delivering copper to the iron import machinery. *J. Biol. Chem.* (2022) 298(7) 102139. <https://doi.org/10.1016/j.jbc.2022.102139>

**Feb 13)** Batzios et al. Newly identified disorder of copper metabolism caused by variants in CTR1, a high-affinity copper transporter. *Human Molecular Genetics*, 2022, Vol. 31, 24, 4121–4130. <https://doi.org/10.1093/hmg/ddac156>

**Feb 20)** Prasad et al. Syndrome of iron deficiency anemia, hepatosplenomegaly, hypogonadism, dwarfism and geophagia. *Am. J. Med.* 1961 31:532-46. doi: 10.1016/0002-9343(61)90137-1.

**Feb 25)** Kemp et al. Zinc Supplementation Initiated Prior to or During Pregnancy Modestly Impacted Maternal Status and High Prevalence of Hypozincemia in Pregnancy and Lactation: The Women First Preconception Maternal Nutrition Trial. *Journal of Nutrition* 154 (2024) 1917–1926. <https://doi.org/10.1016/j.tjnut.2024.04.018>

**Mar 6)** Nicolaysen. THE INFLUENCE OF VITAMIN D ON THE ABSORPTION OF CALCIUM AND PHOSPHORUS IN THE RAT. *Biochemistry* 1937

**Mar 13)** Tuschl et al. Mutations in SLC39A14 disrupt manganese homeostasis and cause childhood-onset parkinsonism–dystonia. *NATURE COMMUNICATIONS* 2016 | 7:11601 | DOI: 10.1038/ncomms11601

**Mar 27)** Ingold et al. Selenium Utilization by GPX4 Is Required to Prevent Hydroperoxide-Induced Ferroptosis. *Cell* 172, 409–422, January 25, 2018. <https://doi.org/10.1016/j.cell.2017.11.048>

**Apr 3)** Dai et al. Cloning and characterization of the thyroid iodide transporter. *NATURE* · VOL 379 · 1 FEBRUARY 1996.

**Apr 8)** Green et al. Association Between Maternal Fluoride Exposure During Pregnancy and IQ Scores in Offspring in Canada. *JAMA Pediatr.* 2019;173(10):940-948. doi:10.1001/jamapediatrics.2019.1729