

Nutritional Sciences

Graduate Study

The Interdepartmental Graduate Program in Nutritional Sciences (IGPNS), administered through the Graduate College, under the auspices of the Chairs of Food Science and Human Nutrition (FS HN) and Animal Science, will provide the structure for coordinating and enhancing interdisciplinary nutrition research and graduate education. M.S. and Ph.D. degrees in Nutritional Sciences will be offered with three specializations: Animal Nutrition, Human Nutrition, or Biochemical & Molecular Nutrition.

The following undergraduate course work is recommended of all applicants who are applying to the IGPNS, but may be modified depending upon the student's area of emphasis. Recommended course work includes organic chemistry with laboratory, physics, analytical chemistry, a nutrition course that requires biochemistry or organic chemistry as a prerequisite, and a course in biology/physiology or anatomy. Under certain circumstances students can be admitted or provisionally admitted with course work deficiencies. Students with an undergraduate degree will be generally admitted into the M.S. program and upon completion, they can then apply for admission into the Ph.D. program. However, exceptional students with experience can apply directly to the Ph.D. program.

The general requirements of the Nutritional Sciences degree at the MS level, in addition to those of Graduate College, are:

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| NUTRS 501 | Biochemical and Physiological Basis of Nutrition: Macronutrients and Micronutrients | 4 |
| BBMB 404 | Biochemistry I | 3 |
| BBMB 405 or BBMB 420 | Biochemistry II Physiological Chemistry | 3 |
| STAT 401 | Statistical Methods for Research Workers | 4 |
| FS HN 580 or AN S 501 | Orientation to Food Science and Nutrition Research Survey of Animal Disciplines | 1 |
| AN S 603 or FS HN 682X | Seminar in Animal Nutrition Seminary Reflection (experimental course) | 1 |
| FS HN 581 | Seminar (or AN S equivalent) | 1 |
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| FS HN 590C or AN S 590L | Special Topics: Teaching Special Topics: Teaching | 1-3 |
| Successful completion and defense of thesis | | |

Students are expected to complete the course work established by the Program of Study (POS) committee based on specialization with a minimum of 30 graduate-level semester credits, not less than 22 of which must be earned at Iowa State University.

The general requirements of the Nutritional Sciences degree at the PhD level, in addition to those of the Graduate College, are:

- Completion of all requirements of the MS degree in Nutritional Sciences
- 3 additional credits of graduate-level biochemistry (6 credits total including those for the M.S.), graduate-level statistics (STAT 402 Statistical Design and the Analysis of Experiments), and physiology (if not taken for the M.S.)
- Additional graduate-level courses in the field of study as deemed appropriate by the POS Committee and specialization, and additional teaching assistant requirements (FS HN 590C Special Topics: Teaching).

Satisfactory completion of a preliminary examination, a written dissertation, seminar presentation of dissertation research, and defense of the dissertation is also required. Overall a minimum of 72 graduate-level semester credits, no less than 36 of which must be earned at Iowa State University

Courses primarily for graduate students, open to qualified undergraduates:

NUTRS 501. Biochemical and Physiological Basis of Nutrition: Macronutrients and Micronutrients.

(4-0) Cr. 4. F. Prereq: Credit or enrollment in BBMB 404 or BBMB 420

Integration of the molecular, cellular, and physiologic aspects of energy, macronutrient, and micronutrient metabolism in mammalian systems. Survey course that includes interactions among nutrients (dietary carbohydrate, fiber, lipid, protein, vitamins, and minerals) and non-nutrients, metabolic consequences of nutrient deficiencies or excesses, relevant polymorphisms, and major research methodologies.

NUTRS 503. Biology of Adipose Tissue.

(2-0) Cr. 2. Alt. S., offered 2013. Prereq: Undergraduate: consent of instructor; Graduate: NutrS 501

Principles regarding the development of adipose tissue and its role in energy balance, and will focus considerably on endocrine and immune actions of the adipocyte. Course material will be in lecture format, including handouts and selected journal articles. Students will be asked to lead critical discussions of key research findings as summary material for a given topic. Species differences will be highlighted, particularly as they relate to research models.

NUTRS 504. Nutrition and Epigenetic Regulation of Gene Expression.

(1-0) Cr. 1. Alt. S., offered 2012. Prereq: graduate standing; undergraduate with consent of instructor

Discussion of epigenetic regulation of gene expression and the role that nutrition plays in this process. Examination of current research literature to understand how different nutrients and physiological states influence epigenetics, as well as, the research methodology used to address these relations.

NUTRS 505. Short Course.

(1-0) Cr. 1. SS. Prereq: Permission of instructor

NUTRS 506. Diet and cancer prevention.

(Dual-listed with NUTRS 406). (1-0) Cr. 1. Alt. F., offered 2012. Prereq: BBMB 404 and BBMB 405 or BBMB 420

Principles of cancer biology and cancer etiology will be integrated with the impacts of diet on cancer development and prevention. Contributions of research with humans, animals, cultured cells and cell free systems will be included. The importance of dietary contaminants, macronutrients and micronutrients will be examined with an emphasis on the strength of the evidence and mechanisms of action.

NUTRS 512. Food Product Development.

(Dual-listed with FS HN 412). (1-6) Cr. 3. S. Prereq: FS HN 311 or FS HN 411, FSHN 471

Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, microbiology, and processing. Some pilot plant experiences. Electronic communication from web emphasized for class reports, notes and assignments. Nonmajor graduate credit.

NUTRS 518. Digestive Physiology and Metabolism of Non Ruminants.

(Cross-listed with AN S). (3-0) Cr. 3. Alt. S., offered 2013. Prereq: AN S 419 or NUTRS 501

Digestion and metabolism of nutrients. Nutritional requirements and current research and feeding programs for poultry and swine.

NUTRS 519. Food Toxicology.

(Cross-listed with TOX, FS HN). (3-0) Cr. 3. Alt. F., offered 2012. Prereq: A course in biochemistry

Basic principles of toxicology. Toxicants in the food supply: modes of action, toxicant defense systems, toxicant and nutrient interactions, risk assessment. Only one of FS HN 419 and FS HN 519 may count toward graduation.

NUTRS 520. Digestive Physiology and Metabolism of Ruminants.

(Cross-listed with AN S). (2-2) Cr. 3. Alt. S., offered 2012. Prereq: AN S 419 or NUTRS 501

Digestive physiology and nutrient metabolism in ruminant and preruminant animals.

NUTRS 529. Foodborne Toxicants.

(Dual-listed with FS HN 429). (Cross-listed with TOX). (2-0) Cr. 2. F. Prereq: A course in biochemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.

Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HAACP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only.

NUTRS 542. Introduction to Molecular Biology Techniques.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, GDCB, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS. Prereq: Graduate classification
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NUTRS 542A. Introduction to Molecular Biology Techniques: DNA.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, GDCB, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS. Prereq: Graduate classification
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

NUTRS 542B. Introduction to Molecular Biology Techniques: Protein.

(Cross-listed with B M S, GDCB, EEOB, FS HN, HORT, NREM, GDCB). Cr. 1. Repeatable. S.SS. *Prereq: Graduate classification*

Techniques. Includes fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NUTRS 542C. Introduction to Molecular Biology Techniques: Cell.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, GDCB, V MPM, VDPAM). Cr. 1. Repeatable. F.S. *Prereq: Graduate classification*

Includes immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

NUTRS 542D. Introduction to Molecular Biology Techniques: Plant Transformation.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, GDCB, V MPM, VDPAM). Cr. 1. Repeatable. S. *Prereq: Graduate classification*

Includes Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only.

NUTRS 542E. Proteomics. Includes two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. (F.).

(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS. *Prereq: Graduate classification*

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NUTRS 542F. Techniques in Metabolomics. metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects.

(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS. *Prereq: Graduate classification*

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NUTRS 542G. Introduction to Molecular Biology Techniques: Genomic.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, GDCB, V MPM, VDPAM). Cr. 1. Repeatable. S. *Prereq: Graduate classification*

Offered on a satisfactory-fail basis only.

NUTRS 549. Advanced Vertebrate Physiology I.

(Cross-listed with KIN, AN S). (4-0) Cr. 4. F. *Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420*

Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

NUTRS 552. Advanced Vertebrate Physiology II.

(Cross-listed with KIN, AN S). (3-0) Cr. 3. S. *Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420*

Cardiovascular, renal, respiratory, and digestive physiology.

NUTRS 561. Medical Nutrition and Disease I.

(4-0) Cr. 4. F. *Prereq: FS HN 360, FS HN 361, 3 credits in physiology at 300 level or above*

(Dual listed with FS HN 461.) Pathophysiology of selected chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state. Recitation section (1 cr.) will focus on refinement of assessment skills, diagnosis of nutritional problems, nutrition care, and documentation. Course must be taken for 4 credits if Didactic Program in Dietetics (DPD) verification statement of completion is desired. Graduate students may take the lecture portion without the recitation section.

NUTRS 562. Assessment of Nutritional Status.

(3-0) Cr. 3. Alt. S., offered 2013. *Prereq: FS HN 461/NUTRS 561 or NUTRS 501*

Overview and practical applications of methods for assessing nutritional status, including: theoretical framework of nutritional health and disease, dietary intake, biochemical indices, clinical examination, and body composition.

NUTRS 563. Community Nutrition.

(3-0) Cr. 3. F. *Prereq: FS HN 265 or FS HN 360; FS HN 366 recommended*

Dual listed with FS HN 463. Survey of current public health nutrition problems among nutritionally vulnerable individuals and groups. Discussion of the multidimensional nature of those problems and of community programs addressing them. Grant writing as a means for funding community nutrition program development. Significant emphasis on written and oral communication at the lay and professional level. Field trip. Nonmajor graduate credit.

NUTRS 564. Medical Nutrition and Disease II.

(3-0) Cr. 3-4. S. *Prereq: FS HN 360, FS HN 461, or NUTRS 561. 3 credits in physiology at 300 level or above*

(Dual listed with FS HN 464.) Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

NUTRS 566. Nutrition Counseling and Education Methods.

(Dual-listed with FS HN 466). (Cross-listed with DIET). (2-2) Cr. 3. F.S. *Prereq: Graduate student status*

Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories.

NUTRS 571. Food Processing I.

(Dual-listed with FS HN 471). (2-3) Cr. 3. F. *Prereq: FS HN 351 or A E 451 or CH E 357; MICRO 201 or MICRO 302; CHEM 163 or CHEM 177.*

Principles and applications of food processing by application of heat (blanching, pasteurization, canning, extrusion, evaporation and distillation, extrusion and dehydration) and by removal of heat (refrigeration and freezing). Emphasis on solving problems in laboratory and recitation sessions.

NUTRS 572. Food Processing II.

(Dual-listed with FS HN 472). (2-3) Cr. 3. S. *Prereq: FS HN 351 or A E 451 or CH E 357.*

Principles and applications of food processing by biological (fermentation, enzymes) and nontraditional (high pressure, irradiation, pulsed electric field) preservation methods. Includes packaging, waste water treatment, and sanitation. Emphasis on solving problems in laboratory and recitation sessions.

NUTRS 596. Food Science and Human Nutrition Travel Course.

(Dual-listed with NUTRS 496B). Cr. 1-4. Repeatable. F.S.SS. *Prereq: Permission of instructor*

(One credit per week traveled and 1 credit for pre-departure class, if offered.)

Limited enrollment. Tour and study of food industry, culinary science, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

NUTRS 596A. Food Science and Human Nutrition Travel Course: International travel.

(Dual-listed with FS HN 496). Cr. 1-4. Repeatable. F.S.SS. *Prereq: Permission of instructor*

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

NUTRS 596B. Food Science and Human Nutrition Travel Course: Domestic travel.

(Dual-listed with FS HN 496). Cr. 1-4. Repeatable. F.S.SS. *Prereq: Permission of instructor*

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

Courses for graduate students:**NUTRS 619. Advanced Nutrition and Metabolism - Protein.**

(Cross-listed with AN S). (2-0) Cr. 2. F. *Prereq: BBMB 405*

Digestion, absorption, and intermediary metabolism of amino acids and protein. Regulation of protein synthesis and degradation. Integration of cellular biochemistry and physiology of mammalian protein metabolism.

NUTRS 620. Advanced Nutrition and Metabolism - Energy.

(Cross-listed with NUTRS). Cr. 2. Alt. S., offered 2012. *Prereq: BBMB 405*

Energy constituents of feedstuffs and energy needs of animals as related to cellular biochemistry and physiology. Interpretations of classical and current research.

NUTRS 680. Modern Views of Nutrition.

Cr. R. Repeatable. F.

Current concepts in nutrition and related fields. Required for all graduate students in nutrition.

NUTRS 690. Special Problems.

Cr. arr. Repeatable. F.S.SS.

NUTRS 695. Grant Proposal Writing.

(Cross-listed with FS HN). (1-0) Cr. 1. F. *Prereq: 3 credits of graduate course work in food science and/or nutrition*

Grant proposal preparation experiences including writing and critiquing of proposals and budget planning. Formation of grant writing teams in food science and/or nutrition. Offered on a satisfactory-fail basis only.

NUTRS 699. Research in Nutritional Sciences.

Cr. arr. F.S.SS.

Offered on a satisfactory-fail basis only.