Graduate Program in Biochemical and Molecular Nutrition (BMN)

The Biochemical and Molecular Nutrition (BMN) Program is designed to train nutrition scientists whose interests are in the fundamental understanding of biochemical, physiological and molecular processes in nutrition. BMN faculty members are selected based on their dedication to teaching, research, and mentoring. The interactive relationship with other programs within the school, as well as with the Jean Mayer USDA Human Nutrition Research Center on Aging, the School of Medicine, the Frances Stern Nutrition Center, the New England Medical Center, the Sackler School of Graduate Biomedical Sciences, and Tufts University Graduate Program in Arts and Sciences provides a rich environment for collaborative and cross-discipline instruction. Students completing the BMN program will graduate with the necessary analytical, technical, and communication skills required for research and teaching positions in academia, industry, and government.

Why Study Biochemical and Molecular Nutrition?

Nutrition is a natural science that has a fundamental biological basis. Understanding nutrition-related biochemical and cellular processes and pathways will have far reaching implications for human nutrition. To study such processes and pathways requires a critical knowledge of biochemistry and physiology combined with a fundamental background in basic sciences.

What You Will Learn?

The curriculum combines rigorous academic coursework in nutrition, biochemistry, physiology, statistics and molecular biology, with practical training in specific areas of interest. Students thereby acquire in-depth knowledge as well as an understanding of how to design, conduct, and report peer-reviewed research. Students take academic courses at the Friedman School of Nutrition Science and Policy and at the Sackler School of Graduate Biomedical Sciences. However, students have the opportunity to take courses in the School of Medicine and School of Arts and Sciences of Tufts University and at other schools within the Boston area via consortium arrangements.

Who is Eligible?

Candidates accepted for study are chosen for their outstanding performance in undergraduate study in nutrition, biology, physiology, biochemistry, and related fields. A fundamental interest in research is required. Specific prerequisites are of undergraduate course work in each of the following: general chemistry, organic chemistry, and biochemistry.
Programs of Study

The Biochemical and Molecular Nutrition (BMN) Program leads to the Master of Science and Doctor of Philosophy degrees, as well as a dual degree with MPH. The curriculum includes nine core courses in the areas of nutrition, graduate biochemistry including a molecular component, human physiology, biostatistics, and epidemiology. There are also mandatory laboratory rotations. In addition, each student is required to select an area of specialization in consultation with the adviser. The exact number of required courses will depend upon the student’s prior academic preparation. Students with adequate preparation and/or demonstrated proficiency in an area(s) of required study may substitute electives in biochemistry, genetics, cellular physiology, immunology, neuroscience, or developmental biology. A full listing of course descriptions is available in the general catalog of the Friedman School of Nutrition Science and Policy available online.

MASTER OF SCIENCE

The curriculum includes core courses in nutrition, biostatistics, and biochemistry. Each student completes a specialization (three to five courses). A minimum of sixteen credits is required for the M.S. degree. Unless otherwise noted, each course is equivalent to one credit. The exact number of required courses will depend upon the student’s prior academic preparation.

DOCTOR OF PHILOSOPHY

Students enrolled in the doctoral program must have completed courses equivalent to the Nutritional Biochemistry and Metabolism master’s degree based on previous graduate level coursework taken either at the Friedman School of Nutrition Science and Policy or elsewhere. Students entering at the Ph.D. level must complete or be exempted from all required courses of the M.S. curriculum. Students in the doctoral program must first pass a written and oral qualifying examination, and then complete and formally defend a doctoral dissertation based on original research.

DUAL DEGREE PROGRAM:

Master of Science/Master of Public Health

Students enrolled in the dual degree program complete all the requirements for both degrees, but by counting selected courses toward both programs, they reduce the total time required for completion. Students must be admitted independently to each program. Our dual degree program allows formal recognition of students emphasizing these additional areas of study, greater depth of professional preparation, and opportunities to make connections with students and faculty in other related programs.

• A dual degree program in association with Tufts University’s School of Medicine, leads to the Master of Science and the Master of Public Health (MPH).

Course Curriculum

I. NUTRITION SCIENCE AND POLICY CORE COURSE

The nutrition core provides students with an understanding of basic nutrition and nutrition science policy. Courses in these areas reflect the broad science and policy mission of the school. Each course is one credit unless noted otherwise. Students with prior coursework or knowledge may be able to exempt a specific course.

General Nutrition
Nutrition Science Policy requirement

In addition to these courses, a standardized training in the ethical treatment of human subjects is a requirement for graduation.

II. BIOCHEMISTRY AND PHYSIOLOGY

Graduate Biochemistry (2 credits)
Human Physiology
Nutritional Biochemistry and Physiology (3 credits)

“I see a huge opportunity for individuals who have both an extensive background in the basic sciences (including understandings of molecular mechanisms of disease, for example) and a keen understanding of research methodologies, who can then translate, communicate and apply this information on a community, national or even international level to promote better overall health.” —RACHEL CHEATHAM, CLASS ’07
“I am currently working as the epidemiologist for the Division of Dental Health, Virginia Department of Health (VDH.) The MS/MPH program provided me with important skills regarding statistical analysis, research/methodology, important health concepts, grant/research writing, program evaluation, and use of software related to data analysis.” —ELIZABETH LAZAR, CLASS ’05

III. BIOSTATISTICS AND EPIDEMIOLOGY
Statistical Methods for Nutrition Research I
Statistical Methods for Nutrition Research II
Principles of Epidemiology

IV. SPECIALIZATION COURSES
Specialization areas are unique concentrations chosen by the student and adviser based on a knowledge base or set of skills desired. These courses are selected from the Friedman School of Nutrition Science and Policy, the School of Medicine and the Sackler School of Graduate Biomedical Sciences. Examples of areas of specialization include: cellular and molecular biology, epidemiology, policy, immunology, and physiology.

V. ELECTIVES
Courses are chosen as electives in an area of specialization. Students are encouraged to do Directed Studies, which are independent studies under the supervision of the Friedman School of Nutrition Science and Policy faculty members. Directed studies are in the form of lab training, data analysis and interpretation, and literature reviews, among others.

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How to Apply
Those interested in learning more about the school should check the website (nutrition.tufts.edu) or contact the admissions office at 617-636-3777 or nutritionadmissions@tufts.edu. Applicants must submit a completed on-line application (available on the website) by January 15 for the fall semester. The on-line application will include the fee, three letters of recommendation, and GRE and TOEFL scores. Original transcripts must be submitted directly to the Friedman School of Nutrition Science and Policy. Applications received by January 15 will receive full consideration for tuition and/or stipend packages. Applications received after that date will be considered for funds as remaining. International students requiring a visa must apply by January 15 for the fall semester.

Finances
The annual cost of tuition may be obtained from the website (nutrition.tufts.edu). Friedman School of Nutrition Science and Policy tuition scholarships are awarded to incoming students based on academic merit. For full consideration for a tuition scholarship, you must apply by January 15. Student financial support may also come from competitive stipends, National Institutes of Health traineeships, industry awards, or federal financial aid (Office of Financial Aid 617-627-2000).
“I am now a post doctoral fellow at Novartis Institute for Biomedical Research working in the diabetes and metabolism group. The research experience and knowledge I gained in the area of obesity and metabolism through working in my lab (Obesity and Metabolism Lab with Dr. Andrew Greenberg at the HNRC) provided me with the skills and knowledge for my current position.” —TARA D’EON, CLASS ’06

Affiliated Centers and Schools

USDA HUMAN NUTRITION RESEARCH CENTER ON AGING AT TUFTS
The USDA Human Nutrition Research Center (HNRC) on Aging at Tufts University occupies a fourteen-story building constructed in 1982 and is located on the Health Science campus of Tufts University. The center is operated by Tufts University through a cooperative agreement with the Agricultural Research Service of USDA. The overall mandate of the HNRCA is to explore the relationship of nutrition to the aging process and to investigate the many age-related physiologic changes that can affect the dietary requirements of older adults. HNRCA scientists use cell, molecular biology, animal and stable isotope methodologies, and human metabolic and field studies in order (1) to better understand the processes of nutrient utilization and metabolism and (2) to determine how diet interacts with genetic and environmental factors in order to promote health and vigor over the life span.

THE SACKLER SCHOOL OF GRADUATE BIOMEDICAL SCIENCES
The Sackler School was established in cooperation with the faculties of the Tufts University Schools of Medicine, Dental Medicine, and Veterinary Medicine, and the Graduate School of Arts and Sciences to further broaden the university’s commitment to multidisciplinary health science investigation. A special goal of the school is to provide a graduate education program in the biomedical sciences for future leaders in research and teaching, stressing interdisciplinary approaches that will integrate basic and clinical sciences.

THE NEW ENGLAND MEDICAL CENTER
Nutrition resources at the New England Medical Center (NEMC) include both adult and pediatric clinical programs for hospitalized and ambulatory patients, as well as the Frances Stern Nutrition Center. NEMC is the major clinical unit affiliated with the Tufts University School of Medicine. NEMC has established a national and international reputation for research, teaching, patient care, and graduate and postgraduate education.

THE FRANCES STERN NUTRITION CENTER
This is a subunit in the Division of Endocrinology of the Department of Medicine at NEMC. The center is responsible for ambulatory nutrition services at NEMC, a satellite nutrition education and resource center at the Massachusetts Department of Public Health, and several research grants and contracts involving clinical nutrition or nutrition education and information.

Career Opportunities
Biochemical and Molecular Nutrition (BMN) graduates emerge with a set of basic science, nutrition, investigative, analytical, and quantitative skills that will enable them to play leading roles in academics, government agencies or private industry. Here are a few examples of careers chosen by recent graduates of BMN (M.S. and Ph.D.):

• Postdoctoral Fellow in academia or private industry
• Faculty position in academia
• Scientist for a biotechnology, food, or pharmaceutical company
• Advisory position in government
• Data analyst for population based studies
CORE FACULTY

Sarah L. Booth, Ph.D.
PROGRAM DIRECTOR
Vitamin K; food composition, metabolism, and role in chronic disease prevention

Lynne M. Ausman, D.Sc.
Effect of dietary fat, cholesterol, and fiber on coronary artery disease and colon cancer; nutritional primatology

Jeffrey B. Blumberg, Ph.D.
Antioxidants and disease prevention in the aging population

Carmen Castaneda Sceppa, M.D., Ph.D.
Protein requirements and exercise in the elderly

Sang Woon Choi, M.D., Ph.D.
Mechanisms underlying the modulation of carcinogenesis by nutrients

Natalia A. Crivello, Ph.D.
Lipids in brain aging and nutrition

Paul Jacques, D.Sc.
Causes and consequences of elevated plasma homocystine levels; antioxidants and age-related eye diseases; dietary patterns and disease risk

Elizabeth Johnson, Ph.D.
Absorption and metabolism of carotenoids in humans; role of carotenoids in eye disease prevention

Stefania Lamon-Fava, M.D.
Hormonal replacement, nutrition, lipoproteins, aging and risk of cardiovascular disease

Paul Leavis, Ph.D.
Mammalian physiology; leptin induced signaling in breast cancer

Alice H. Lichtenstein, D.Sc.
Dietary fatty acids, nutrition, lipoproteins, and cardiovascular disease risk; phytoestrogens/soy protein; sterol/stanol esters; genetically modified/selectively bred oils

Joel B. Mason, M.D.
Folate and carcinogenesis; intestinal metabolism of folate

Mohsen M. Meydani, D.V.M.
Role of dietary antioxidants, lipids and oxidative stress on molecular mechanisms of immune/endothelial cells interaction in atherogenesis and angiogenesis

Simin Nikbin Meydani, D.V.M.
Age and nutrient induced changes in immune response and their underlying mechanisms

Aviva Must, Ph.D.
Childhood growth antecedents and adult health outcomes, childhood and adolescent obesity, epidemiology of obesity in adults

Martin Obin, Ph.D.
Photoreceptors degeneration; effects of calorie restriction and novel vitamin K-dependent proteins using transgenics and knockouts

Jose Ordovas, Ph.D.
Molecular biology, nutrition and genetics; lipoproteins, and cardiovascular disease risk

Susan B. Roberts, Ph.D.
Dietary determinants of body fatness, energy efficiency, expenditure, and intake; stable isotope kinetic techniques

Irwin H. Rosenberg, M.D.
Folate nutriture; relationship between homocystine, B vitamin nutriture, and vascular disease

Robert M. Russell, M.D.
Retinoids; carotenoids; aging; gastrointestinal function

Ernst J. Schaefer M.D.
Nutrition, genetics, lipoproteins, and cardiovascular disease risk

Jacob Selhub, Ph.D.
Relationship between B vitamin nutriture, homocysteine, and vascular disease

Allen Taylor, Ph.D.
Proteolytic processes in the lens and retina

Xiang-Dong Wang, M.D., Ph.D.
Retinoid and carotenoid metabolism and signaling

Richard J. Wood, Ph.D.
Gene-diet interactions; micronutrient bioavailability

Dayong Wu, M.D., Ph.D.
Eicosanoids in aging and immune response

EXAMPLES Recent BMN Research Projects

- Effects of dietary glycemic load on mood during caloric restriction
- Genetic polymorphisms underlying the role of vitamin K in vascular and bone health
- The metabolic complications of chronic inflammation in rheumatoid arthritis
- The Role of Heat Shock Protein 90 in the Molecular Mechanism of Vitamin D Action
- Differential Effects of Dietary Fatty Acids and Cholesterol on (HDL) and (nHDL) Metabolism
- The Effects of Aging and Vitamin E Supplementation on Coxackievirus B3 Infection in Mice
- Effects of Combined Antioxidants (Beta-Carotene, Alpha-Tocopherol and Ascorbic Acid) Supplementation against Carcinogenesis