

Tehran University of Medical Sciences
(TUMS)

School of Nutritional Sciences and Dietetics

Curriculum

For

M.Sc. in
Cellular and Molecular
Nutrition

September 2022

Chapter 1: General Characteristics

a. Program Description

- This program is a master level program in cellular and molecular nutrition.
- The proposed degree is “MSc Cellular and Molecular Nutrition”.
- The name of the program is Cellular and Molecular Nutrition.

Cellular and Molecular Nutrition is the study of interactions between man and his environment at a cellular and molecular level, with specific reference to nutritional environment. These interactions could also be studied at system or whole body levels, such that the information generated can be the scientific basis of a “cell to society” concept for addressing national nutritional problems.

Health and well-being in the population depends on nutritional status to a large extent. Addressing the relationships between health, environment and well-being requires the development of different scientific capacities, starting at the cellular level and leading up to community level studies and interventions. The cellular and molecular nutrition group will provide the basic information dealing with causes and mechanisms of disease, leading to rational strategies for problem identification and solving, and finally resulting in appropriate and rational management of community interventions. Further downstream, cellular and molecular approaches to evaluating the efficacy of nutritional interventions is also very important. The cellular and molecular nutrition programs could also lead to the development of effective markers of tools to conduct surveillance on a population to identify and prevent nutrition associated disease.

The future of rational and effective therapies will depend on the ability of science to characterize a person’s genetic information such that susceptibilities and risks associated with changing environment can be tailored to individual needs. Indeed, it is predicted that, such strategies will lead to the next generation of healthcare by 2030 (Vicente, 2020). The proposed program would result in an integration of many fields of scientific activity, such as genetics, molecular biology, biotechnology, immunology and so on, for their most optimal utilization for modern nutritional science. The cellular and molecular nutrition program will provide direction to future initiatives in these fields, directed towards nutrition, and perhaps generate a new science arena in Iran.

The graduates of this program will, over the next 10 years, form a significant capability which will serve the needs of nutrition education and research expertise in Iran. More importantly, the cellular and molecular nutrition MSc program will, through the graduation of its candidates, provide potential skilled graduates for further doctoral training and to provide a cohort of trained research assistants for the expansion of molecular and cellular approaches to science in general and food and nutrition science in particular.

c. Mission

Many countries all over the world has demonstrable nutrition-related health problems spanning the range of under-nutrition, poverty-related food insecurity, micronutrient deficiencies, and diet-related chronic diseases of adulthood (WHO 2019, Moslemi 2020). In order to carry out effective nutritional surveillance on the problems related above, and to be sensitive to emerging nutritional problems, it is essential to have a strong technological ability, such that information can be gathered economically and efficiently; this technological ability is rooted in a strong cellular and molecular program, which will additionally be able to look for preventive strategies, therapies as well as community level interventions that could be evaluated by the other downstream nutritional programs.

The mission is to develop nutrition graduates who have

- An understanding of a cellular and molecular approach to human and clinical nutrition in the integrated “cell to society” paradigm.
- Experience of specialized cellular and molecular biology techniques applied to nutritional studies.
- An understanding of statistical methods and bio-informatics, in the design of nutrition research.
- An ability to evaluate research reports; and to review data for synthesis in scientific peer presentations
- Ability to work in a team, in either an academic setting or in industrial settings.
- Ability to undertake supervised research activities.

d. Values

These values should be based on international norms in general and current Iranian tenets in particular.

Respect for human dignity

Promotion of a right-based approach to nutrition development. International human rights standards and principles are integrated into the nutrition plans, policies and processes. (Rights-based approach is a comprehensive economic, social cultural and political process designed to constantly improve the well-being of the population and individuals, on the basis of their active, free and meaningful participation in development and in the fair distribution of the resulting benefits.)

Equity

A society’s nutritional well-being depends on ensuring that all its members feel included from the mainstream of the program. Particular attention is given to equality, equity, non-discrimination, fairness, inclusiveness and priority consideration of the vulnerable groups. This requires disaggregated data, as far as possible by ecological zone, ethnicity, language, gender, and other categories of human rights concern. Finally, it requires particular attention to the most vulnerable, giving them the opportunity to improve or maintain their well-being.

Efficiency

Results are produced that meet the needs of society while making the best use of resources at their disposal avoiding wasted time and effort. It also covers the sustainable use of natural resources and the protection of the environment.

Integrity

Maintaining the highest standards –moral, ethical and legal – without compromise in dealing with the beneficiaries/customers, colleagues and with each other and in the process earning the trust and respect by being open, honest, uprightness and honorable in words and in deeds.

Self-reliance and Self esteem

Giving people the power, capacities, capabilities and access to resources needed to ensure their own food and nutrition security.

Community service

This program should encompass any service in collaboration with governmental and local non-profit organizations for the benefit of local community designed to improve quality of life for community residents, particularly low-income individuals and vulnerable groups.

Conservation of national patrimony wise

Use and management of resources and national patrimony for the sake of future generations

Ethics

Observance of highest ethical behavior to gain and maintain public trust and respect

e. Vision

In keeping with modern concepts concerning doctoral graduates in a field of nutrition, all graduates will be expected to (1) have an awareness of the full range of nutritional science research applications, from molecular/cellular through those at the organism level (including human) and the population/community level, and (2) to exhibit competency in integrative nutritional biochemistry (metabolism).

f. Graduates role in public health

The cellular molecular nutritionist is a graduate who:

1. *Has ability to critically review literature and provide scientific advice.*

The graduate should be able to undertake problem solving exercises by critically reviewing literature and application of knowledge particularly in relation to good laboratory practice. The cellular and molecular nutritionist should also be able to design and disseminate laboratory practices and information to junior assistants.

2. *Acts as an advocate for the importance integrating nutrition considerations in other sectoral plans/programs/projects levels across various administrative levels.*
3. *Can serve as an advisor to community nutritionists, food policy and program planners.*
4. *Has competency as a research assistant and is qualified for further doctoral studie.*

As an assistant, a cellular and molecular nutritionist is expected to use their skills in managing a laboratory program. The graduate is expected to be able to understand the aims and complexities of an experimental program and translate this into effective laboratory procedures and practices.

5. *Has acquired skills of specific molecular techniques.*

The graduates should be open to evolving laboratory techniques. They must be able to absorb, evaluate and put into practice newer technologies.

g. Task analysis

1. Leadership of peripheral or community surveillance laboratory team
2. Organizer of logistics and laboratory practices
3. Preparation of scientific background and strategic interventions
4. Preparation of critically evaluated standard operating procedures
5. Assisting in the development of novel vertical nutritional and health surveillance laboratory programs to serve the needs of new nutritional and metabolic advances.
6. Development and working out the methods applicable to community nutrition research
7. Leadership of a laboratory team, in a multidimensional setting.
8. Ability to work in a larger sub-national or national team, in research and development in either academic or in private sector settings.
9. Ability to undertake supervised research activities.
10. Advocacy for the importance of nutritional health and role in national development

h. Goals and objectives

The goals of the MSc in Cellular and Molecular Nutrition program are to train nutrition graduates who can provide skills and support to addressing fundamental questions of food and nutrition sciences. The ultimate goal is to have trained professionals who can work efficiently in solving health and nutritional problems within the cell to society concept.

Specific objectives

At the end of the program, the graduate should have:

- An understanding of a cellular and molecular approach to human and clinical nutrition in the integrated “cell to society” paradigm.
- Experience of specialized cellular and molecular biology techniques applied to nutritional studies.
- An understanding of statistical methods and bio-informatics, in the design of nutrition research.
- An ability to evaluate research reports; and to review data for synthesis in scientific peer presentations
- Ability to work in a team, in either an academic setting or in industrial settings.
- Ability to undertake supervised research activities.
- Competency as a research assistant and to be qualified for further doctoral studies.
- Ability to critically review literature and provide scientific advice.
- Skill acquisition of specific molecular techniques.

i. Strategies

A strong cellular and molecular approach to nutritional problems will strengthen the evidence base for etiology, diagnostic, preventive and therapeutic interventions in solving national health problems (Norheim, 2012). The guiding philosophy will be to integrate this vision into a holistic and participatory strategy to provide a foundation for more effective and efficient health policies and programs. The strength of the cellular and molecular program is its focus on fundamental science; this will continually generate new ideas to flow into the other programs relating to communities and populations within the “cell to society” concept (National Department of Health, 2013). The program will provide for multi-functional human resource training, which will be primarily student oriented, although, in the first phase, considerable instructor training will be optimized. The course will be offered through class training with didactic lectures and practicum content, and will focus heavily on skill learning development.

Teaching Methods

Multidisciplinary seminar lectures and workshops
Case studies, problem oriented
Laboratory practicum
Interactive problem solving
Self-instructional materials
e-learning

j. Application requirements

- The acceptance requirements for a proposed candidate in the MSc program are that they should be qualified graduates of recognized universities, colleges or schools who hold Bachelor's degree in nutrition and related disciplines (see below). If they are not qualified appropriately, then they may be required to take additional courses to make up for the deficiencies without graduate credit (see below). Submission of relevant documents for admission, such as: transcript of records, copy of certificate or diploma, certificate of English proficiency, and application fee is necessary.
- Candidates are selected based on the following:
 - Interview
 - Up to date Curriculum vitae (CV)
 - Overall fit for program
- Timeline: There is no formal application deadline and interested candidates should contact the program director. Applications are encouraged at least one year prior to the proposed start date.

Quotas for students in this course will be per existing University guidelines

The following entry groups are suggested:

<u>Group A</u>	<u>Group B</u>
(Eligible for the MSc course)	(Eligible for MSc course along with prerequisite courses)
1. BSc –Nutrition	1. BSc – General Biology * 2. BSc- Laboratory Technology** 3. BSc- Molecular Biology* 4. BSc – Animal Biology (Zoology) ** 5. BSc- Genetics* 6. BSc- Chemistry*** 7. BSc- Health and Medical related courses

Prerequisite Courses

* : Basic Nutrition; Statistics

** : Basic Nutrition; Statistics; Basic Genetics.

*** : Basic Nutrition; Physiology, Statistics; Basic Genetics.

Prerequisite (Make up) Courses

At least the following:

Mandatory (for Group A & B):

<u>Course</u>	<u>Units</u>
• Laboratory techniques	1 Unit
• Computer techniques & report writing	1 Unit

As defined above for different courses in Group B:

<u>Course</u>	<u>Units</u>
• Basic Nutrition	2 Units
• Basic Genetics	2 Units
• Statistics	2 Units
• Biochemistry	3 Units
• Physiology	2 Units

k. Rationale

No such program exists in Iran.

Many scientists in different disciplines in Iran, such as Molecular Biology, Biochemistry, Immunology, Endocrinology, Pharmacology, Physiology, etc., have been involved for many years in conducting research on topics that in essence could have been categorized as Cellular and Molecular Nutrition, while they themselves have been unaware of their impact in this field.

This is very good ground, reasoning and suitable justification that establishment of Cellular and Molecular Nutrition and its institutionalization can exploit these opportunities and salvage the dispersed and spread efforts nationwide that exist presently. A further rationale for the cellular and molecular program is that by the creation of a strong cellular and molecular program, a sustained and creative effort within the “cell to society” concept is guaranteed.

Finally, the development of the cellular and molecular program is an example of the responsiveness of the scientists at Tehran University of Medical Sciences (TUMS) to the needs of society as embodied in recent government policy (Damari, 2018) while remaining in an integrated scientific model that generates ideas for evaluation and application at a community level.

l. Background information about the program in other countries

This course mirrors what is planned to be offered in the University of Vienna, Faculty of Life Sciences, Institute of Nutritional Sciences. The Masters course has a duration of 2 years and is a new course. Its content is similar to that developed in the present Iranian MSc in Cellular and Molecular Biology. Although there are masters programs in nutrition in European Universities, there is no comparable program that looks at a specific development of graduates with skills in cellular and molecular nutrition. The close juxtaposition of the MSc program in cellular and molecular nutrition, along with the MSc in nutritional epidemiology and public health nutrition makes this combined program unique in the region.

m. Required facilities

As stated in the situational analysis, the following facilities are needed:

1. Laboratories: Expansion of cell culture facilities, expansion of RT-PCR and cloning facilities plus virology and vector manipulation laboratory, microarray systems (DNA and protein), expansion of flow cytometry facilities (e.g. cell sorter), immunohistochemistry facilities, expansion of HPLC facilities (extra HPLC equipment, detectors, etc.), image capture facilities, autoradiography facilities, expansion of animal room facilities
2. Computation: Extra-computers, molecular biology software
3. Library resources: Relevant textbooks, relevant journals (online and hard copies), longer opening times for the library, carrels
4. Physical space: Office for PhD students, common room for MSc students, guest room for the invited teachers and rooms for the above mentioned laboratories.

References

Damari, B., et al., Nutrition and food security policy in the Islamic Republic of Iran: situation analysis and roadmap towards 2021. 2018. 24(02): p. 177-188.

Moslemi M; Kheirandish M; Mazaheri R; Hosseini H; Jannat B; Mofid V; et al. National food policies in the Islamic Republic of Iran aimed at prevention of noncommunicable diseases. *East Mediterr Health J.* 2020; 26(12):1556–1564.

National Department of Health. Roadmap for nutrition in South Africa 2013–2017. 2013, Department of Health Pretoria.

Norheim, F., et al., Molecular nutrition research-the modern way of performing nutritional science. 2012. 4(12): 1898-1944.

Vicente, A.M., Ballensiefen, W. & Jönsson, JI. How personalised medicine will transform healthcare by 2030: the ICPeMed vision. *J Transl Med.* 2020; 18: 180. <https://doi.org/10.1186/s12967-020-02316-w>.

World Health Organization. Nutrition in universal health coverage. World Health organization; 2019.

Chapter 2.

Program specifications

1. Duration: 2 years (4 semesters)

2. Program characteristics

Total number of units: 32 units (inclusive of 4 units of practicum and 6 units of thesis)

- Education Phase

- a) General Obligatory Courses (6 Units)

- b) Specialized Obligatory Courses (18 Units)

- c) Specialized Elective Courses (Choose 2 Units from the list below)

- Research Phase

- MSc Thesis (6 Units)

- Training

- Practical and hands-on training at different laboratories and institutions to gain specific expert skills

3. Course Titles and number of Units

- General Obligatory Courses (6 Units)

- Nutrition as an integrated discipline: cell to society(2 units theory)
- Advanced Physiology of Nutrition (2 units theory/practice)
- Population, environment and nutrition (2 units theory)

- Specialized Obligatory Courses (18 Units)

- Molecular basis for establishing nutrient intake guidelines, Research methodology in Nutritional Sciences (2 units),
- Micronutrients in Health and Disease (1 unit theory, 1 unit practice)
- Cellular and molecular biology (2 units theory, 1 units practice)
- Introduction to Genetics, Nutrition and gene regulation (2 units)
- Principles of Nutritional Immunology and Allergy (2 unit theory)
- Biostatistics, Bioinformatics (2 unit theory)
- Integrative Biochemistry and Metabolic regulation (2 unit theory), molecular markers of nutritional status, (2 unit theory)
- Advanced studies seminars (1 unit)

- Specialized Elective Courses (Choose 2 Units from the list below)

- Nutritional problems throughout the life-cycle; peculiarities of vulnerable groups (2 unit theory)
- Human ecology (1 unit theory)
- Food and nutrition toxicology, Food Safety (2 units theory)
- Nutrition in Disasters and Emergency Situation (1 unit, theory)

- Biochemical aspects of dietetics and clinical nutrition (2 unit theory)

- Make up courses

Prerequisite (Make up) Courses for students who need is (please see section ‘j’ in Chapter 1)

Mandatory (for Group A & B):

<u>Course</u>	<u>Units</u>
Laboratory techniques	1 Unit
Computer techniques & report writing	1 Unit

As defined above for different courses in Group B:

<u>Course</u>	<u>Units</u>
Basic Nutrition	2 Units
Basic Genetics	2 Units
Statistics	2 Units
Biochemistry	3 Units
Physiology	2 Units

- Dissertation

The dissertation for the Masters course is considered to be the MSc Thesis (6 Units)

Chapter 3

Index:

GENERAL OBLIGATORY COURSES (6 Units)

- Nutrition as an integrated discipline: cell to society
- Advanced Nutrition
- Population, environment and nutrition

Course Specification

Course Specification

- I. Name of the Course:** NUTRITION AS AN INTEGRATED DISCIPLINE: CELL TO SOCIETY
- II. Prerequisites:** None (meeting entry requirements for degree is sufficient)
- III. Number of Units:** 2 units
- IV. Type:** Theory
- V. Goals and Objectives:**

By the end of the course students will be able to:

(a) Describe the nature of the evidence base underpinning current nutritional recommendations for treatment and prevention of a nutritional deficiency and a nutrition related chronic disease

(b) Identify the role of the different nutrition disciplines in contributing to the evidence base for understanding and addressing nutrition issues and, will have experience in working in cross-disciplinary teams.

VI. Course Description:

The course examines the evidence base underpinning current nutritional recommendations for treatment and prevention of two important nutritional problems as case studies to identify the role of the various nutritional disciplines in contributing to policy and practice recommendations.

VII. Topics:

1. Nutritional deficiency – examination of the evidence base linking food and nutrient intakes with the deficiency in terms of:
 - 1.1 Extent and distribution internationally and in Iran
 - 1.2 Aetiology and modifying factors
 - 1.3 Recommended intakes and dietary guidelines
 - 1.4 Efficacy and effectiveness of interventions for treatment and prevention
2. Nutrition related chronic disease – examination of the evidence base linking food and nutrient intakes with the chronic disease in terms of:
 - 2.1 Extent and distribution internationally and in Iran
 - 2.2 Aetiology and modifying factors
 - 2.3 Recommended intakes and dietary guidelines

2.4 Efficacy and effectiveness of interventions for treatment and prevention

VIII. References:

Nieman D., Nutritional Assessment, 7th Edition. 2019, Mc Graw Hill.

National Institutes of Health. Dietary Supplement Fact Sheet; 2022. Washington, USA. Available online at: <https://ods.od.nih.gov/factsheets/list-all/>

Ross, A.C., et al., Modern nutrition in health and disease. 11th edition. 2020: Jones & Bartlett Learning.

US Department of Agriculture, Dietary Reference Intakes; 2022. Available online at: <https://www.nal.usda.gov/legacy/fnic/dietary-reference-intakes>.

Willett W. Nutritional Epidemiology. 3rd Edition. 2012, Oxford University Press.

IX. Student Evaluation Methods:

Brief individual Paper - Nutritional Anemia (20%)

Group report - Nutritional Anemia (30%)

Individual Paper - Coronary heart disease (20%)

Group report - Coronary heart disease (30%)

I. Name of the Course: ADVANCED NUTRITION

II. Prerequisites: Basic nutrition

III. Number of Units: 2 units

IV. Type: Theory

V. Goals and Objectives:

To give students a higher level of training in nutrition compared to what they received in Bachelor's degree training.

VI. Course Description:

Advanced knowledge of the physiology of nutrients and specific topics of modern nutrition with special emphasis on indicators of the nutritional status assessment.

VII. Topics:

- Introduction, literature
- Energy metabolism
- Dietary fiber, non-starch polysaccharides, glycemic index
- Fatty acids, emphasis on PUFAS, Trans fatty acids, conjugated linoleic acids, cholesterol metabolism
- Protein, peptides, amino acids (also D-AA), protein quality
- Micronutrients (vitamins and minerals)
- Bioactive compounds of plant foods,
- Functional Foods, food fortification, safety aspects
- Nutrition and immune function
- Nutrient and energy requirements; Food based dietary guidelines
- Public health nutrition, prevention empowerment

VIII. References:

Sources of this graduate level course would be based on state of art lecturing and most recent literature review orientation as related to course content Active and guided participation of student is sought and mandated in library and net searching and presentation on narrow topics of field.. The following are intended to provide only necessary background and principles:

Caterina, R., Martinez, A., Kohlmeier, M., Principles of Nutrigenetics and Nutrigenomics; Fundamentals of Individualized Nutrition. 1st edition. 2019, Elsevier Science.

Gropper, S., Smith, J.L., Carr, T.P., Advanced Nutrition and Human Metabolism. 7th edition. 2018. Cengage Learning Inc.

Joseph F Pierre • Metabolism of Nutrients by Gut Microbiotabooks. 1st edition. 2022, Royal Society of Chemistry.

Leninger, A., D. Nelson, and M. Cox, Lehninger principles of biochemistry. 7th edition. 2017, New York: Worth Publishers.

Maulik, N., Personalized Nutrition as Medical Therapy for High-Risk Diseases, 1st edition. 2020, CRC Press.

Raymond, J.L. and K. Morrow, Krause and mahan's food and the nutrition care process. 2020: Elsevier Health Sciences.

Ross, A.C., et al., Modern nutrition in health and disease. 11th edition. 2020: Jones & Bartlett Learning.

Sauberlich, H.E., Laboratory tests for the assessment of nutritional status. 2018: Routledge.

Corcuff, J.B., Nutrigenomics and Nutrigenetics: The Basis of Molecular Nutrition, in Molecular Basis of Nutrition and Aging. 2016, Elsevier.

Vinood B. Patel, Molecular Nutrition: Vitamins 1st Edition. 2019, Academic Press.

IX. Student evaluation methods:

Written assignments
Examinations
Group presentations
Special projects

I. Name of the Course: POPULATION, ENVIRONMENT AND NUTRITION

II. Prerequisites: None

III. Number of Units: 2 units

IV. Type: Theory

V. Goals and Objectives:

At the end of the course, the student should have a comprehensive understanding of the food and nutrition system for an in-depth and holistic perspective of food and nutrition security issues.

Specifically, the student should be able to:

- Describe the food and nutrition system as a framework for understanding the dimensions and consequences of food and nutrition security;
- Explain how the different ecological, socio-cultural, economic, technological, political and demographic factors affect food production, food distribution, food consumption and nutrient utilization; and
- Identify the critical points in the food and nutrition system for risk and vulnerability assessment.

VI. Course Description:

Ecological, socio-cultural, economic, technological, political and demographic determinants of food production, food distribution, food consumption and nutrient utilization of population groups.

VII. Topics:

- A. Review of Basic concepts in Nutrition and Development Economics
- B. Overview of the Food and Nutrition System
- C. Deconstructing Food and Nutrition Security
- D. Factors affecting the components of the Food and Nutrition System
 1. Food Availability
 - a. Food production and supply
 - i. Crop production
 - ii. Livestock production
 - iii. Fisheries production
 - iv. Post-harvest, processing and storage
 - v. Food safety
 2. Food marketing and distribution
 - a. Marketing systems
 - b. Price policies

- E. Household Food utilization and consumption
 - 1. Demographic factors
 - 2. Socio-cultural and gender issues
 - 3. Economic factors

- F. Biological utilization of food
 - 1. Environmental sanitation
 - 2. Caring capacity
 - 3. Infections and malnutrition synergism
 - 4. Access to health services

- G. Consequences of malnutrition
 - 1. Physical development
 - 2. Mental development
 - 3. Economic and work productivity

VIII. References:

Fageria, N., Growth and Mineral Nutrition of Field Crops. 3rd Edition. 2010, CRC Press.

Nieman D., Nutritional Assessment, 7th Edition. 2019, Mc Graw Hill.

Sabate, J., Environmental Nutrition; Connecting Health and Nutrition with Environmentally Sustainable Diets. 1st Edition. 2019, Elsevier.

Unisa, S., Population, Health and Environment. 1st edition. 2016, Rawat Publications.

IX. Student Evaluation Methods:

Examinations

Term paper

Causal model for specific vulnerable groups

Index:

SPECIALIZED OBLIGATORY COURSES

- Molecular basis for establishing nutrient intake guidelines, Research methodology in Nutritional Sciences (2 units),
- Micronutrients in Health and Disease (1 unit theory, 1 unit practice)
- Cellular and molecular biology (2 units theory, 1 units practice)
- Introduction to Genetics, Nutrition and gene regulation; Principles of Nutritional Immunology and Allergy (4 units)
- Integrative Biochemistry and Metabolic regulation, molecular markers of nutritional status, (2 unit theory)
- Biostatistics, Bioinformatics (2 unit theory)
- Advanced studies seminars (1 unit)

Course Specification

I. Name of the course: RESEARCH METHODOLOGY IN NUTRITIONAL SCIENCES, MOLECULAR BASIS FOR ESTABLISHING NUTRIENT INTAKE GUIDELINES.

Course Number:

II. Prerequisites: Basic Nutrition

III. Number of units: 2

IV. Type: Theory

V. Goals and Objectives:

- To induct the Master students in the methods of research in nutritional sciences. To show the Master students research units, and in particular animal research facilities
- To train the Master students how to organize research proposals and where to submit them
- Aims to provide the theoretical background of pathomechanisms of nutrition associated diseases, to define disease risk and to develop diagnostic and prediagnostic indicators of assessment. Aims to explore and understand the molecular basis and impact of nutrient based dietary guidelines.

VI. Course Description:

This course aims to teach students the basics of research methodology, and techniques, and to use this knowledge in understanding the evidence linked to the generation of nutrient based dietary guidelines.

VII. Topics

- How to determine the nutritional status in humans
- Animal experiments / alternative methodologies to animal studies
- Cell lines studies and cell research in general
- Statistical methodologies in nutrition research
- Epidemiological studies, design, types and relevance
- How to plan and organise clinical studies
- Adoption of, and establishing, (Bio) markers (DNA, RNA and proteins and intermediary metabolites) of risk for developing nutrition related disease. Definitions: minimum requirement, estimated average requirement, average intake, dietary reference intake, tolerable upper intake level of nutrients
- Nutritional status (Macro-/Micronutrients): Nutrition surveys, anthropometry, biochemical/analytical parameters (status/functional parameters, basic analytical methodology in the laboratory, sample preparation, etc.)
- Clinical trials: Pre-clinical period, Submission to the ethical commission, organisation of clinical trials, etc.
- Organisation of a research proposal, practical advice, submission guidelines, evaluation criteria

- Literature search: Organisation, data bases, search criteria, how to combine main items, etc.
- Criteria of evidence based assessment of minimum energy and nutrients requirements.
 - Essential amino acids/protein,
 - Essential fatty acids/lipids,
 - Carbohydrates,
 - Fat soluble vitamins (Retinol, Calciferol, Phylloquinone, Tocopherol),
 - Water soluble vitamins (Thiamin, Riboflavin, Pyridoxin, Niacin, Cobalamin, Folate, Biotin, Pantothenate, Ascorbate),
 - Micronutrients and trace elements (Na, K, Ca, Cl, Mg; Fe, Zn, Se, Mn, Mo, Cu, I) and ultra-trace elements.
- Criteria of disease risk-reduction and prevention of nutrition associated diseases.

VIII. Reference:

Lovegrove, J., Nutrition Research Methodologies (The Nutrition Society Textbook). 1st Edition. 2015, Wiley-Blackwell.

Nieman D., Nutritional Assessment, 7th Edition. 2019, Mc Graw Hill.

Pounis, G., Analysis in Nutrition Research: Principles of Statistical Methodology and Interpretation of the Results. 2019, Academic Press.

IX. Student evaluation methods

Written assignments
 Examinations
 Group presentations
 Special projects

Course Specification

I. Name of the course: MICRONUTRIENTS IN HEALTH AND DISEASE

Course Number:

II. Prerequisites: Basic Nutrition, Physiology

III. Number of units: 2

IV. Type:

Theory	1
Lab	1

V. Goals and Objectives: Aims to provide the student with a higher level of training in nutrition and micronutrients than what they would have received in Bachelor's degree training, along with practical training.

VI. Course Description: The micronutrients and their role in prevention and therapy of disease, including practical assessment of micronutrient status.

VII. Topics:

Theory

Minerals and Trace elements
Bioavailability of trace elements: iron, zinc, selenium, iodine
Toxic trace elements: arsenic, lead, cadmium, mercury
Vitamins: retinol/carotinoids, tocopherol, phylochinone, vitamin C, cobalamin, folate, pyridoxine, thiamine, riboflavine, niacin,
Vitamin status: requirement, deficiency, markers
Oxidative stress, micronutrients and immune function
Nutrition requirement, Nutrition recommendations
Safety aspects of nutrients, Tolerable Upper Intake Level (UL)
Public Health, prevention empowerment

Lab:

Status of vitamins and minerals: static and functional parameters/markers
Assessment of parameters of oxidative stress (MDA, CD)
Nutrient deficiency anemia, characterization: vitamin B12/folate/iron and others

VIII. Reference:

Ross, A.C., et al., Modern nutrition in health and disease. 11th edition. 2020: Jones & Bartlett Learning.

Vinood B. Patel, Molecular Nutrition: Vitamins 1st Edition. 2019, Academic Press.

IX. Student evaluation methods

Written assignments

Examinations

Group presentations

Special projects

Course Specification

I. Name of the course: CELLULAR AND MOLECULAR BIOLOGY

Course Number:

II. Prerequisites: Basic genetics, molecular biology, biochemistry

III. Number of units: 3

IV. Type:

Theory	2
Lab	1

V. Goals and Objectives: Aims to provide an advanced knowledge of cellular and molecular biology, along with exposure to techniques such as cell culture, cloning, and other research methods.

VI. Course Description

Theory and lab based course which introduces genomic sciences to the student, through basic and classical genetics as well as modern methods of genotypic and phenotypic analysis, related to transcription and functional genomics. A basic grounding in relating these variables to nutritional status and nutrition associated disease is also given.

VII. Topics:

Theory and practice:

Genome sequences

Techniques & Organisms

How to sequence a genome

Data management of large sequences – local and remote, www-sources, retrieval of sequences,

Results of genome sequences, implications for everyday scientific work, implications for everyone (molecular signatures)

Transcriptome analysis, mRNA-profiling

Techniques; from sequenced genome to spotted cDNA,

Microarray experiments: scope, design and evaluation, impact on current biological approaches

Proteomics

from DNA-sequence to proteome, ORF assignment (also bioinformatics),

Genome-wide proteome analysis, 2-D Gels,

Mass spectroscopy methods,

Genome wide determination of protein modification (phosphorylation, glucosylation, acetylation, methylation)

Functional genomics

Saccharomyces cerevisiae as a pioneer how to generate 15.000 yeast

strains

Genome-wide interaction screens, functional display, how to knock out the worm, fly and mouse; and what to do then

Blending: on the importance of the combination of techniques

VIII. Reference:

Bergtrom, G., Basic Cell and Molecular Biology: What We Know & How We Found Out. 4th Edition. 2018, University of Wisconsin, Milwaukee.

Lodish, H., Molecular Cell Biology. 9th Edition. 2021, W. H. Freeman.

Ross, A.C., et al., Modern nutrition in health and disease. 11th edition. 2020: Jones & Bartlett Learning.

IX. Student evaluation methods

Written assignments

Examinations

Group presentations

Special projects

Course Specification

I. Name of the course: INTRODUCTION TO GENETICS, NUTRITION AND GENE REGULATION; PRINCIPLES OF NUTRITIONAL IMMUNOLOGY AND ALLERGY

Course Number:

II. Prerequisites: Basic Genetics

III. Number of units: 4

IV. Type: Theory

V. Goals and Objectives: Enable the students to comprehend gene structure and functions and their role in human and plant metabolism and the geneses of diseases. Aims to provide a comprehensive course on immunology with specific reference to the modulating effect of nutrition on immune function, assessment of immune response and food allergies.

VI. Course Description: Aims to provide information on regulation and interactions between nutrients and genomics. The lectures start with the theoretical basis of immunology (nomenclature, general properties, humoral factors, cells, tissues and organs of the immune system. A detailed review on innate immunology, involving antigen recognition, the structure and function of immunoglobulins, antigen capture/presentation, furthermore major histocompatibility complex, T-cells, T-cell receptors and their diversity are presented. MHC-restriction of T-cells and all other important elements of the cellular and humoral immune responses are also discussed in details.

VII. Topics:

Introduction to basic genetics and genomics

The structure and function of genes, genetic inheritance and recombination

Interactions of genes and environment, genetic mutations; chromosomal mutations, aberrations

The Genetics of bacteria and phages; recombinant DNA technology and its application

Regulation of gene transcription; regulation of cell number: normal and cancer cells

Basics of developmental genetics, population and evolutionary genetics; quantitative genetics

The organization of the genome; transcriptomes, proteomes; new perspectives in the post-genomic era: immunogenomics, pharmacogenomics

For and against genetically modified foods (Pros and contras), plant and animal gene banks

Genetics and nutrition, some clinical examples: Genetics of obesity, hyperlipoproteinemias, diabetes mellitus, food-hypersensitivities; genetic background of the most common disorders of the gastrointestinal tract

Basics of immune tolerance and autoimmunity

Nutritional aspects of immunology
Immune-defense system of the gastrointestinal tract
Specific hypersensitivity diseases, food allergies (diagnostic steps, therapeutical approaches, primary and secondary prevention)
Common food allergens and cross-allergens
Allergic diseases, inflammatory bowel diseases (IBD), inflammatory disorders of the gastrointestinal system
Nutritional immunology, breast feeding and formula feeding

VIII. Reference:

Berdanier, C., Nutrition and Gene Expression. 1st Edition. 2017, CRC Press.

Gershwin, E., Nutrition and Immunology: Principles and Practice. 4th Edition. 2000, Springer.

Joseph F Pierre • Metabolism of Nutrients by Gut Microbiotabooks. 1st edition. 2022, Royal Society of Chemistry.

Lodish, H., Molecular Cell Biology. 9th Edition. 2021, W. H. Freeman.

IX. Student evaluation methods

Written assignments
Examinations
Group presentations
Special projects

Course Specification

I. Name of the course: INTEGRATIVE BIOCHEMISTRY AND METABOLIC REGULATION

Course Number:

II. **Prerequisites:** Biochemistry

III. **Number of units:** 1

IV. **Type:** Theory

V. **Goals and Objectives:** Aims to provide the student with a higher level in biochemistry than what they would have received in Bachelor's degree training.

VI. **Course Description:** Aims to outline nutritional aspects of integration of biochemical pathways (macronutrients) in normal and pathological conditions. Aims to provide a comprehensive review of intermediary metabolism and its integration and regulation.

VII. Topics:

- General regulation mechanisms
- Signal transduction
- Intracellular receptors
- Digestion
- Energy metabolism of the muscle
- Blood glucose regulation
- Lipid metabolism
- Acid-base-balance
- Water and electrolyte balance
- Calcium and phosphate metabolism
- Thermogenesis

VIII. Reference:

Leninger, A., D. Nelson, and M. Cox, Lehninger principles of biochemistry. 7th edition. 2017, New York: Worth Publishers.

IX. Student evaluation methods

- Written assignments
- Examinations
- Group presentations
- Special projects

Course Specification

I. Name of the course: BIostatistics and Bioinformatics

Course Number:

II. Prerequisites: Statistics and basic molecular biology

III. Number of units: 2

IV. Type:

Theory

V. Goals and Objectives: The course provides – along with the practical part – competency of solving problems with standard methods of biometry. Students acquire the skills to build statistical models, to select the appropriate method and to interpret the results.

VI. Course Description: Methods of biometry and statistical analysis relevant to the CMN program. Describing the human genome, data basing of genotypic and phenotypic information.

VII. Topics:

Introduction in statistical functions of MS Excel and SPSS
Introduction to testing: 1- and 2-sample comparison of metric and dichotomous population
1-factorial ANOVA
Correlation and one-way linear regression
Test planning: planning of sample size
Computers & applications for Bioinformatics
Calculus of probabilities
Probability distribution
Parameter estimation
Correlation and regression
Probability calculation
Feature types, discrete and continuous variates, distributions
One-dimensional data description, sample average, sample variance, confidence intervals
Database & Database Queries,
DNA & protein sequence analysis,
Proteomics,
Genomics DNA sequences,
Annotation & Data Mining Scripts,
Gene finding, gene modeling, molecular modeling & structure prediction,
Bimolecular interactions (viz. DNA-protein interaction, protein-protein interaction, protein-ligand interaction and protein-cofactor interaction)

Application of Bioinformatics in pharmacogenomics, biodiversity,
taxonomy and phylogenetics

VIII. Reference:

Donato, L., Advances in Bioinformatics, Biostatistics and Omics Sciences. 1st Edition. 2020, Bentham Science Publishers.

Zhao, Y., New Frontiers of Biostatistics and Bioinformatics. 1st Edition. 2018, Springer.

IX. Student evaluation methods

Written assignments

Examinations

Group presentations

Special projects

Course Specification

I. **Name of the course:** ADVANCED STUDIES SEMINARS

Course Number:

II. **Prerequisites:** Should be held in the 3rd and 4th semesters.

III. **Number of units:** 1

IV. **Type:** Internship

V. **Goals and Objectives:** Students learn to present seminars (and actively participate in guided discussion).

VI. **Course Description:**

Course mentor assigns a specific theme of actual topic in nutrition research or the student prepares a presentation of own research work and results, develops an interpretation of results and defends his own position.

VII. **Topics:**

To be proposed by the mentor according to students level and advancement.

VIII. **Reference:**

IX. **Student evaluation methods:**

Grading of performance (in different aspects such as presentation, interpretation, content and discussion) by faculty and peers

INDEX

SPECIALIZED ELECTIVE COURSES

- Nutritional problems throughout the life-cycle; peculiarities of vulnerable groups (1 unit theory)
- Human ecology (1 unit theory)
- Food and nutrition toxicology, Food Safety (2 units theory)
- Nutrition in Disasters and Emergency Situation (1 unit, theory)
- Biochemical aspects of dietetics and clinical nutrition (1 unit theory)

Course Specification

I. **Name of the course:** NUTRITIONAL PROBLEMS THROUGHOUT THE LIFE-CYCLE;
PECULIARITIES OF VULNERABLE GROUPS

Course Number:

II. **Prerequisites:** Advanced nutrition, Molecular basis for establishing nutrient requirements and Micronutrients in health and disease

III. **Number of units:** 1

IV. **Type:** Theory

V. **Goals and Objectives:** Aims to provide comprehensive and detailed information on cellular and molecular mechanisms throughout the life-cycle ranging from genetics to intermediary metabolism and markers of risk, and to apply this to understanding the peculiarities of vulnerable populations.

VI. **Course Description:** Peculiarities of nutritional requirements throughout the life cycle as well as related nutritional problems.

VII. Topics:

Nutrition of pregnant women and nursing mothers

Nutrition of babies and children

Nutrition of the elderly

Body composition, changes with age

Nutritionally relevant biochemical and physiological changes

Energy and nutritional requirements and advice on their supply

Feeding time requirements and contents of the food; choice of food

Specific nutritional problems and risks

Health optimizing nutrition physiological measures

Nutritional problems and feeding strategies/catering systems for elderly people (free living and in nursing homes).

VIII. Reference:

Brown, J., Nutrition through the Life Cycle. 6th Edition. 2016, Cengage Learning.

Devine, A., Nutrition and Vulnerable Groups. 1st Edition. 2019, Mdpi AG.

IX. Student evaluation methods:

Written assignments

Examinations

Group presentations

Special projects

Course Specification

I. **Name of the course:** HUMAN ECOLOGY

Course Number:

II. **Prerequisites:** Advanced nutrition, basic biology and chemistry

III. **Number of units:** 1

IV. **Type:** Theory

V. **Goals and Objectives:** Aims to provide students with integrative aspects in man – ecosystem – sustainability.

VI. **Course Description:** Outlining interactions between man and his macro- and micro-environment, with relevance to the cell-to-society concept.

VII. **Topics:**

Changes in the biosphere due to mankind and conversely effects of the altered biosphere on humans

Atmosphere balance, ozone problem, greenhouse gas and climate change

Energy resource problem

Accumulation of environmental toxins

Biotope and species extinction

Risk of radioactivity

Population growth, soil erosion and world hunger

Ecology and principles of sustainable development

VIII. **Reference:**

Bates, D., Human Ecology; Contemporary Research and Practice. 2010, Springer Science & Business Media.

Steiner, F. Human Ecology: How Nature and Culture Shape Our World. 1st Edition. 2016, Island Press.

IX. **Student evaluation methods:**

Written assignments

Examinations

Group presentations

Special projects

Course Specification

I. Name of the course: FOOD TOXICOLOGY

Course Number:

II. **Prerequisites:** Basic nutrition, biochemistry and Cellular, Molecular Biology

III. **Number of units:** 1

IV. **Type:** Theory

V. **Goals and Objectives:** Aims to provide the background of nutritional assessment within the risk analysis in the field of food and nutrition sciences.

VI. **Course Description:** Application of methods of toxicological assessment to food quality and safety.

VII. Topics:

Principles of toxicology: toxicity tests, units, definitions, etc.
Antinutrients and toxicants occurring naturally in plant foods
Mushroom toxins
Seafood toxins and poisoning
Fungal toxins
Bacterial toxins, Prions, Toxicants resulting from food processing
Drug residues
Herbicides, pesticides: residues and contamination
Contaminants: Toxic metals, nitrite/nitrate, etc.
Food additives

VIII. Reference:

Bagchi, D., Food Toxicology. 1st Edition. 2016, CRC Press.

Galanakis, C., Food Toxicology and Forensics. 1st Edition. 2020, Elsevier Science.

IX. Student evaluation methods

Written assignments
Examinations
Group presentations
Special projects

X. Course Specification

I. Name of the course: NUTRITION IN DISASTERS AND EMERGENCY SITUATIONS

Course Number:

II. Prerequisites: Basic nutrition, nutrition through the lifecycle, Molecular basis for establishing nutrient intake guidelines

III. Number of units: 1

IV. Type: Theory

V. Goals: The goal is to train students in understanding the steps in developing feeding programs in famine and disasters. The students should be able to rapidly assess nutritional status of populations at risk and work out their basic nutrient requirements.

VI. Course Description: Course will demonstrate, through theory lectures, the history of feeding programs during famine and disasters. Students will be taught the theory of estimating risk and nutrient requirements in populations and the issues surrounding interventions and food aid.

VII. Topics:

1. Strategies to maintain nutrition security in disasters
2. Design and implementation of feeding programs
3. Food aid: forms, means and efficiency

VIII. Reference:

Save the Children Fund, Emergency Nutrition Assessment: Guidelines for Field Workers. 2004, Save the Children Fund.

World Health Organization. Food and nutrition needs in emergencies. 2004, WHO.

IX. Student evaluation methods

Written assignments
Examinations
Group presentations
Special projects

X. Course Specification

I. Name of the course: BIOCHEMICAL ASPECTS OF DIETETICS AND CLINICAL NUTRITION

Course Number:

II. **Prerequisites:** Biochemistry, Physiology, Advanced Nutrition

III. **Number of units:** 1

IV. **Type:** Theory

V. **Goals and Objectives:** Aims to provide an exposure to molecular diagnostic techniques in nutrition related disease. It also aims to provide the biochemical basis of corresponding nutritional therapies.

VI. **Course Description:** The course provides nutrition-based therapeutical actions for selected nutrition related diseases. Epidemiological data, pathophysiological mechanisms and other therapeutical possibilities are shown.

VII. Topics:

- Obesity
- Hyperlipidaemia
- Hypertension
- Diabetes mellitus and other metabolic disorders
- Gout
- Atherosclerosis: primary and secondary prevention
- Gastroenterological diseases
- Cancer
- Malnutrition (PEM, marasm, kwashiorkor)
- Anemia
- Parenteral and enteral nutrition (nutrient based and chemically defined formulae for artificial nutrition)

VIII. Reference:

Devlin, T., Textbook of Biochemistry with Clinical Correlations. 8th Edition. 2019, Wiley.

Leninger, A., D. Nelson, and M. Cox, Lehninger principles of biochemistry. 7th edition. 2017, New York: Worth Publishers.

IX. Student evaluation methods

- Written assignments
- Examinations
- Group presentations
- Special projects

x. Research Project leading to MSc THESIS

6 UNITS

Review of Courses according to sufficient level
of awareness, competency and proficiency
(based on design of course outline)

Courses	Awareness	Competency	Proficiency
General Obligatory Courses (6 Units)			
Nutrition as an integrated discipline: cell to society: advanced level case studies CVD and Anemia (2 units, theory)	√		
Advanced Physiology of Nutrition (2 unit theory)	√		
Population, environment and nutrition (2 units theory)	√		
Specialized Obligatory Courses (18 Units)			
Molecular basis for establishing nutrient intake guidelines, Research methodology in Nutritional Sciences (2 units),		√	
Micronutrients in Health and Disease (1 unit theory, 1 unit practice)		√	
Cellular and molecular biology (2 units theory, 1 units practice)			√
Introduction to Genetics, Nutrition and gene regulation, Principles of Nutritional Immunology and Allergy (4 units)			√
Integrative Biochemistry and Metabolic regulation, molecular markers of nutritional status (2 unit theory),			√
Biostatistics, Bioinformatics (2 unit theory)			√
Advanced studies seminars (1 unit)			√
Specialized Elective Courses (Choose 2 Units)			
Nutritional problems throughout the life-cycle; peculiarities of vulnerable groups (2 unit theory)		√	
Human ecology (1 unit theory)		√	
Food toxicology (1 unit theory)			√
Food Safety (1 unit theory)			√

Nutrition in Disasters and Emergency Situation (1 unit, theory)		√	
Practical course in computing techniques and report writing (1 unit practice)		√	
Interventions in food and nutrition (1 unit theory)		√	
Biochemical aspects of dietetics and clinical nutrition (2 unit theory)			√

Chapter 4

Program Evaluation

1. Evaluation Process

Internally, by University committees set up for the purpose, and externally, by invited international review. The review will be done by several methods: by interviewing program graduates (past and present), interviews with faculty members and peer reviewed evaluation of program content and delivery.

2. Evaluation Frequency

The evaluation will be conducted 3 years after start up and every 2 years thereafter.

3. Evaluation Tools

Evaluations tools will include recruitment rates of students, student satisfaction, student performance, an evaluation of percentage of students passing in the stipulated time, dropout rates, faculty development, and devolution of expertise from external sources to internal faculty, networking, job placement, progress of students to PhD courses, and acceptance of graduates in public domain.

4. Criteria for each tool

These have to be developed. Ideally, criteria like satisfaction, pass rate, employment rate would be set at 100%, however, in a pragmatic fashion, one would expect to have a high student satisfaction rate in the beginning of the program, but only expect a high rates of successful outcome indicators such as employment rate, or progress to a higher degree with success, to happen once the program has matured.