# Syllabus*: Molecular Nutrition (2405021713)

## Second Semester 2025/2026

| COURSE INFORMATION | |
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| **Course Name:** Molecular Nutrition<br>**Semester:** Second<br>**Department:** Department of Clinical Nutrition and Dietetics<br>**Faculty: Applied Medical Sciences** | **Course Code: 2405021713**<br>**Section:**<br>**Core Curriculum**: Elective |
| **Day(s) and Time(s):** Monday: 14:00-15:15<br>Wednesday: 14:00-15:15<br>**Classroom:** **To be Decided later** | **Credit Hours:** **3 (Theory)**<br>**Prerequisites**: |

## COURSE DESCRIPTION

Nutrition and Cell Biology: Molecules of the cells; Cell membranes and enzymes; cellular mechanisms in relation to Nutrition and Exercise; Nutrigenetics and Nutrigenomics. Nutrition and Metabolic dysregulation: The role of food bioactive compounds in inflammatory disease; Nutritional and Exercise strategies for obesity, metabolic syndrome and diabetes; Nutritional and Exercise strategies for cancer; The role of nutrition and exercise in gut health. Personalized/precision nutrition: Dietary treatment for inherited conditions/diseases; Role of food bioactive compounds in gene expression; Effects of dietary manipulation on genotypes (epigenetics); Future nutrition challenges using Omics technology; Use of microbiome as a predictor of metabolic disease.

## DELIVERY METHODS

The course will be delivered through a combination of active learning strategies. These will include:

- PowerPoint lectures and active classroom-based discussion
- Collaborative learning through small groups acting in an interdisciplinary context.
- Relevant films and documentaries
- Video lectures
- E-learning resources: e-reading assignments and practice quizzes through Model and Microsoft Team

## FACULTY INFORMATION

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| **Name** | **Dr. Allalddin Alqatatsheh** |
| **Academic Title:** | **Associate Professor** |
| **Office Location:** | **Department of Clinical Nutrition** |
| **Telephone Number:** | |
| **Email Address:** | **a.qatatsheh@hu.edu.jo** |
| **Office Hours:** | **Sunday** 9:30- 10:30, 11:30-12:30<br>**Tuesday** 11:30-12:30<br>*Please send an e-mail **(a.qatatsheh@hu.edu.jo**) to meet at any other time.* |

## REFERENCES AND LEARNING RESOURCES

**Required Textbook:**

**"Molecular Nutrition: A Guide to the Nutrient Genome" by Stephanie R. Faulkner & Sarah A. I. Johnson**

**Additional Resources Suggested**:

1. Nutrigenomics and Nutrigenetics in Functional Foods and Personalized Nutrition" by M. I. G. R. Lopes
2. Molecular Nutrition and Genomics: Implications for Health and Disease" edited by M. M. Prakash, D. A. de Vries, and L. S. Crowley

**Useful Web Resources**: original and review articles from google scholar, PubMed, ….

## ACADEMIC SUPPORT

It is The Hashemite University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their instructor to ensure that their individual needs are met. The University, through its Special Need section will exert all efforts to accommodate for individual's needs.

**Special Needs Section:**

**Tel:**
**Location:**
**Email**: **a.qatatsheh@hu.edu.jo**

| STUDENT LEARNING OUTCOMES MATRIX* | | | | |
|---|---|---|---|---|
| **Core Curriculum Learning Outcomes** | **Program Learning Outcomes** | **course objectives** | **Course Student Learning Outcomes** | **Assessment Method** |
| Understanding Nutrient Metabolism at the Molecular Level | (KP1) Students will be able to explain the biochemical and molecular processes by which nutrients (proteins, carbohydrates, fats, vitamins, minerals) are metabolized in the body. | 1. Understand the biochemical pathways of nutrient metabolism. Students will demonstrate a comprehensive understanding of how macronutrients (carbohydrates, proteins, and fats) and micronutrients (vitamins, minerals) are metabolized at the molecular level in the human body.<br>2. Apply nutrigenomics principles to human health; students will learn the concept of nutrigenomics and its role in influencing gene expression, particularly how dietary components | 1. CLO1: Demonstrate an understanding of the molecular mechanisms of nutrient metabolism, and describe the biochemical pathways involved in the metabolism of macronutrients (carbohydrates, proteins, and fats) and micronutrients (vitamins, minerals) at the molecular level.<br>2. CLO2: analyse the role of nutrients in gene expression and health, and apply principles of **nutrigenomics** to understand how specific nutrients modulate gene expression and contribute to health outcomes such as disease risk, inflammation, and metabolic disorders.<br>3. CLO3: critically evaluate the impact | **EXAM** |
| | (KP2) Describe the pathways of nutrient absorption, digestion, and metabolism, and how these processes impact cellular function. | | | |
| Understanding Mechanisms of Nutrient-Gene Interactions | (KP3) Students will understand how nutrients influence gene expression, and how genetic variation can affect nutrient metabolism and health outcomes. | | | **CASE STUFY ANALYSIS** |
| | (KP4) Explain the principles of nutrigenomics and describe how specific nutrients can alter gene expression and influence health risks such as obesity, diabetes, and cardiovascular diseases. | | | |
| Understanding Epigenetic Modifications in Response to Diet | (SP1): Students will be able to analyze how dietary factors lead to epigenetic changes that affect gene expression without altering the underlying DNA sequence. | | | |
| Exploring the impact of Microbiome on Nutrient Metabolism and Health | (SP2): Students will understand the role of the gut microbiome in nutrient digestion and absorption, and how it interacts with host metabolism. | | | **PRESENTATIONS** |
| | (SP3): Analyze the relationship between the gut microbiome and the absorption of nutrients like fiber, vitamins, and minerals, and how this impacts immune function and metabolic health. | | | **EXAM** |
| Identify molecular Basis of Nutrient Deficiencies and Toxicities | (SP4): Students will be able to identify the molecular mechanisms that underlie the health consequences of nutrient deficiencies and toxicities. | | | **REVIEW ARTICLE** |

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| | (CP1): Discuss the molecular mechanisms of diseases caused by vitamin or mineral deficiencies, such as scurvy (vitamin C deficiency) or rickets (vitamin D deficiency). | interact with genetic variations to affect health and disease.<br>3. Analyze the role of epigenetics in diet-disease relationships; students will be able to explain how dietary components influence epigenetic modifications such as dna methylation and histone modification, and how these changes can impact long-term health outcomes.<br>4. investigate the impact of the gut microbiome on nutrient absorption and health; students will explore how the gut microbiome interacts with the digestive system and the broader impact of microbiota on nutrient bioavailability | of epigenetic modifications on health.<br>4. CLO4: Investigate the Relationship Between the Gut Microbiome and Nutrient Absorption<br>5. CLO5: Identify the Molecular Mechanisms of Nutrient Deficiencies and Toxicities<br>6. CLO6: Design and Evaluate Personalized Nutrition Plans Based on Molecular Insights<br>7. CLO7: Effectively Communicate Complex Molecular Nutrition Concepts | |
| Integrating Nutritional Science with Disease Prevention | (CP3): Students will demonstrate how knowledge of molecular nutrition can be applied to disease prevention and personalized nutrition strategies. | | | |
| The ability to do critical Analysis of Molecular Nutrition Research | (CP4): Students will develop the ability to critically evaluate primary research in molecular nutrition, assessing methodology, results, and implications. | | | |
| | (CP5): Critically review recent studies on the role of specific nutrients in disease prevention or treatment, identifying strengths, weaknesses, and future research directions. | | | |

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| | | and metabolic health**.**<br>5. identify the molecular basis of nutrient deficiencies and toxicities; students will investigate the molecular mechanisms underlying nutrient deficiencies and toxicities and understand their physiological consequences**.**<br>6. Evaluate scientific research in molecular nutrition; students will critically analyze scientific literature on molecular nutrition, focusing on study design, methodologies, and the molecular mechanisms studied**.**<br>7. Design personalized nutrition plans based on molecular | | |

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| | | principles; students will be able to apply principles from molecular nutrition to create personalized nutrition strategies that take into account genetic, biochemical, and metabolic factors**.** | | |

## COURSE REGULATIONS

***Participation***

Class participation and attendance are important elements of every student's learning experience at The Hashemite University, and the student is expected to attend all classes. A student should not miss more than 15% of the classes during a semester. *Those exceeding this limit of 15% will receive a failing grade regardless of their performance*. It is a student's responsibility to monitor the frequency of their own absences. **Attendance record begins on the first day of class irrespective of the period allotted to drop/add and late registration. It is a student's responsibility to sign-in; failure to do so will result in a non-attendance being recorded.**

In exceptional cases, the student, with the instructor's prior permission, could be exempted from attending a class provided that the number of such occasions does not exceed the limit allowed by the University. The instructor will determine the acceptability of an absence for being absent. A student who misses more than 25% of classes and has a valid excuse for being absent will be allowed to withdraw from the course.

***Plagiarism***

Plagiarism is considered a serious academic offence and can result in your work losing marks or being failed. HU expects its students to adopt and abide by the highest standards of conduct in their interaction with their professors, peers, and the wider University community. As such, a student is expected not to engage in behaviours that compromise his/her own integrity as well as that of the Hashemite University.

Plagiarism includes the following examples and it applies to all student assignments or submitted work:

- **Use of the work, ideas, images or words of someone else without his/her permission or reference to them.**
- **Use of someone else's wording, name, phrase, sentence, paragraph or essay without using quotation marks.**
- **Misrepresentation of the sources that were used.**

**The instructor has the right to fail the coursework or deduct marks where plagiarism is detected**

***Late or Missed Assignments***

In all cases of assessment, students who fails to attend an exam, class project or deliver a presentation on the scheduled date without prior permission, and/or are unable to provide a medical note, will automatically receive a fail grade for this part of the assessment.

- Submitting a term paper on time is a key part of the assessment process. Students who fail to submit their work by the deadline specified will automatically receive a 10% penalty.

Assignments handed in more than 24 hours late will receive a further 10% penalty. Each subsequent 24 hours will result in a further 10% penalty.

- In cases where a student misses an assessment on account of a medical reason or with prior permission; in line with University regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

***Student Complaints Policy***

Students at The Hashemite University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

## COURSE ASSESSMENT

***Course Calendar and Assessment***

Students will be graded through the following means of assessment and their final grade will be calculated from the forms of assessment as listed below with their grade weighting taken into account. The criteria for grading are listed at the end of the syllabus

| Assessment | Grade Weighting | Deadline Assessment |
|---|---|---|
| *Midterm Exam* | *30%* | *Will be decided at the beginning of the semester* |
| Case study analysis and presentations | 20% | Presentations after midterm Case study 10 May |
| Review paper | 10% | 30 May |
| Final exam | 40% | Week 16 |

**Description of Exams**

Test questions will primarily come from material presented in the lectures. Semester exams will be conducted during the regularly scheduled lecture period. The exam will consist of a combination of multiple-choice, short-answer, match, true-and-false, and/or descriptive questions.

**Case Study Analysis**

Purpose: To evaluate students' ability to apply molecular nutrition concepts to real-world scenarios.

Format: Provide a detailed case study (e.g., a patient with a specific condition like obesity or cardiovascular disease) and ask students to analyze it, considering molecular mechanisms and nutrition interventions.
Example: “A patient with type 2 diabetes presents with high blood sugar and low HDL cholesterol. Analyze the role of nutrition, genetics, and molecular mechanisms that might be contributing to these symptoms. Propose dietary interventions.”
Rationale: Case studies assess both the depth of understanding and the ability to apply knowledge to practical situations.

**Review paper:**

Purpose: To assess students’ ability to engage with primary scientific literature, synthesize information, and communicate complex ideas clearly.
Format: Students select a topic related to molecular nutrition (e.g., the impact of micronutrients on gene expression) and write a well-researched, evidence-based paper.
Example: “Write a review article on the role of the gut microbiome in the absorption and metabolism of dietary fiber and its implications for metabolic health.”
Rationale: This assessment encourages independent research, critical analysis of scientific literature, and the development of scholarly writing skills.

**Presentations (Individual or Group)**

Purpose: To evaluate students’ ability to synthesize and communicate complex molecular nutrition topics to both scientific and general audiences.
Format: Students prepare an oral presentation on a selected topic in molecular nutrition and present it to the class, followed by a Q&A session.
Example: “Prepare a presentation on the molecular mechanisms through which omega-3 fatty acids impact inflammatory pathways, tailored for a general audience.”
Rationale: Presentations assess verbal communication skills, the ability to simplify complex information, and the integration of molecular nutrition knowledge.

**Grades are not negotiable and are awarded according to the following criteria*:**

| Letter Grade | Description | Grade Points |
|---|---|---|
| A+ | Excellent | 4.00 |
| A | | 3.75 |
| A- | | 3.50 |
| B+ | Very Good | 3.25 |
| B | | 3.00 |
| B- | | 2.75 |
| C+ | Pass | 2.50 |
| C | Pass | 2.25 |
| C- | Fail | 2.00 |

## WEEKLY LECTURE SCHEDULE AND CONTENT DISTRIBUTION

***"Lecture hours and weeks are approximate and may change as needed"***

Note: For Chem 101 sections with 2 lecture periods per week (S/T, M/W or T/R), one lecture period covers 1.5 lecture hours (80 minutes). The course content specifies the sections in chapters 1-10 of the textbook that will be included in homework's and exams.

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| ***Chapter 1*** | **Introduction to Molecular Nutrition** | **Week 1** | **3 lecture hours** |
| **1. 7** | **The Intersection of Nutrients and Genetics** | | |
| **1. 8** | **Importance of Nutritional Genomics in Health and Disease** | | |
| **1. 9** | **Key Concepts in Molecular Nutrition** | | |
| ***Chapter 2*** | **Basic Biochemistry and Molecular Biology in Nutrition** | **Week 2/3** | **4 lecture hours** |
| **2. 3** | **Carbohydrates, Fats, Proteins, and Micronutrients** | | |
| **2. 4** | **Absorption and Transport of Nutrients** | | |
| **2. 7** | **Metabolic Pathways (Glycolysis, Citric Acid Cycle, ETC, etc.)** | | |
| ***Chapter 3*** | **Nutrigenomics and Gene Expression** | **Week 3-4** | **5 lecture hours** |
| **3. 1** | **The Basics of Nutrigenomics** | | |
| **3. 2** | **Mechanisms of Gene-Nutrient Interaction** | | |
| **3. 3** | **Examples of Gene-Nutrient Interactions in Health and Disease** | | |
| ***Chapter 4*** | **Epigenetics and Diet** | **Week 5-6** | **6 lecture hours** |
| **4. 1** | **Introduction to Epigenetics** | | |
| **4. 2** | **The Role of Diet in Epigenetic Regulation** | | |
| **4. 5** | **Long-Term Health Implications of Epigenetic Changes** | | |
| ***Chapter 5*** | **The Microbiome and Nutrient Metabolism** | **Week 7** | **3 lecture hours** |
| **5.1** | **Gut Microbiota and Metabolic Health** | | |
| **5. 4** | **How the Microbiome Affects Nutrient Bioavailability** | | |
| **5. 5** | **Diet-Microbiome Interactions and Their Impact on Disease** | | |
| ***Chapter 6*** | **Personalized Nutrition and the Role of the Genome** | **Week 8-9** | **4 lecture hours** |
| **6. 1** | **Introduction to Personalized Nutrition** | | |
| **6. 5** | **Genomic Variability and Nutritional Needs** | | |
| **6. 6** | **Nutritional Interventions Based on Genetic Profiles** | | |
| ***Chapter 7*** | **Nutrient Signaling and Molecular Pathways** | **Week 9-10** | **4 lecture hours** |
| **7. 1** | **Molecular Pathways Involved in Nutrient Signaling** | | |
| **7. 8** | **The Role of Nutrients in Metabolic Diseases** | | |
| ***Chapter 8*** | **Nutritional Interventions and Disease Prevention** | **Week 11** | **2 lecture hours** |
| **8. 1** | **Nutritional Modulation of Genetic Risk Factors** | | |
| **8. 5** | **Nutritional Interventions in Public Health** | | |
| ***Chapter 9*** | **The Future of Molecular Nutrition** | **Week 11-13** | **5 lecture hours** |
| **9. 1** | **Emerging Research in Nutritional Genomics** | | |
| **9. 2** | **Technological Advancements in Nutrigenomic Testing** | | |
| **9. 4** | **Ethical and Social Implications of Personalized Nutrition** | | |
| ***Review*** | | ***Week 15*** | |
| **University Exams** | | ***Week 16*** | |
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## Assessment Rubrics

| Classroom Participation: Assessment Criteria | | | | | |
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| **Criteria** | **Quality** | | | | **Score** |
| | **Excellent (4 points)** | **Good (3 points)** | **Satisfactory (2 points)** | **Needs Improvement (1 points)** | |
| **Degree to which student integrates course readings into classroom participation** | - often cites from readings;<br>- uses readings to support points;<br>- often articulates "fit" of readings with topic at hand. | -occasionally cites from readings;<br>- sometimes uses readings to support points;<br>-occasionally articulates "fit" of readings with topic at hand . | -rarely able to cite from readings;<br>- rarely uses readings to support points;<br>- rarely articulates "fit" of readings with topic at hand | -unable to cite from readings;<br>-cannot use readings to support points; cannot articulates "fit" of readings with topic at hand . | |
| **Interaction / participation in classroom discussions** | -always a willing participant, responds frequently to questions;<br>- routinely volunteers point of view . | -often a willing participant,<br>- responds occasionally to questions;<br>- occasionally volunteers point of view . | -rarely a willing participant,<br>- rarely able to respond to questions;<br>- rarely volunteers point of view . | -never a willing participant.,<br>- never able to respond to questions;<br>- never volunteers point of view . | |
| **Interaction /participation in classroom learning activities** | -always a willing participant;<br>-acts appropriately during all role plays;<br>- responds frequently to questions;<br>- routinely volunteers point of view. | -often a willing participant;<br>-acts appropriately during role plays;<br>- responds occasionally to questions;<br>-occasionally volunteers point of view. | -rarely a willing participant.<br>-occasionally acts inappropriately during role plays;<br>- rarely able to respond to direct questions;<br>-rarely volunteers point of view . | -never a willing participant<br>- often acts inappropriately during role plays;,<br>- never able to respond to direct questions;<br>- never volunteers point of view. | |
| **Demonstration of professional attitude and demeanor** | -always demonstrates commitment through thorough preparation;<br>- always arrives on time;<br>- often solicits instructors' perspective outside class. | - rarely unprepared; rarely arrives late;<br>- occasionally solicits instructors' perspective outside class . | -often unprepared; occasionally arrives late;<br>- rarely solicits instructors' perspective outside class . | -rarely prepared;<br>- often arrives late;<br>-never solicits instructors' perspective outside class | |

***Classroom Participation: Oral Presentation***

| Element | Excellent | | Satisfactory | | | Needs Improvement | | | | score |
|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| **Organization** | ▪ There is a logical sequence of information.<br>▪ Title slide and closing slide are included appropriately. | | ▪ There is some logical sequence of information.<br>▪ Title slide and closing slides are included. | | | ▪ There is little or no logical sequence of information.<br>▪ Title slide and/ or closing slides are not included. | | | | |
| **Slide Design** (text, colors, background, illustrations, size, titles, subtitles) | Presentation is attractive and appealing to viewers. | | Presentation is somewhat appealing to viewers. | | | Little to no attempt has been made to make presentation appealing to viewers. | | | | |
| **Content** | ▪ Presentation covers topic completely and in depth.<br>▪ Information is clear, appropriate, and accurate. | | ▪ Presentation includes some essential information.<br>▪ Some information is somewhat confusing, incorrect, or flawed. | | | ▪ Presentation includes little essential information.<br>▪ Information is confusing, inaccurate, or flawed. | | | | |
| **Language** | ▪ Spelling, grammar, usage, and punctuation are accurate.<br>▪ Fluent and effective | | There are minor problems in spelling, grammar, usage, and/or punctuation. | | | ▪ There are persistent errors in spelling, grammar, usage, and/or punctuation.<br>▪ Less or not fluent and effective. | | | | |
| **Delivery** | ▪ Ideas were communicated with enthusiasm, proper voice projection and clear delivery.<br>▪ There was sufficient eye contact with audience.<br>▪ There were sufficient use of other non-verbal communication skills.<br>▪ Appropriate delivery pace was used. | | ▪ There was some difficulty communicating ideas due to voice projection, lack of preparation, incomplete work, and/or insufficient eye contact.<br>▪ Insufficient use of non-verbal communication skills.<br>▪ Delivery pace is somewhat appropriate. | | | ▪ There was great difficulty communicating ideas due to poor voice projection, lack of preparation, incomplete work, and/or little or no eye contact.<br>▪ No use of non verbal communication skills.<br>▪ Inappropriate delivery pace was used. | | | | |
| **Interaction with Audience** | ▪ Answers to questions are coherent and complete.<br>▪ Answers demonstrate confidence and extensive knowledge. | | ▪ Most answers to questions are coherent and complete.<br>▪ Answers somehow demonstrate confidence and extensive knowledge. | | | ▪ Answers to questions are neither coherent nor complete.<br>▪ Is tentative or unclear in responses. | | | | |
| **Total score** | ***= (y*5/16)*** | | | | | | | | | |