



RSCI301 – Human Genetics

Master Course Syllabus

Course Overview (QM Standards 1.2)

Course description:

This interdisciplinary natural science course is addressed to non-majors. It does not require any prerequisites. The course covers basic knowledge of human genetics and molecular mechanisms of inheritance. It bridges understanding of reproductive biology, body chemistry, human health and nutrition, and other natural sciences. An emphasis is on DNA as a molecule of heredity. Students learn structure and function of this fundamental biological molecule, which reinforces understanding of basic chemistry and biology. To illustrate mechanisms and patterns of inheritance, we use case studies of real human genetic traits and disorders. Students will investigate medically important real-life examples of single-gene mutations, including sickle-cell anemia, phenylketonuria, achondroplasia, hemophilia diseases; and chromosomal abnormalities such as Down, Turner, Klinefelter syndromes. Other genetic traits (e.g. blood groups, albinism, color-blindness) will be used to illustrate the structure and function of the genetic material. We continue with investigation of mutations at the DNA molecule level, and conclude with the brief survey of modern biotechnology and its impact on human health (recombinant drugs, gene therapy).

Course Goals and Objectives:

- Analyze the biologic molecules--*carbohydrates* and *proteins*—for basic structure and function
- Investigate nucleic acids (DNA and RNA) as the bearers of genetic information
- Examine the development, structure, and function of human reproductive cells and chromosomes and their role in genetics
- Analyze the basic Mendelian genotypes and patterns of inheritance
- Solve Mendelian problems related to human medical disorders using knowledge of genes, genotypes, and advanced patterns of inheritance
- Analyze the structure and function of human chromosomes and the effects of chromosome-level mutations
- Investigate the process of gene expression (protein synthesis) and basic types of DNA mutations as changes in structure and function of Genetic Code
- Examine the basic concepts and methodologies involved in DNA manipulation (biotechnology, gene cloning, GMO)

Pre-Requisites (QM Standard 1.6)

No pre-requisites are required for this course.

Minimum Technical Requirements and Online Resources (QM Standards 1.5 & 1.7)

In addition to a web browser (preferable Firefox) that is Blackboard compatible, you will need the following software in order to complete the activities in this class:

1. Word processing package capable of reading and creating .doc, .docx or rich text formatted (rtf) documents.
2. *Adobe Acrobat Reader*: If you do not have *Adobe Acrobat Reader*, you can download it free from <http://www.adobe.com/products/acrobat/readstep.html>
3. PDF Creator Software: If you are using a MAC or do not have software capable of saving a file as a .doc or .docx file and do not have the capability on your campus to print files to PDF, you can download a free version of *CutePDF* at <http://www.cutepdf.com/Products/CutePDF/writer.asp> This software installs a virtual printer on your PC that allows you to print files to the PDF format.
4. Virus Protection Software: This course requires you to download and upload files from your PC. Virus protection software protects your computer and my computer.

Online Resources: This course makes use of many online resources. I have made every effort to make sure the links I have are up-to-date. However, due to the changing nature of the web, you may find that a resource is temporarily unavailable or has been removed. If this should happen, please send me an email and I will find an alternative resource or modify the assignment accordingly.

Instructor Information (QM Standards 1.8 & 5.3)

Individual instructors complete this information.

Virtual Office Hours

I am available in my virtual office by appointment only. Send me an email to set up an appointment.

Personal Commitment

My personal commitments to you as a participant include:

I will reply to course mail messages within 24 hours;

I will read all discussion postings and will reply where appropriate within 3 days

I will acknowledge my receipt of every course mail message immediately upon reading it. If I am unable to respond to the request or concern at the time of initial reply, I will give you an estimated time for my next reply.

If I am going to be away from the course space for more than a day or two, I will send a message to you indicating the length of my absence.

I will regularly update information regarding due dates in the course announcements.

Optional/Required Course Materials (QM Standard 4.6)

All required readings and videos are included in each of the modules.

Grading Policy (QM Standard 3.2)

Each module consists of a series of assignments, each having specific point values. For each assignment you will be given the rubric or grading criteria from which you will be evaluated.

Your final number grade will be based on the following formula:

$$\text{Total Points Earned/Total Points Possible} \times 100 = \text{Final Number Grade}$$

Your final letter grade will be determined based on the following total points earned and grading scale:

Total Points Earned	Final Number Grade	Final Letter Grade
702 - 780	90 - 100	A
624 - 701	80 - 89	B
546 - 623	70 - 79	C
468 - 545	60 - 70	D
Less than 60	Less than 60	F

Module Objectives and Assessments (QM Standard 2.2, 2.3, 2.4, 2.5, 3.4, 3.5, 5.1)

Module 1

After you have complete the readings and content for this module you will be able to:

- Differentiate between carbohydrates and proteins. (M1S1: Self-assessment, M1A1: Activity, Identification of Mono- and Polysaccharides' Basic Structure, M1A2: Activity, Identification of Protein's Basic Structure, M1A3: Discussion, The Functions of Carbohydrates and Proteins, M1A4: Quiz, Identification of the Structure and Function of Carbohydrates and Proteins)
- Identify the basic structure of mono- and polysaccharides. (M1S1: Self-assessment, M1A1: Activity, Identification of Mono- and Polysaccharides' Basic Structure, M1A3: Discussion, The Functions of Carbohydrates and Proteins, M1A4: Quiz, Identification of the Structure and Function of Carbohydrates and Proteins)

- Identify the basic structure of amino acids and proteins. (M1S1: Self-assessment, M1A2: Activity, Identification of Protein's Basic Structure, M1A3: Discussion, The Functions of Carbohydrates and Proteins, M1A4: Quiz, Identification of the Structure and Function of Carbohydrates and Proteins)
- Analyze schemes and descriptions of carbohydrates and proteins to identify structure and function. (M1S1: Self-assessment, M1A1: Activity, Identification of Mono- and Polysaccharides' Basic Structure, M1A2: Activity, Identification of Protein's Basic Structure, M1A3: Discussion, The Functions of Carbohydrates and Proteins, M1A4: Quiz, Identification of the Structure and Function of Carbohydrates and Proteins)

Module 2

After you have complete the readings and content for this module you will be able to:

- Relate nucleotides to nucleic acids. (M2S1: Self-assessment, M2A1: Quiz, Nucleotides, Nucleic Acids, RNA, and DNA)
- Differentiate between nucleotides found in RNA and nucleotides found in DNA. (M2S1: Self-assessment, M2A1: Quiz, Nucleotides, Nucleic Acids, RNA, and DNA)
- Explain how the structure of the Watson & Crick double-helix model is formed through the process of nucleotide bonding. (M2S1: Self-assessment, M2A2: Discussion, The Formation of the Double-Helix Model through Nucleotide Bonding)
- Identify the process of DNA replication. (M2S1: Self-assessment, M2A3: Exam, Carbohydrates, Proteins, and Nucleic Acids)

Module 3

After you have complete the readings and content for this module you will be able to:

- Identify the cell as a major biological unit. (M3S1: Self-assessment, M3A3: Quiz Mitosis and Meiosis)
- Examine the human chromosomal set and the process of cell division (mitosis). (M3S1: Self-assessment, M3A1: Discussion, The Process of Cell Division (Mitosis), M3A3: Quiz, Mitosis and Meiosis)
- Describe the stages of the reductional cell division (meiosis) that leads to the manufacturing of human reproductive cells. (M3S1: Self-assessment, M3A2: Discussion, The Stages of Reductional Cell Division (Meiosis), M3A3: Quiz, Mitosis and Meiosis)
- Explain the role human reproductive cells and chromosomes play in genetics. (M3S1: Self-assessment, M3A2: Discussion, The Stages of Reductional Cell Division (Meiosis))

Module 4

After you have complete the readings and content for this module you will be able to:

- Identify the basic human genotypes. (M4S1: Self-assessment, M4A1: Discussion, Basic Human Genotypes and Patterns of Inheritance)

- Differentiate among the basic human genotypes and patterns of inheritance. (M4S1: Self-assessment, M4A1: Discussion, Basic Human Genotypes and Patterns of Inheritance, M4A2: Quiz, Solving Mendelian Problems, M4A3: Exam, Human Reproductive Cells, Mendelian Genotypes and Their Role in Genetics)
- Solve basic Mendelian problems related to human medical disorders (cystic fibrosis, PKU, sickle-cell anemia, etc.) (M4A2: Quiz, Solving Mendelian Problems, M4A3: Exam, Human Reproductive Cells, Mendelian Genotypes and Their Role in Genetics)

Module 5

After you have complete the readings and content for this module you will be able to:

- Identify human genotypes related to advanced patterns of inheritance. (M5S1: Self-assessment, M5A1: Discussion, Human Genotypes and Advanced Patterns of Inheritance)
- Differentiate among the advanced patterns of inheritance. (M5S1: Self-assessment, M5A1: Discussion, Human Genotypes and Advanced Patterns of Inheritance)
- Solve advanced Mendelian problems related to human biology and medical disorders (hemophilia, ABO blood groups, color-blindness, etc.) (M5S1: Self-assessment, M5A2: Quiz, Solving Advanced Mendelian Problems)

Module 6

After you have complete the readings and content for this module you will be able to:

- Categorize human chromosomes as cell structures that contain genes. (M6S1: Self-assessment, M6A3: Exam, Advanced Mendelian Problems, Chromosome-Level Mutations and Their Role in Genetics)
- Investigate the occurrence of human chromosome-level mutations. (M6S1: Self-assessment, M6A1: Discussion, The Occurrence of Human Chromosome-Level Mutations, M6A3: Exam, Advanced Mendelian Problems, Chromosome-Level Mutations and Their Role in Genetics)
- Identify medical disorders resulting from chromosome-level mutations. (M6S1: Self-assessment, M6A2: Quiz, The Relationship Between Chromosomes and Medical Disorders, M6A3: Exam, Advanced Mendelian Problems, Chromosome-Level Mutations and Their Role in Genetics)
- Describe the effects of chromosome-level mutations. (M6S1: Self-assessment, M6A1: Discussion, The Occurrence of Human Chromosome-Level Mutations)

Module 7

After you have complete the readings and content for this module you will be able to:

- Outline basic DNA structure and its function as Genetic Code (gene expression as protein synthesis). (M7S1: Self-assessment)

- Examine case studies of DNA-level mutations as changes in structure and function of Genetic Code. (M7A1: Discussion, Case Studies of DNA-level Mutations as Changes in Structure and Function of Genetic Code)
- Draw conclusions about Genetic Code and DNA-level mutations (M7A2: Quiz, Drawing Conclusions about Genetic Code and DNA-level Mutations)

Module 8

After you have complete the readings and content for this module you will be able to:

- Identify the basic concepts and methodologies involved in DNA manipulation (biotechnology) based upon knowledge of DNA structure and function. (M8S1: Self-assessment)
- Examine case studies of DNA manipulation (gene cloning, GMO). (M8A1: Discussion, Case Studies of DNA Manipulation/Biotechnology)
- Draw conclusions about DNA Manipulation. (M8A2: Quiz, Drawing Conclusions about DNA Manipulation/Biotechnology)
- Combine facts, knowledge of processes, and implications to demonstrate understanding of human genetics. (M8A3: Final Exam, A Comprehensive Demonstration of the Facts, Processes, and Implications Related to Human Genetics)