Course program and reading list

Semester 1 Year 2024

School: Baruch Ivcher School of Psychology

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Course No.:	Course Type :	Weekly Hours :	Credit:
3950	Lecture	3	3

Course Requirements :	Group Code :	Language:
No Final Assignment	241395000	Hebrew

Course Description

This course provides an introduction to the fundamental concepts of genetics and their applications in medicine. The course is designed to provide students with a broad understanding of genetics and its role in human health.

I had intended for there not to be a textbook for the course, but given the nature of this year, I am attempting to purchase e-textbooks for the class that should make learning the material easier

The Syllabus is subject to change

There may be labs subject to availiblitly of materials.

Course Goals

1. **Genetics Basic Concepts**
    1. Relationship between phenotype and genotype: *the relationship between phenotype and genotype is complex, and many traits are influenced by multiple genes.*
    2. Structure of the Gene, and its role in the cell: *A gene is a unit of heredity that is passed down from parents to offspring. Genes are made up of DNA, which is a molecule that contains the instructions for building proteins. Proteins are essential for all life, and they play a role in every cell in the body.*
    3. Genetic variation: *Genetic variation is the difference in DNA sequences between individuals. Genetic variation can be caused by mutations, which are changes in the DNA sequence. Mutations can occur spontaneously or they can be caused by environmental factors, such as exposure to radiation.*
    4. Chromosomal variation and diagnostics: *Chromosomal variation is a type of genetic variation that affects the structure or number of chromosomes. Chromosomal variation can be caused by errors in cell division or by exposure to certain environmental factors. Chromosomal variation can lead to a variety of genetic disorders, such as Down syndrome and Klinefelter syndrome.*

2. **Mendelian Inheritance**
    1. Basic molecular biology of cellular reproduction: *Cellular reproduction is the process by which cells divide to create new cells. There are two types of cellular reproduction: mitosis and meiosis. Mitosis is the process by which cells divide to create two identical daughter cells. Meiosis is the process by which cells divide to create four haploid daughter cells. Haploid cells contain half the number of chromosomes as diploid cells.*
    2. *DNA Repair:* DNA repair is the process by which damaged DNA is repaired. These processes are essential for maintaining the integrity of the genome.
    3. *RNA transcription and translation:*RNA transcription is the process by which DNA is copied into RNA. RNA translation is the process by which RNA is used to produce proteins. These processes are essential for gene expression.
    4. *Gene regulation:*Gene regulation is the process by which gene expression is controlled. Gene regulation can be influenced by a variety of factors, such as transcription factors, epigenetic changes, and environmental factors.

1. Pedigree analysis: *A pedigree is a diagram that shows the relationships between family members and the inheritance of a particular trait. Pedigree analysis can be used to identify patterns of inheritance and to determine the likelihood of a person inheriting a particular genetic disorder.*

2. Linkage: *Linkage is a phenomenon that occurs when genes that are located close together on the same chromosome are more likely to be inherited together. Linkage can be used to identify the location of genes on chromosomes and to develop diagnostic tests for genetic disorders.*
3. Genetic Testing
4. Mitochondrial inheritances: *Mitochondria are organelles that are found in the cytoplasm of cells. Mitochondria have their own DNA, which is separate from the nuclear DNA. Mitochondrial DNA is inherited only from the mother. Mutations in mitochondrial DNA can lead to a variety of genetic disorders.*

3. **Cancer Genetics**
    1. Mutations: *Cancer is a disease that is caused by changes in the DNA of cells. These changes can be caused by mutations, which can be inherited or acquired. Acquired mutations are caused by environmental factors, such as exposure to radiation and carcinogens.*
    2. Oncogenes and tumor suppressors: *Oncogenes are genes that promote cell growth and division. Tumor suppressor genes are genes that inhibit cell growth and division. Mutations in oncogenes can lead to uncontrolled cell growth and cancer. Mutations in tumor suppressor genes can also lead to cancer by removing the brakes on cell growth.*

4. **Complex Traits**
    1. GWAS: *A genome-wide association study (GWAS) is a type of genetic study that is used to identify genes that are associated with complex traits, such as height, weight, and risk of disease. GWAS work by comparing the DNA of thousands or even millions of people to identify genetic markers that are associated with the trait of interest.*
    2. Epigenetics *Epigenetics is the study of how changes in gene expression that are not caused by changes in the DNA sequence. Epigenetic changes can be caused by a variety of factors, such as diet, environment, and lifestyle. Epigenetic changes can be passed down from parents to offspring, and they can play a role in the development of a variety of diseases, including cancer.*
    3. Gene-environment interactions*: Gene-environment interactions are the effects of both genetic and environmental factors on the same trait. Gene-environment interactions can play a role in the development of many complex diseases, such as cancer and heart disease.*
    4. Genetic factors in pharmacogenetics: *Pharmacogenetics is the study of how genetic variation affects individual responses to drugs. Pharmacogenetic testing can be used to predict how an individual will respond to a particular drug and to adjust the dosage accordingly.*
    5.

5. **Genome Editing**
    1. Sequencing: *DNA sequencing is the process of determining the order of nucleotides in a DNA molecule. DNA sequencing is used in a variety of research and clinical applications, such as identifying genetic mutations and diagnosing genetic disorders.*
    2. Synthetic biology: *Synthetic biology is a field of biology that uses engineering principles to design and create new biological systems. Synthetic biology is used in a variety of research and commercial applications, such as developing new drugs and vaccines and creating new biofuels.*
    3. CRISPR: *CRISPR is a gene editing technology that allows scientists to make precise changes to the DNA of cells. CRISPR is used in a variety of research and clinical applications,*
    4. Gene therapy: Gene therapy is a technique that can be used to correct genetic defects or to introduce new genes into cells. Gene therapy is still in its early stages of development, but it has the potential to cure a variety of genetic disorders.
    5.

6. **Genetic Tools and Online Resources**

In addition to the textbooks and other resources listed above, there are a number of online resources that can be helpful for students in genetics courses. Some of these resources include:

1. BLAST: *BLAST (Basic Local Alignment Search Tool) is a powerful tool that can be used to search for and compare DNA and protein sequences. BLAST can be used to identify the function of a gene, to determine the evolutionary relationship between two organisms, and to diagnose genetic disorders.*
2. NCBI*: The National Center for Biotechnology Information (NCBI) is a government agency that provides a variety of resources for biomedical research, including BLAST and other genetic tools.*
3. OMIM: *Online Mendelian Inheritance in Man (OMIM) is a database that contains information about human genes and genetic disorders. OMIM can be used to learn more about the genetic basis of a particular disease, to identify the likelihood of a person inheriting a disease, and to find resources for families affected by genetic disorders.*
4. HGMD: *The Human Gene Mutation Database (HGMD) is a database that contains information about human gene mutations and their associated diseases. HGMD can be used to learn more about the genetic basis of a particular disease, to identify the likelihood of a person inheriting a disease, and to find resources for families affected by genetic disorders.*

7. **Ethical Implications of Genetics and Medicine**

This section of the course will explore the ethical implications of genetics and medicine in more depth. We will discuss the different ethical concerns that have been raised and the various ways that these concerns have been addressed. We will also consider the future of genetics and medicine and the ethical challenges that we may face.

The rapid advances in genetics have raised a number of ethical concerns. Some of these concerns include:

1. Discrimination: Genetic information could be used to discriminate against people in employment, insurance, and other areas of life.
2. Privacy: Genetic information is highly personal and sensitive. There is a concern that this information could be misused or disclosed without consent.
3. Autonomy: People should have the right to make their own decisions about whether or not to undergo genetic testing and how to use the results of that testing.
4. Justice: Genetic advances have the potential to benefit some people more than others. This could lead to health disparities and other social injustices.
5. **Role of Genetics in Public Health**

Genetics plays an important role in public health. By understanding the genetic basis of diseases, we can develop better ways to prevent, diagnose, and treat them. We can also use genetic information to identify people who are at high risk for certain diseases and to develop targeted interventions to reduce their risk.

This section of the course will explore the role of genetics in public health in more detail. We will discuss specific examples of how genetics is being used to improve public health, such as newborn screening programs and genetic counseling. We will also consider the challenges of using genetics in public health, such as the need to ensure that genetic information is used fairly and equitably.

Grading

As this year we will not have final exams, there will be quizzes for the students in class. These quizes will make up 80% of your grade. (although this is subject to change)

20% Participation (subject to change)

If there is a paper/take home work instead of the quizes then Limitation on subject matter of the paper - write about something that fits within the scope of the course.

Grading criteria is subject to change depending on changing circumstances and the instructor's discretion

A couple housekeeping notes before we start the course

1. **Class participation is worth 20% of your final grade (subject to change if things change)**
2. **I HATE moodle.**
    1. **Do not email me through Moodle, I may never respond.**
    2. **The powerpoints will never be on moodle. Do not look for them there.**
    3. **The powerpoints will be up on this site before class**
    4. **Zoom recordings will not be on moodle, they will be here**
3. **To get full participation credit you must do two things**
    1. **Complete the in class surveys: These are conducted through polleverywhere**
        1. **PollEverywhere can be done on either your phone or your computer**
        2. **The link for the polleverywhere polls will *always* be pollev.com/dovg**
        3. **Please sign up or login for the polleverywhere component of the class.**

WHY?? Because this is part of your grade and to give you credit for your responses I need to know who you are and who gave the responses. If you don't tell me that it was you giving the responses, how can I give you a grade.

2. **Complete the take home surveys (around 4-6 for the semester)**
    1. **The take home surveys are not hard, there is no right or wrong answers and you are anonymous**
    2. **When completing the take home surveys two things are of utmost importance**
        1. **You will be asked to provide your teudat zehut - please enter it CORRECTLY. It is how you are identified in the poll. If you aren't identified correctly, you cannot receive credit. The system cannot figure out who you are unless you give it the right information**
        2. **You will be asked to provide your email. This is important as GOOGLE will *ALWAYS* provide you with confirmation that you have**

completed the survey. If you do not complete the survey you cannot get credit. If you do not receive the confirmation from Google there are three possible reasons

1. **You inputted your email incorrectly, Google can't guess your correct email, you must tell it the correct email**
2. **You failed to complete the survey, do it again**
3. **The google response went to your spam folder**

3. **I trust Google more than I trust you. At the end of the semester, Google will tell me if you completed the surveys or not. If Google says you didn't then you didn't. If you personally don't have faith in google, keep all of your confirmation emails.**

Reading List

Papers will be assigned before each class to correspond to subject matter of the class