MI Final Exam: End of Course (EOC) Assessment Information 2015-16

MI Final Exam Components

1) End of Course (EOC) Assessment (49 multiple choice questions) = 50% of Semester 2 Exam
    a. Section 1: 25 multiple choice questions (40 minutes)
    b. Section 2: 24 multiple choice questions (40 minutes)
2) Final Project (4.4.2: Bionic Human) = 50% of Semester 2 Exam Grade
3) Schedule:
    a. Tuesday (May 31): Final Projects Due
    b. Exam day: (Tuesday, June 7): Multiple Choice Section 1 and Section 2 (Content from entire year)

PLTW EOC Test Policies

Materials that are authorized for use by students taking PLTW End of Course Assessments:

1) A calculator
2) Blank scratch paper (will be provided by the teacher) and pencil or pen

MI End of Course (EOC) Assessment Information

1) Approximate percent of test items per unit and lesson→

Unit.Lesson	Approximate Percent
1.1	11%
1.2	7%
1.3	7%
1.4	8%
2.1	8%
2.2	6%
3.1	8%
3.2	7%
3.3	8%
3.4	7%
4.1	12%
4.2	5%
4.3	3%
4.4	3%

2) The EOC is scored as a Stanine score on a scale of 1-9. The explanation for the Stanine scores is shown below.

End of Course Score	Basic			Proficient				Advanced	
	The student demonstrates a minimal or limited understanding of course concepts. Major gaps may be present in the student's knowledge and skills.			The student demonstrates a competent understanding of the course concepts. The student can apply knowledge and skills to familiar situations. There may be minor gaps in the student's understandings.				The student demonstrates a comprehensive and complex understanding of the course concepts. The student has the capability to transfer knowledge and skills to novel situations. Gaps in knowledge and skills are minimal.	
	1	2	3	4	5	6	7	8	9

3) Requirement for college credit: You must receive at least a Stanine score of 7 to be eligible to receive college credit through MSOE.

UNIT 1: HOW TO FIGHT INFECTION

Lesson 1.1: The mystery infection

Concepts:

Medical interventions help maintain health and homeostasis in the body.
A variety of methods can be used to detect and/or identify infectious agents.

Key Terms:

- Antibody
- Antigen
- Bioinformatics
- BLAST
- Concentraion
- ELISA (enzyme-linked immunosorbant assay)
- Enzyme
- Genome
- Medical intervention
- Outbreak
- Pathogen
- Primer
- Serial dilution
- Solute
- Solvent
- Solution
- Substrate

Essential Questions

1) What is a medical intervention?
2) What are the main categories of interventions that function to maintain human health?
3) How do scientists gather evidence during the potential outbreak of an infectious disease?
4) What is bioinformatics?
5) How can DNA sequences be used to identify disease pathogens?
6) What is an antibody?
7) How to antibodies identify and inactivate antigens?
8) How can the ELISA assay be used to detect disease?
9) Why is it important for doctors to know the concentration of disease antigen present in a patient's system?
10) What steps do scientists take to diagnose, treat, and prevent future spread of a disease outbreak?

Lesson 1.2: Antibiotic treatment

Concepts:

Antibiotics disrupt the pathways that bacteria use to survive.
Bacterial cells use multiple pathways to gain resistance to antibiotics.
Overuse and misuse of antibiotics will promote the selection of resistant bacteria.

Key Terms:

- Antibiotic
- Antibiotic resistance
- Conjugation
- Nucleoid
- Plasmid
- Transduction
- Transformation

Essential Questions

1. How do antibiotics work to fight bacterial infections? (Be able to describe specific parts of bacteria that antibiotic drugs target.)
2. What methods do bacteria use to share antibiotic resistant genes? Describe the difference between the three methods.
3. What actions are humans taking that are contributing to bacteria becoming resistant to commonly used antibiotics?
4. What are the different types of DNA in bacteria? How are they different? How do they relate to antibiotic resistance?
5. Explain what occurred in the lab 1.2.2: Superbugs. You should be able to explain each step of the lab.

Lesson 1.3: Aftermath: hearing loss

Concepts:

Problems with one or more structures within the ear cause various types of hearing loss.
There are a variety of interventions available to help people with hearing loss.

Key terms:

- Audiogram
- Hearing aid
- Inner ear
- Outer ear
- Middle ear
- Sensorineural hearing loss
- Conductive hearing loss
- Cochlear implant
- Sound wave
- Frequency
- Wavelength
- Pitch
- Volume
- Amplitude
- Pinna
- Auditory canal
- Tympanic membrane
- Ossicles
- Cochlea
- Sensory hairs
- Auditory or cochlear nerve
- Vestibular/ semi-circular canals

Essential Questions:

1. How do frequency and amplitude affect how humans interpret sound?
2. What causes different types of hearing loss?
3. How is hearing loss diagnosed?
4. What interventions are available for patients with hearing loss?
5. What are the bioethical concerns related to the use of cochlear implant technology?
6. Describe the path of sound as it travels through the ear.
7. What is the difference between sensorineural hearing loss and conductive hearing loss?
8. What is an audiogram? Be able to interpret an audiogram and determine what type of hearing loss the audiogram shows.

Lesson 1.4: Vaccination

Concepts:

Vaccines are medical interventions that activate the immune system to recognize a disease antigen and produce antibodies necessary to defend the body.
Vaccines can be produced in the laboratory by various methods, including recombinant DNA techniques.
Epidemiologists are dedicated medical professionals at the heart of the public health field who monitor the health of human populations, search for patterns in the development of both infectious and chronic illnesses, assist in outbreak investigations, and design disease treatment and prevention strategies.

Key Terms:

- Case-control study
- Cohort study
- DNA ligase
- Epidemic
- Epidemiology
- Herd immunity
- Inoculation
- Plasmid
- Recombinant DNA
- Restriction enzyme
- Vaccination
- Vaccine
- Immunity
- Antibodies
- Antigens
- Epidemic
- Epidemiology

Essential Questions:

1. What is vaccination?
2. How does a vaccine activate the body's immune system?
3. How has vaccination impacted disease trends in our country?
4. What methods are used to produce vaccines in the laboratory? (similar pathogen vaccine, attenuated vaccine, killed vaccine, toxoid vaccine, subunit vaccine, naked DNA vaccine. Be able to list examples of vaccines that are produced using each method)

1) What is the difference between an antigen and an antibody? How do these relate to immunity?
2) What is recombinant DNA?
3) How are molecular "tools" or components used to create recombinant DNA?
4) How can recombinant DNA and bacterial cells used to produce vaccinations?
5) How can engineered plasmids (recombinant DNA) be inserted into bacterial cells?
6) What is the purpose of having an antibiotic resistance gene on a recombinant DNA plasmid?
7) What is epidemiology?
8) How can epidemiologists assist with the detection, prevention, and treatment of both chronic and infections diseases?

UNIT 2: HOW TO SCREEN WHAT IS IN YOUR GENES

Lesson 2.1: Genetic testing

Concepts:

Genetic testing is the use of molecular methods to determine if someone has a genetic disorder, will develop one, or is a carrier of a genetic illness and involves sampling a person's DNA and examining the chromosomes or genes for abnormalities.

Genetic counseling can help a family understand the risks of having a child with a genetic disorder, the medical facts about an already diagnosed condition, and other information necessary for a person or a couple to make decisions suitable to their cultural, religious, and moral beliefs.

Proper prenatal care and monitoring of the fetus are vital to maternal and child health during a pregnancy.

Key terms

- Amniocentesis
- Anneal
- Carrier screening
- Chorionic villus sampling (CVS)
- Denaturation
- Gene
- Genetic counseling
- Genetic testing
- Genome
- Genotype

- Karyotype
- Newborn screening
- Phenotype
- Polymerase chain reaction (PCR)
- Preimplantation genetic diagnosis (PGD)
- Primer
- Restriction enzyme
- Single nucleotide polymorphism (SNP)
- Taq polymerase
- Thermal cycler
- Ultrasound

Essential Questions

1) What is genetic testing?
2) What are the duties of a genetic counselor?
3) Describe the difference between the 4 types of genetic conditions/disorders were discussed in class: single-gene, multifactorial, chromosomal, mitochondrial.
4) Be able to give an example of a disease or disorder for each of the 4 types of disorders above.
5) Describe how a karyotype would look for an individual with a chromosomal genetic disorder.
6) What is genetic counseling?
7) Be able to describe the following types of genetic testing: PGD, CVS and amniocentesis. Explain each procedure, what the results can show, any risks involved, and ethical concerns.
8) What can be determined by an ultrasound? How can an ultrasound be used to screen for certain disorders?
9) What is the goal of PCR?
10) Explain the process of PCR. Be able to specifically explain what occurs during each step.
11) Why do the steps of PCR occur at different temperatures?
12) What are the components needed to run a PCR reaction?
13) What is the difference between a genotype and a phenotype?
14) What is a SNP?
15) How can restriction enzymes and electrophoresis be used to identify SNPs and determine genotype?
16) What medical interventions and lifestyle modifications can help a pregnant woman have a healthy pregnancy?
17) What can amniocentesis and chorionic villus sampling tell a couple about their developing fetus?

Lesson 2.2: Our genetic future

Concepts:

Gene therapy is a type of disease treatment in which faulty genes are replaced by functional copies.

Advances in reproductive technology open many moral, ethical, and scientific debates.

Key terms:

- Cloning
- Gene therapy
- In vitro fertilization
- Pre-implantation genetic diagnosis (PGD)
- Sex selection
- Vector

Essential Questions:

1) How can genetic diseases be cured if scientists could replace faulty genes?
2) What vectors can be used to transfer DNA to human cells?
3) How might gene therapy open the door to genetic enhancement?
4) What medical interventions are available for couples who would like to choose the gender of their child?
5) Should parents be able to design their children? (Know ethical debates.)
6) What is the difference between reproductive cloning and therapeutic cloning?
7) What are some of the ethical dilemmas surrounding current and future reproductive technology?

UNIT 3: HOW TO CONQUER CANCER

Lesson 3.1: Detecting Cancer

Concepts:

Cancer is a term used for more than 100 different diseases in which cell regulation genes are mutated causing the cells to reproduce out of control.

X-rays, CT scans, and MRI scans are used to create pictures of the inside of the body to diagnose and treat many disorders.

Scientists use DNA microarray technology to determine the differences in gene expression between different tissue samples.

Key Terms:

- Apoptosis
- Biopsy
- Bone scan
- Cancer
- Cell cycle
- Computer tomography scan (CT or CAT scan)
- Diagnostic imaging
- DNA microarray
- Magnetic resonance imaging (MRI)
- Oncogene
- Osteosarcoma
- Proto-onco gene
- Radiology
- Risk factor
- Tumor suppressor gene
- p53
- X-ray
- Angiogenesis
- Metastasis
- Gene expression
- mRNA
- cDNA

Essential Questions:

1) What fundamental characteristics do all cancers have in common?
2) In what ways are diagnostic imaging technologies used to diagnose and treat disorders?
3) How do genes play a role in the development of cancer? (tumor suppressor genes, onco genes, and proto-onco genes.)
4) What are some ways DNA can become mutated (affecting genes that would normally regulate the cell cycle and prevent cancer?)
5) What are the functions of the p53 protein? Why is it important in the study of cancer?
6) What are specific risk factors for cancer?
7) Describe the physiology of how a cancer can develop and spread within the body.
8) How are cancerous cells structurally different from noncancerous cells? How do these differences appear under the microscope.
9) Be able to look at a microscopic slide and identify and describe differences in cancerous cells and noncancerous cells.
10) Describe the steps to performing a DNA Microarray test and analysis.
11) What do DNA microarrays measure?
12) How is a DNA Microarray used to determine the differences in gene expression between different tissue samples?
13) What are limitations of DNA Microarray technology?
14) How was the DNA Microarray lab you preformed in class different from an actual microarray?
15) How are the similarities of gene expressions between individuals calculated?

Lesson 3.2: Reducing Cancer Risk

Concepts:

Behavioral, biological, environmental, and genetic risk factors increase the chance that a person will develop cancer.

The risk for developing many cancers can be reduced with life-style changes.

Molecular diagnostic tests, such as marker analysis, can be used to detect inherited genetic mutations associated with certain cancers and can be used to predict risk for developing those

cancers.

Viruses insert their DNA or RNA into a host cell, causing the host cell's genes to mutate which can sometimes cause the cell to become cancerous.

Routine cancer screenings can prevent certain types of cancer or can increase the chance that cancer is detected at an early stage when treatment is more effective.

Key Terms:

- Allele
- BRCA
- Cryosurgery : use cold temps to "freeze" external tissue off
- Familial cancer
- Genetic marker
- Hereditary cancer
- Marker analysis
- Microsatellite (also known as Short Tandem Repeats- STRs)
- Melanoma
- Model system (biological models)
- Screening
- Sporadic cancer
- Virologist/ virology

Essential Questions:

1) In what ways do different risk factors increase the chance that a person will develop cancer?
2) How can lifestyle changes reduce the risk for developing cancer?
3) How can molecular tests be used to detect inherited genetic mutations associated with certain cancers?
4) What is the importance of routine cancer screenings?
5) Describe the difference between hereditary cancer, familial cancer, and sporatic cancer.
6) How are viruses related to cancer?
7) Know which type of cancer are either caused by or the risk is increased, as associated with these viruses: Ebstein-Barr virus, Hepatitus B and C viruses, Human Papalloma vius.
8) What is an allele? How do alleles relate to the BRCA 1 and BRCA 2 gene?
9) What type of gene are the BRCA 1 and BRCA 2 genes? How do the BRCA 1 and BRCA 2 genes relate to breast cancer?
10) What is marker analysis?
11) What are STRs?
12) What is a genetic marker?
13) How are the process of marker analysis and gel electrophoresis used to identify gene mutations?
14) What are some ways to prevent breast cancer in a patient with a BRCA 1 or BRCA 2 mutation?

Lesson 3.3: Treating Cancer

Concepts:

Various methods are used to treat cancer.

Various biomedical science disciplines and professionals help patients cope with cancer or the side effects of cancer treatment.

Experiments are designed to find answers to testable questions.

Key Terms:

- Biofeedback
- Chemotherapy
- Metastasis
- Myoelectric
- Occupational therapy
- Physical therapy
- Prosthesis
- Radiation therapy

Essential Questions:

1) What can a cancer patient receiving chemotherapy and/or radiation therapy expect during treatment?
2) What is biofeedback? How is biofeedback therapy used to help patients improve their health or manage pain?
3) What are some involuntary functions that could be measured in biofeedback?
4) Explain differences between radiation therapy and chemotherapy, including how each therapy works, time frame for the treatment, and side effects of the treatment.
5) In what ways do artificial limbs allow patients who have suffered from the loss of a limb regain lost function?
6) How do myoelectric prosthetic devices work?
7) How do advances in technology allow for the development of artificial limbs that look and move like actual human limbs?
8) How do physical and occupational therapists help patients with disabilities or patients recovering from surgery or injury?

Lesson 3.4: Building a better cancer treatment

Concepts:

The field of pharmacogenetics investigates how genetic variations correlate with responses to specific medication and strives to develop medical treatments tailored to the individual.
Nanotechnology is a field of science that can be applied to health and medicine.
Clinical trials are biomedical or health-related research studies that investigate how a new medicine or treatment works in human beings.

Key Terms:

- Clinical trial
- Controlled study
- Double-blind study
- Nanomedicine
- Open study
- Pharmacogenetics
- Placebo
- Single-blind study
- SNP (Single nucleotide polymorphism)

Essential Questions:

1) Why do some drugs affect individuals in different ways?
2) How can some information in our genes affect how our bodies interact with certain medicines?
3) How are clinical trials set up to ensure all data collected is valid and that all human subjects are treated ethically?
4) What are laws and policies that regulate the treatment of participants in clinical trials?
5) How might nanomedicine change the future of medicine?

UNIT 4: HOW TO PREVAIL WHEN ORGANS FAIL

Lesson 4.1: Manufacturing Human Protein

Concepts:

The methods used to diagnose and treat diabetes have changed dramatically over the last 200 years, including the use and production of insulin.
Recombinant DNA technology allows scientists to custom-design bacteria that can produce a variety of important protein products, including insulin.
Amino acid interactions affect the structure and function of proteins.
Proteins in a mixture can be separated by various laboratory techniques.

Numerous biomedical professionals assist with the production, distribution, and marketing of a new pharmaceutical or bioengineered product.

Key Terms:

- Amino acid
- Ampicillin
- Chromatograpy
- Column chromatography
- Gel electrophoresis
- Genetic engineering
- Hydrophobic
- Hydrophilic
- Insulin
- Plasmid
- Polyacrylamide
- Recombinant DNA
- Transformation
- Transformation efficiency

Essential Questions:

1) What role does insulin play in diabetes?
2) How has the diagnosis and treatment of diabetes changed in the last 200 years?
3) How can bacterial plasmids be used to produce proteins such as insulin?
4) What is bacterial transformation?
5) How can you gauge the success of a transformation experiment?
6) How does amino acid structure relate the overall shape of a protein?
7) What is chromatography?
8) How can chromatography be used to separate proteins?
9) How can electrophoresis be used to verify the purity of a protein sample?
10) What is SDS-PAGE?
11) How does protein electrophoresis differ from gel electrophoresis? How is it similar?
12) What biomedical professionals are involved in the stages of producing and manufacturing a protein?

Lesson 4.2: Organ Failure

Concepts:

When the kidneys are not functioning properly, they will not filter adequately. Harmful waste products such as urea, creatinine, and blood urea nitrogen build up in the blood stream, which causes the body to make fewer red blood cells due to the lack of the hormone erythropoietin. Dialysis is an artificial process that removes waste products and excess water from the blood when the kidneys can no longer function.

Key Terms:

- Dialysis
- End stage renal disease (ESRD)
- Hemodialysis
- Kidney transplant
- Peritoneal dialysis

Essential Questions:

1) What is end stage renal disease (ESRD)? How is it diagnosed?
2) What are the treatment options or medical interventions available for people with ESRD?
3) How does dialysis work? (both hemodialysis and peritoneal dialysis)

Lesson 4.3: Transplant

Concepts:

Deciding who receives donated organs is not always a clear-cut issue and involves many difficult decisions guided by federal policies.

In organ transplantation, the organ donor and recipient need to have compatible blood and tissue types.

Organ transplant surgery is a complex procedure involving various surgical techniques and a variety of biomedical science professionals.

Key Terms:

- Allocation policies (established by the OPTN for regulation of organ transplants)
- Anesthesia
- Antibody
- Antigen
- Crossmatch
- Haplotype
- Histocompatability
- HLA (Human Leukocyte Antigen)
- Laparoscope
- Laparoscopy/ Laparoscopic procedure
- MHC (Major histocompatibility complex)
- National Organ Transplant Act (NOTA)
- Nephrectomy
- OPTN: Organ procurement and transplantation network
- Organ procurement organization
- Panel Reactive Antibody (PRA)
- Suture
- Tissue Typing (also known as HLA typing)
- Trocar

Essential Questions:

1) What organizations decide who should receive an organ? How do they decide?
2) How are organ donors and recipients matched? Describe HLA tissue typing.
3) What general surgical techniques are necessary for a live donor kidney transplant?
4) What are the roles of the various members of the surgical transplant team?
5) How does a heart transplant compare to a kidney transplant?

Lesson 4.4: Building a Better Body

Concepts:

A variety of tissues and organs can be transplanted from one person to another.
Scientific research is investigating the possibility of replacing damaged organs and tissues using xenotransplantation and tissue engineering.
Advancing medical knowledge and technology will enable scientists to enhance the human body.
Scientists need to make sure that what they present is accurate and is communicated in a way that keeps interest and focus.

Key Terms:

- Tissue engineering: A multidisciplinary field involving biology, medicine, and engineering working to restore, maintain, and enhance tissue and organ function.
- Xenotransplantation
- Medical intervention

Essential Questions:

1) What parts of the human body can be replaced?
2) What are the benefits and risks of using xenotransplantation and tissue engineering for replacement organs?
3) What are the ethical considerations for xenotransplantation and tissue engineering?
4) How can the human body be remodeled or enhanced to create a “super” human?
5) What role do medical interventions play in the prevention, diagnosis, and treatment of disease?