Physiology and Disease

Course Description:
This is a one-semester integrated course that explores topics of human physiology and the changes in physiology that result from non-non-infectious disease or physiological conditions. Topics include cellular physiology, metabolic functions and nutrition, and changes in systems homeostasis during disease. Significant student inquiry opportunities are presented throughout the course through organ dissections, study of disease development and practical applications of lab conditions. The course ends with student-led seminars that detail their understanding of the etiology and physiology of different non-infectious diseases and conditions.

INSTRUCTOR:

- Name: Dr. Sowmya Anjur
- Office Number : B159
- Telephone number: 5941
- Email address: sanjur@imsa.edu

Meeting Days, Time and Room
A202, Meeting days and times vary

Textbook:
Essentials of Human Anatomy and Physiology, 7th edition, by Elaine Marieb, 2002, Benjamin Cummings Publishers, CA.
Anatomy and Physiology for Dummies, 2nd edition, by Maggie Norris and Donna Rae Siegfried, Wiley Publishing Inc., NJ
Anatomy and Physiology Workbook for Dummies, by Janet Rae-DuPree and Pat DuPree, Wiley Publishing Inc., IN

Student Learning Objectives (SSLs and Outcomes):
IA= Informally Assessed; FA=Formally Assessed

- To enhance student learning and understanding in the following areas: data acquisition and analysis, experimental design, written and oral communication, using inquiry to analyze and understand structure-function relationships, and relating concepts studied in the classroom to real life situations.
- To develop students' skills and levels of understanding and proficiency in the following Standards of Significant Learning (SSLs):
  - IB (construct meaningful questions that advance learning)
    This is done by analyzing data to draw conclusions and relate it to the concepts. **FA**
  - IC (observe precisely and record accurately)
    This is done through laboratory observations, data collection and analysis. **FA**
  - ID (critically evaluate information and reasoning)
    This is done by drawing conclusions from laboratory data. **FA**
  - IIIA (use appropriate technologies as extensions of the mind)
    This is done by the use of computers and calculators. **IA**
  - IIIB (find and explain connections among things and ideas)
    This is done by making historical connections to the scientists as well as relationships to everyday phenomena. **FA**

- IVA (construct and support judgments based on evidence)
  This is done by laboratory exploration, constructing laboratory reports as well as identifying unknown compounds based on previous learnings. **FA**
- IVB (write and speak with power, economy and elegance)
  This is done through lab reports, demonstrating understanding through discussions and oral presentations. **FA**
- IVC (recognize the parts that make up complex wholes)
  This is done by applying basic naming and reaction properties to more complex molecules. **FA**
- V (make reasoned decisions which reflect ethical standards, and act in accordance with those decisions.
  This is done by not manipulating data to fit conclusions and preventing plagiarism in lab reports. **FA**

Teaching and Learning Methodology and Philosophy (Instructional Design and Approach):

Students will develop the skills necessary to conduct an inquiry project through a variety of learning activities that deepen with time. These activities, which are competency-driven, inquiry-based, problem-centered, and integrative, will support the development of research skills, as well as demonstrate discipline-appropriate scientific thinking. Student assessments for these learning activities will be completed individually or with a partner and will include homework assignments and in-class quizzes.

After building appropriate inquiry and research skills, students will work with a partner to define and conduct their own inquiry investigation and will report the results of that investigation in the form of a research paper, poster presentation, and oral presentation. Students will work with their partner to complete the poster and oral presentations, but the final research paper will be written individually.

Student Expectations:

The course meeting times will be used mainly for labs, discussions, and other activities. A significant portion of the material in the course will be given as reading assignments and other homework. It is expected that students will spend at least three hours per week on readings for this course. Other assigned work may require extra time outside of class. Students must be prepared and appropriately dressed for lab activities or they will not be allowed to work in the lab.

Students are expected to arrive to class on time prepared to work. If during class you are unprepared, non-attentive, or engage in distracting or minor unsafe behavior, you will be warned only once. If you continue to behave inappropriately, you will be asked to leave class and will be given an unexcused absence. Egregious behavior, especially serious safety violations, will result in immediate removal with no warning.

Attendance Policy

See the IMSA handbook for official attendance policy. If you have a counselor excused absence, or an unexcused absence, you will not be able to make up the missed absence. If you have an excused absence, be sure to contact your teacher to find out what you will miss. If that is not possible, you should see your teacher as soon as possible to discuss your absence. It is your responsibility to follow up on what you missed in class.

Please note: Class starts EXACTLY at the time stated and you will be marked tardy or absent as the case may be if you are not in class when attendance is taken. If your class is the first one of

the day, please make sure that you get up 5 minutes early to get grab and go breakfast before class and do not ask for permission to go get breakfast after giving attendance, if you do so, you will be marked tardy or absent.

Other expectations of students include the following:

1) bring laptop computers to class every day; inappropriate use of computers will be reported to the discipline officer.
2) participate in class discussion sessions by asking or answering questions or sharing relevant comments;
3) complete all assigned work within specified deadlines;
4) follow all safety procedures and guidelines for in class and out of class activities; and
5) arrive to class on time and prepared for each day's activities.

[Note: The Academy's Student Attendance Policy is strictly enforced.]

Assessment Practices, Procedures, and Processes:

There will be a variety of assessments consisting of out-of-class writing, class participation in discussions, homework, formal presentations, spot quizzes, modeling projects and in-class assessments. There will be **short quizzes** every day to ensure that students are reading material and class notes. After studying the material presented in the text and online, all students should be able to complete all behavioral/learning objectives with a minimum competency of 70% on assignments and exams.

Grading generally falls along the following scale:

90% and above = A
80-89% = B
70-79% = C
Below 70% = D
All assessments are subject to change at the instructor's discretion at any time

Please note:

Late work will not be accepted.
Work should be turned in on time on turnitin.
All other work will be assigned a zero (only exception is an excused absence).
There will be no extra credit available for this class unless deemed appropriate by the instructor.
There will be no makeup for any tests or other work given in class unless it is an excused absence and the student has informed me well beforehand and set up a time and day to make up the test. In the event that the student had an excused absence but did not inform me beforehand, the student may make up the test with a 25% penalty.
Stress Days will not be considered an excused absence if a test has been scheduled or an assignment is due on that day.
Grades are non-negotiable.
Students cannot receive a grade for a late assignment once the class assignments have been graded and posted on power school.

Student Learning Outcomes:

Student learning outcomes include study of the pathology and general health management of diseases and injuries across the life span of humans using etiology, symptoms, and the physical and psychological reactions to diseases and injuries.

Students must be able to

1. Distinguish environmental factors, physical, psychosocial, and cognitive characteristics of various diseases and conditions.
2. Identify implications of therapeutic interventions for diseases and conditions.
3. Demonstrate a basic understanding of the concepts and elements of disease.
4. Demonstrate an understanding of the mechanisms of diseases, the diagnosis of diseases, and the treatment of diseases.
5. Understand the pharmacological treatment of diseases or conditions.

Specific Course Objectives

After studying the material presented in the text and online, the student should be able to complete all behavioral/learning objectives listed below with a minimum competency of 70% on assignments and exams.

1. Demonstrate a basic understanding of the concepts and elements of disease.

a. Describe the difference between
i. Signs and symptoms of disease
ii. Acute and chronic disease
b. Identify the predisposing factors of disease
c. Track the essential steps in the diagnosis of disease

2. Demonstrate an understanding of the mechanisms of diseases, the diagnosis of diseases, and the treatment of diseases.

A. Developmental, Congenital, and Childhood Diseases and Disorders

i. List the possible causes of congenital anomalies
ii. Discuss the purpose and procedure of amniocentesis
iii. Distinguish between muscular dystrophy and cerebral palsy

Labs focus on understanding the mechanisms of congenital versus hereditary disorders.
Labs include presentations and case study activities, cell slides, library assignments, group projects and student designed inquiry project on disease slides

B. Immunologic Diseases and Conditions

i. Name the functional components of the immune system
ii. Characterize the three major functions of the immune system
iii. Explain the difference between natural and acquired immunity
iv. Explain the ways that HIV is transmitted

Labs focus on integration of immune system with other body systems.
Labs include Slides, library assignments, case study building, AIDS simutest kit, blood test kits (using fake blood), group projects, design a new method for AIDS testing (group project), virtual ELISA lab, Student designed inquiry lab on immunity, Immune Quest video game.

C. Diseases and Conditions of the Endocrine System

i. Describe the importance of hormones, and explain some of the critical body functions that they control
ii. Compare gigantism to acromegaly
iii. Classify the two major types of diabetes mellitus

Labs focus on hormonal dysfunctions and their resultant physiologies
Labs include concept maps of endocrine disorders such as Addison's disease and diabetes, modeling of diabetes mechanisms and complications (see section 5 for details)

D. Diseases and Conditions of the Integumentary System

i. Explain the functions of the skin

ii. Recognize common skin lesions
iii. Discuss the possible causes of contact dermatitis, atopic dermatitis, and psoriasis
Labs focus on different kinds of cell abnormalities and pathologies.
Labs include poster presentations, slide labs and library assignments.

E. Diseases and Conditions of the Musculoskeletal System

i. Distinguish between the features of lordosis, kyphosis, and scoliosis
ii. Differentiate between a strain and a sprain
Labs focus on differentiating between muscular and skeletal system disorders
Labs include presentations on muscular and skeletal disorders, testing each other's reflexes using reflex hammer, flashlight, Babinski's reflex and eyecharts

F. Diseases and Conditions of the Respiratory System

i. Explain the process of respiration
ii. Discuss the causes and medical treatment for the common cold, sinusitis, and pharyngitis
Labs focus on relationship of respiratory system with cardiovascular system
Labs include Dissection of cow lungs, Student designed inquiry lab on changing (a) heart rate (b) Blood Pressure and (c) Lung capacity, studying the correlation of these parameters and neuronal controls directing them, lung disorders project and activity,

G. Diseases and Conditions of the Circulatory System

i. Explain the difference between myocardial infarction and angina pectoris
ii. Explain what happens when the pumping action of the heart fails
iii. Compare arteriosclerosis with atherosclerosis
iv. Define anemia, and list the presenting symptoms
Labs focus on significance of cardiovascular health in everyday life.
Labs include Dissection of cow hearts, Student designed inquiry lab on changing (a) heart rate (b) Blood Pressure and (c) Lung capacity, studying the correlation of these parameters and neuronal controls directing them, heart disorders project, heart model planning and construction, and modeling mechanisms and complications of hypertension (see Section 5 for details)

H. Diseases and Conditions of the Urinary System

i. Explain the diagnostic value of urinalysis
ii. Describe diabetic nephropathy
iii. Define stress incontinence
Labs focus on connections between the urinary system and other systems such as digestive.
Labs include kidney dialysis simulations and renal failure mechanisms modeling (see Section 5 for details).

I. Diseases and Conditions of the Reproductive System

i. Identify risk factors for STD's
ii. Explain what is meant by a silent STD
iii. Explain how genital herpes is transmitted
iv. Explain the value of prostate-specific antigen (PSA) as a screening test
Labs focus on pathologies during pregnancy among other reproductive disorders.
Labs include modeling pregnancy complications and mechanisms (see Section 5 for details)

J. Neurologic Diseases and Conditions

q. List some of the problems to which the nervous system is susceptible
r. Name the common symptoms and signs of a CVA

s. Define a transient ischemic attack
t. Describe three mechanisms of spinal injury

Labs focus on differentiating between spinal and brain injuries and designer babies.
Labs include presentations on brain injuries and complications, spinal injuries and complications, and modeling the mechanisms of action potential in nerves, especially the effect of drugs and ions such as K+ and Na+ (see Section 5 for details). Nervous system physiology – reflex hammer activity, reflexes testing, Emphasis on muscle reflexes and reflex arc, connection to yoga and aerobic exercise, nervous system slides (thin sections), and dissection of cow brains

K. Mental Disorders

i. Name some contributing factors to mental disorders
ii. Relate treatment options for alcohol abuse
iii. Name the classic signs and symptoms of schizophrenia
iv. Explain the difference between reactive depression and a major depressive disorder
v. Explain how posttraumatic stress disorder differs from other anxiety disorders

Labs focus on awareness of mental disorders and how to differentiate between them
Labs include presentations and discussions on the major mental disorders such as depression, schizophrenia, alcohol and drug abuse, anxiety disorders and so on.

L. Disorders and Conditions Resulting from Trauma

i. List the major types of trauma
ii. List environmental factors that may result in trauma
iii. Distinguish between an abrasion and an avulsion Explain the rule of nines.

Labs focus on awareness of trauma related conditions.
Labs include case study discussions and group discussions

M. Diversity, Social Justice and Equity

i. Research diversity, epidemiology and social justice.
ii. Research impediments to education and civil rights
iii. Research awareness of LGBTQ1+
iv. Research bioethics with respect to genetics and physiology

Labs focus on awareness of social justice and bioethics.
Labs include group discussions on dangers of teenage pregnancy, ethics of “designer genes”, presentations on diversity, epidemiology, social justice, impediments to civil rights and education, student designed inquiry lab on bioethics/genetic engineering pros and cons

N. Final integration project

i. Research on history of physiology
ii. Extrapolation of integration of material studies to solve real life issues

Labs focus on applying and articulating material learned during the course to real world case studies and situations.
Labs include group discussions and presentations on the history of physiology and medicine, focusing on advancement of physiology over time, and case study discussions to improve diagnostic and analytical skills.

O. Mini Seminars

i. Research current events and relate to class material
ii. Bring recent scientific papers or interesting scientific facts/experiments to the attention of the class

Labs focus on current events and the opportunity for all students to participate in a seminar like setting

Labs include presentation and discussions of current events, and creation of c ase studies based upon them

3. Building Arduino Heart Rate LED monitors and Arduino BP monitors

i. Students will learn how to build arduino heart rate and BP monitors, building upon their programming skills from sophomore computer science.

Labs focus on integration of physiology with computer science and programming

Labs include creating an arduino heart rate LED monitor using partial code provided by instructor and creating arduino blood pressure monitor for use in the cardiovascular unit.

4. Integration of other disciplines

i. Students will integrate biophysics by modeling the nerve action potential using material I received from a conference.

ii. The simulation will include the effect of drugs and ions such as K+ on the action potential. This will pave the way for understanding of the pharmacology used for treatment.

5. Modeling Biological Systems

i. Students will model the pathological mechanisms of the following diseases starting at the molecular level.

(a) modeling simulation of the mechanisms of nerve action potential,
(b) modeling pathologies during pregnancy (specific TBD),
(c) modeling pathology and complications of diabetes
(d) modeling pathology and complications of hypertension, and
(e) modeling renal failure and dialysis simulations

For example, they will model the development of diabetes starting with the causes and relate it to physiological symptoms.

ii. Students will also model complications of these diseases

iii. Students will also relate their understanding of concepts to real life examples by writing a lab procedure including objectives, materials, procedure and case studies for the biological systems-modeled.

NOTE: A list of student readings for each topic has been posted on moodle to help students

Study Tips –Please Note Carefully In Order To Excel In This Course!

This is an interactive class. Based on student successes from previous semesters, I have compiled some study tips to help students do well in this class. One important fact to remember is that this class covers a lot of information in a short period of time, therefore it is essential to keep up to date with the class, and make sure that you have understood what has been discussed in the previous class BEFORE the next class takes place. In case you are unsure of anything, please make an appointment with me and we will go over the material. The best way for me to help you is if you write daily summaries of material from the class, and bring in your questions so that we can make the most of our time together, since time is a scarce commodity at IMSA.

- Take good notes in class.
- Write down, at the end of each class, what you have understood from the day's discussions. Also note down any questions and anything else that interests you.
- Go over your notes for the day and add to it.
- Save these daily summaries as a review for the final.

- Periodically, I will ask for these summaries so that I can assess whether I can help you do better in the class. Please make sure your summaries are available to you when you come to class.
- Use the IRC a lot. The textbook provides basic information; the IRC provides more up to date information. The internet is also an excellent source provided you use reputable and scholarly sources.
- This class requires both memorization and application of your memory to real life case studies. Please **do prepare continuously for exams and quizzes**, you will definitely do much better, based on past student experiences. Preparation should be an ongoing process.
- I will ask you to interact and participate in class a lot; this is for your own good.
- Students should expect to be prepared to discuss material in class, and also to come up and use the board a lot. Also be prepared to learn Physiology the fun way!!!
- I will expect you to remember what you learned in MSI, because I will ask you to write lab reports that are statistically comprehensive. I will post MSI documents on moodle, but if you need more help, PLEASE contact me.
- Questions on tests/quizzes will be based on material covered in class, and can be found either directly or indirectly from any of the sources listed above. If you are up to date on your class material, you will not find any "surprises" on your tests/quizzes! Many questions on the tests require not pure memorization, but application of concepts studied to case studies and such.
- It is not impossible to do well in this class, many students have done it, and so can you. Please remember to use these study tips regularly and you should have no trouble doing well.

Note: The content and sequence of this syllabus is subject to change at the instructor's discretion at any time as necessary