

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-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
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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.

igniting and nurturing creative, ethical scientific minds that advance the human condition

- 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 re-

port 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.

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 and in-class assessments.

Grading generally falls along the following scale:

90% and above = A

80-89% = B

70-79% = C

Below 70% = D

These ranges are subject to scaling. However, the cut-off for an "A" will never be higher than 90%.

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.

Sequence of Topics and Activities

During the first several weeks, much of the time in the PAD class is spent learning the basic concepts of each organ system, and completing activities that are designed to help students learn and understand these concepts better through inquiry. Students also participate in labs which are specially designed to foster inquiry and involve extensive student participation and analysis. As the semester progresses, students learn how to ask different types of scientific questions, analyze data, and draw conclusions from evidence. They also learn to analyze real life case studies in groups and individually, discuss them and learn from peer feedback. The last part of the semester is spent working on an individual paper where students are asked to provide up to date research on specific topics. The culmination of this research project will be a written paper and group presentation of specific topics in physiology.

GUIDELINES AND SYLLABUS FOR PHYSIOLOGY AND DISEASE:

Instructor:

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Aim: To study the basics of the body's organ systems, and understand how alterations in "normal" conditions lead to disease, as well as to analyze and compare diseases of different organ systems

This class 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.

STUDY TIPS –PLEASE NOTE CAREFULLY IN ORDER TO DO WELL IN THIS CLASS!

- 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.

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.]

OUTLINE OF TOPICS FOR PAD CLASSES:

1. **Introduction:** (week 1)
Basic concepts of cellular physiology - cell, tissue, body systems.
Alterations in cell function and growth
Genetic and congenital disorders
Neoplasia and its significance
Focus: Organ systems of the human body and their interdependence

LAB: Cell slides, library assignments, group projects

Student designed inquiry project on disease slides

2. **Lymphatic system and immunity:** (weeks 1 - 3)

First, second and third lines of body defense, lymphoid organs, specific and nonspecific immunity (review)

Autoimmune diseases and other alterations in Immune response, with emphasis on RA, lupus and multiple sclerosis)

Mechanisms of disease; how these conditions are related to other body systems.

Alterations in skin function/integrity and their consequences to the immune system

Stress and adaptation, stress response and its significance, "flight or fight" response

Alterations in temperature regulation – fever and body response during extreme heat

Focus: Integration of immune system with other body systems.

LAB: 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

Week 3 – TEST 1

3. **Cardiovascular system:** (weeks 4-8)

Anatomy of the heart and blood vessels

Physiology of the heart – EKG, arrhythmias, long QT syndrome, abnormal EKGs

Alterations in cardiovascular function (atherosclerosis, CHF (myocardial infarction), hypertension, cardiac tamponade)

Relationship of these conditions to lipoprotein metabolism, beta oxidation, ketosis and cholesterol metabolism.

Focus: Significance of nutrition to cardiovascular health.

Building a mathematical model of food eaten versus food consumed that demonstrates the relationship between nutrition and physiology (Integration of nutrition with Mary Myers)

LAB: Dissect heart

Exercise and pulse rate

Fitness center activity

Blood pressure, peripheral circulation and body position

Change in blood pressure with imposed conditions
Disorders of heart project
Use of EKG sensors and heart rate monitors as well as gas monitors to enhance cardiovascular learning
cardiovascular physiology, target heart rate zone and its significance
Importance of nutrition on CV health – group activity
Analysis of mathematical model built in class (nutrition-physiology)

Student designed inquiry lab on changing (a) heart rate and (b) BP
Statistical comparison of data obtained to previous data (from website)
Statistical evaluation and analysis of physiological parameters
Blood Pressure Sensor Lab (using Vernier sensors)
Heart Modeling Unit (building artificial heart valves)

Week 7 – TEST 2

4. **Respiratory system:** (weeks 9-11)
Anatomy and respiratory physiology
Organs and structures of the respiratory system and their significance
Alterations in respiratory function (COPD, asthma)
Interdependence of respiratory system with other organ systems, such as digestive system and cardiovascular system.
Alterations in GI function and their consequences
Focus: Group discussion on modification of body functions in case of respiratory dysfunction.
- LAB:** Dissect lungs
Lung bag measurements (respiratory physiology lab)
Breathing parameters at rest and after exercise
Breathing and gravity
Factors affecting breathing patterns
Interdependence of respiratory/CVS/digestive system (group project)
- Student designed inquiry project on changing respiratory rates
Comparison of data to previous data (website) and to data obtained in previous unit using statistical evaluations and analysis

Week 10 – TEST 3

5. **Nervous system:** (weeks 12-13)
Organization of the nervous system, central and peripheral
Brain anatomy and physiology

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Developmental aspects – development of Alzheimer’s, Parkinson’s and Huntington’s diseases.

Why it is possible to stop further deterioration, but not cure these diseases?

Focus: Group discussion on brain changes during teenage emotions.

LAB: Nervous system physiology – reflex hammer activity, reflexes testing

Emphasis on muscle reflexes and reflex arc, connection to yoga and aerobic exercise

Examine nervous system slides (thin sections)

Dissect sheep brain

Neuromuscular disorders presentations (research only) and integration with other systems

Student designed inquiry lab on nervous system physiology

Statistical comparison and evaluation of data obtained with previous data (website)

6. **Musculoskeletal system:** (weeks 13-14)

Overview of muscles

long term effects of anabolic steroids

relationship of muscular system with skeletal system – emphasis on wellness class (moving and learning)

Focus: Different types of joints (emphasis on lever systems studied in Physics class)

How these disease states are related to endocrine system.

Focus: Types of aerobic exercise – differences between yoga, pilates and cardio in terms of muscle strengthening and lengthening

Alterations in neural function and muscular function and impact on musculoskeletal system

Alterations in skeletal system and consequences

LAB: Examine muscle slides (thin sections)

Perform aerobic exercise and yoga and analyze muscular integration with nervous system (emphasis on muscle strengthening and lengthening)

Short group presentations and integration with other systems

Student designed inquiry lab on muscle lengthening and

***strengthening, integration with Moving and Learning class,
and comparison to previous data***

Week 14 – TEST 4

7. **Reproductive system:** (weeks 14-15)

Brief overview

Endocrinology of pregnancy: gestational diabetes, placenta previa, and other prenatal disorders

Alterations in reproductive function

Focus: Group discussion on dangers of teenage pregnancy.

Focus: Group discussion on ethics of "bioengineered kids" – GATTACA discussion

LAB: Worksheets and virtual labs

Watch movie clips and analyze them with regard to bioethics

Student designed inquiry lab on bioethics/genetic engineering pros and cons

8. **Urinary system/special senses:** (week 15-16)

Overview of urinary system and its role in maintaining acid base balance; renal failure and artificial kidney. (maximum of 2 class periods)

Alterations in renal function (review/assignments)

Alterations in fluid and electrolytes (review/assignments)

Focus: Physiological buffer systems and their significance – emphasis on buffer reactions in AdChem and their extrapolation to biological systems

Special senses review and study of alterations in special senses

LAB: Slides/models, urinalysis kit, human senses kit, group projects

Student designed inquiry lab on advantages and disadvantages of dialysis in chronic renal

failure patients (connection to Chemistry and Physics classes – Buffers)

9. **Digestive system:**

Organs of the digestive system

Integration with other systems such as cardiovascular and respiratory systems

Importance of nutrition

Alterations in nutritional status: carbohydrate, protein and fat meta

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bolism and role of liver.

Brief overview of endocrine system, skeletal system and special senses (handout)

Alterations in endocrine function

Diabetes mellitus, diabetes insipidus, increased glucose tolerance (insulin resistance)

Focus: Enhance nutritional model built earlier in class, food exchanges, energy calculations

LAB:

Dissection of sheep pluck – location of digestive organs and their function.

Digestive physiology lab

Student designed inquiry lab on appropriate food for various disease conditions

Final project due week 16/17

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