BME 698: Clinical Human Physiology and Neurophysiology

3 Credits, 3 Contact hours
Instructor: James Haorah, Ph.D.
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Textbook(s)/Materials:
This course does not require any textbook. The main course materials will be the lecture power point handouts. Peer-reviewed article and project given out by the instructor will be the required assignments. Course materials will be provided via the Moodle portal to this course, and can be accessed in http://moodle.njit.edu/.

Prerequisites:
BME 105/106: (Introduction to Human Physiology), BME 303: Biological and Chemical Foundations of Biomedical Engineering. BME 382: Engineering Models in Physiology II. BME 469: Introduction to Human Physiology.

This is a required course for Master/graduate students to be offered in Spring 2016.

Course Syllabus:

Week & date	Lecture Topic	Reading Material	Assignments
Week 1	Overview of course	PPT lecture	
Week 2	Physiology of GI Tract and clinical complications.	PPT lecture	Quiz
Week 3	Respiration and clinical complications.	PPT lecture	Quiz
Week 4	Renal function and clinical complications.	PPT lecture	Quiz
Week 5	Liver functions and clinical complications.	PPT lecture	Quiz
Week 6	Blood cells, Hemostasis, Fibrinolysis, Blood groups and Transfusion	PPT lecture	Quiz
Week 7	Cardiovascular function	PPT lecture	Quiz
Week 8	Blood vessels & regulation of blood circulation	PPT lecture	Quiz & journal assignment
Week 9	Cerebral vascular blood flow, shear stress at the Blood-Brain Interface (BBB)	PPT lecture	Quiz
Week 10	Transport of nutrients at the BBB and brain cell energetic interactions	PPT lecture	Quiz

Week 11	Types of neurons and their functions. Synthesis, storage, & release of neurotransmitters	PPT lecture	Quiz
Week 12	Neurotransmission: chemical-electrical signal transmission, and Postsynaptic potentials	PPT lecture	Quiz
Week 13	Neurotransmission in neurological disease	PPT lecture	Quiz
Week 14	Action of neurotransmitters in peripheral nervous system	PPT lecture	Quiz & journal discussion
Week 15	**Final exam,** project presentation & discussions		slide PPT presentation

Lecture duration: Each lecture is designed for 3 hours class.

Course Grading:

Class Attendance:	5%
Quizzes:	60%
Journal discussion:	5%
Project presentation:	10%
Final Exam:	20%

Course Description:
The lecture series will cover fundamental clinical physiology of Gastrointestinal Tract system, Respiration, Renal and Liver functions, Blood, and Cardiovascular function that are relevant to human disease. This lecture will give a special emphasis to cerebrovascular circulation with respect to the transport of nutrients and minerals into the brain at the interface between the blood and the brain, known as the Blood-Brain Barrier. The lecture will then introduce the concept of how these substrates are shuttled into the brain layer-structured for cell-to-cell energetic communication. This energy source becomes the dynamic driving force for neurotransmission, wherein chemical energy is converted to electrical signal output. We will then discuss the outcomes of neurotransmitters imbalance in neurological disease with emphasis on clinical neuropharmacology.

The course is designed to bridge the biological gap within the many courses offered for graduate/master BME students, purely from general physiology and neurobiology aspect. It is an interactive learning course between the instructor and students. Students will enrich their knowledge with open discussions and critiques on selected peer-reviewed articles within the domain of the course topic in the form of a journal club. Students will get a challenge project to design a biomedical device for improving the pathophysiology of human disease based on the understanding of the course materials.

Assignments:
There will be two assignments. The ***first assignment*** will be a challenge project, where each student will design a diagrammatic biomedical engineering device.

Towards the end of the semester, each student will have a five minutes power point presentation of the assigned project. The *second assignment* will be an interactive learning to scientific research articles. Students will be given a challenge project to critique the soundness of the title, hypothesis, experimental approach, data interpretation and conclusion, statistical evaluation, and novelty of the findings of selected peer-reviewed articles. This will be an open discussion like in journal club. Students will not submit any write-up material.

Quizzes: There will be 13 quizzes during the semester. Each quiz will carry five points, and sum of the highest 12 quizzes points (i.e. a total of 55 points) will be the final score. The lowest score of the quiz will be dropped. There will be no make-up quizzes. If you miss a quiz, that is the quiz that will be dropped.