

# Principles of Medical Physiology

## Course Syllabus Spring 2014

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### COURSES

6 credit comprehensive package:

**GMS6400C** (GMS6400C = GMS6405+6406+6411+6408+6415 + Integrative module)

1 credit modules:

**GMS6405** Fundamentals of Endocrine Physiology

**GMS6406** Fundamentals of Pulmonary/Respiratory Physiology

**GMS6408** Fundamentals of Renal Physiology

**GMS6411** Fundamentals of Cardiovascular & Muscle Physiology

**GMS6415** Fundamentals of Gastrointestinal Physiology

**Course Format:** This online course is tailored for asynchronous online learning.

### COURSE DESCRIPTION

Principles of Medical Physiology teaches the functions of the human body at a level required for clinical medicine. Concepts are organized by systems: Endocrine, Cardiovascular, Respiratory, Renal, and Gastrointestinal. Additional content includes final Integrative Physiology section which applies the learned physiological principles to special situations (Pregnancy, Aging, Exercise, Stress). The course covers normal physiology, as well as selected diseases. The ultimate goal is for students to develop an understanding of the integrated functions of the normal body and “problem solving” and “critical thinking” skills in evaluating clinical situations.

### EDUCATIONAL PHILOSOPHY OF COURSE

Physiology is the science of how the body functions, and is the basis for understanding biomedical research and applications to modern clinical medicine. It is the responsibility of the student to comprehend physiological facts and principles for subsequent use in advanced courses. The faculty will guide students in learning individual facts and in integrating the knowledge in order to understand how organ systems work independently and interdependently in the body. We hope that this course will be a useful and constructive learning experience for you.

### TARGET AUDIENCE

This course is designed to meet the needs of individuals wanting to pursue a career in medicine or biomedical research. This course will provide a foundation for students who have not met the entry requirements for medical school and for those wishing to enhance their applications into Masters and PhD programs in the medical sciences.

### PREREQUISITES

This course requires a BA or BS and a strong science foundation with at least 5 full semester courses related to Biology, chemistry and/or physics. **Graduate student faculty advisors must email the course director (Dr. Stevens) a short note affirming their student's qualification to take the course. A minimum undergraduate GPA = 2.0 is required for admission.**

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## ADMINISTRATIVE STRUCTURE

- Course Director: Bruce R. Stevens, Ph.D. (392-4480), [stevensb@ufl.edu](mailto:stevensb@ufl.edu)
- Departmental Chair: Charles E. Wood, Ph.D. (392-4488), [woodc@ufl.edu](mailto:woodc@ufl.edu)
- Distance learning coordinator: Chris Baylis, Ph.D. (392-7869), [baylisc@ufl.edu](mailto:baylisc@ufl.edu)
- Course IT: Kevin Fortin (392-3794) [kfortin@ufl.edu](mailto:kfortin@ufl.edu)
- Course secretary: Robyn Edwards (294-5064) [redwards@ufl.edu](mailto:redwards@ufl.edu)
- The [Department of Physiology and Functional Genomics homepage](#)
- The [Physiology Advanced Concentration page](#)

## COURSE MODULES and FACULTY

All the modules are listed at the bottom of the IDP webpage for the second semester Physiology & Pharmacology Advanced Concentration: <http://idp.med.ufl.edu/curriculum/spring-courses/>

Course materials are accessed from the e-learning login: <https://elearning2.courses.ufl.edu>

Physiology Faculty responsible for coordinating the different sections of this course are shown below. Issues within each individual section should be directly addressed to the listed section head. Students may contact individual faculty outside of class via email, by phone, or in person after arranging a convenient time. Issues concerning the course as a whole should be addressed to Dr. Bruce Stevens.

## COURSE GOALS

Physiology is the science of how the body functions, and is the basis for understanding modern clinical medicine and the biomedical sciences. This course will provide: 1) a foundation understanding of the basic functions of the human body; 2) knowledge of the physiology of the major systems: endocrine, cardiovascular, muscle, respiratory, renal, and gastrointestinal, as well as selected diseases that affect these systems; 3) integration of these individual facts in order to understand how organ systems work independently and interdependently in the body. One example of this integration is in the control of acid base balance. Other examples covered in this course are in the integrated responses to pregnancy and exercise as well as patho-physiologic responses to aging.

## COMPETENCY CATEGORIES

- Core Discipline Competency
- Problem Solving Competency

## LEARNING OBJECTIVES:

- **CORE DISCIPLINE COMPETENCY**
  1. Demonstrate knowledge of the following individual physiological systems at a level required for an understanding of clinical medicine: 1) Endocrinology, (2) Gastrointestinal, (3) Cardiovascular, (4) Respiration, and (5) Renal.
  2. Demonstrate comprehensive knowledge of the integration of these systems in the body, including cellular events, acid/base physiology, and muscle physiology.
  3. Understand how these systems act in an integrated manner to regulate overall body functions.
  4. Understand how failure of these normal physiologic functions and integrations are associated with some diseases.
- **PROBLEM SOLVING COMPETENCY.**

Demonstrate the ability to apply physiological principles of clinical relevancy by multiple choice examinations and Quiz exercises

## LEARNING RESOURCES

1. Course Website ( <https://elearning2.courses.ufl.edu> ) is the primary portal for learning resources.
2. Recorded video lectures with PowerPoint presentations will be provided on the course website.
3. Recorded video clinical correlation(s) and/or case studies relating to the basic science material.
4. Lecture notes for each video lecture are available as PDF downloads enabled for direct note taking.

5. Opportunity for interactive dialogues via email and Listserv.
6. Practice on-line quizzes (not for grade) to advance the understanding of the material provided in lectures.
7. Example exam questions (not for grade) to test knowledge and prepare for each examination.
8. Required text: Student may wish to supplement the course videos and PDF handout by purchasing an online version of "*Berne & Levy Physiology, 6<sup>th</sup> Edition, Updated*" 2010. Author: Bruce M. Koeppen & Bruce A. Stanton. ISBN: 9780323073622.

### **INTERACTIVE COMMUNICATIONS WITH FACULTY**

During the discussion windows of time for each module of content (see Figure below), students will interact with faculty regarding the material, in addition to students studying at home using the videos and PDF handouts.

- For each module, students and a faculty member will meet in a classroom setting in person at least once during the module discussion window. This will preferably occur on the first day of each of the module, at which time any future meetings will be arranged, preferably once per week at a minimum.
- If email is desired, students should target questions to the particular relevant instructor's individual email address, and the faculty will then reply to a class Listserv which will give all the other students in the class the faculty's response (except that confidential matters will be handled privately, as needed). Students are required to have an active Gatorlink email address.

### **STRUCTURE OF CONTENT**

Each recorded session is roughly 25 minutes; a 'standard' 50 minute lecture is broken up into two 25 minute Parts. The course content is structured into modules by organ systems. The six modules are: Endocrine; Cardiovascular+Muscle; Respiratory; Renal; and Gastrointestinal(+Integrated Physiology only in the case of GMS6400C). The contents of the modules are shown later in this syllabus. Physiology Faculty responsible for coordinating the different sections of this course are shown below. Issues within each individual section should be directly addressed to the listed section leader. Students may contact individual faculty outside of class via email, by phone, or in person after arranging a convenient time. Issues concerning the course as a whole should be addressed to Dr. Bruce Stevens.

### **COURSE CALENDAR and RECOMMENDED TIME MANAGEMENT**

The calendar of all course event is shown in the following Figure. The videos and corresponding PDF notes are available throughout the entire time the course is open, from the first day through the end of the course on the day the grades are reported to the Registrar. For each module the course content lecture titles should be viewed in the order shown later in this syllabus. Adapt your own learning pace within each module, as long as the student is prepared to take the Exam on the specified date.



## **EVALUATION and GRADING**

The Core Competency and Problem Solving Competency are evaluated by multiple choice exams plus essay exams, as shown below. Scores for each exam are reported as a percent of 100%. Exams will last 2 hours, unless otherwise instructed in advance of the day of testing. Weighting for final score will be 60% of the final points contributed by essay points + 40% of the final points contributed by the multiple choice portion. Regarding the entire GMS6400C 6 credit package, there is no "final" exam per se, although many concepts in later sections build on material presented in earlier sections because physiology is an integrative discipline by nature.

### **Testing Center**

All exams are taken using computers in the [Testing Center, Room CG-28](#) (ground floor of the Communicore complex). Note that this is the same room and time that other students may be taking their multiple choice exams in other courses, so the room will be full of lots of students each in an assigned computer carrel. In CG-28 you will look for your assigned computer carrel. You may not take pens, pencils, backpacks, etc to your assigned carrel. The computers have drop down calculators. The friendly testing center proctors will guide you in how to use the computers—be sure you completely understand how the testing software works and the mechanics of how to submit your answers. The proctors are approachable. Students are expected to read and follow the standard Testing Center Policy and Procedures, as described at this

link: <http://medinfo.ufl.edu/omi/testing/>

For the Essay Exams, you will answer questions by typing on those computers which save your entries to each question in realtime, so don't worry if there is a nuclear holocaust during the exam session, because your answers will still be saved even if your carrel computer crashes. In addition to typed text, answers to questions might require any or all of the following: drawing diagrams, tables, graph functions, calculations, etc. The technology in these cases is low-tech: you will draw with a testing center pencil on separate sheets of paper which are supplied by the proctors. You should clearly label your papers with your name and also the question number. You can ask proctors for as much paper as you need to expand on your answer, if you wish. At the end of the exam period (designated as 2 hours, unless otherwise stated in advance by the instructor), you will then hand in the papers to the proctors. Be sure to draw legibly, as if your grade depended on it. After the exam, the faculty will read your answers by accessing the exam online behind a password, along with considering your paper items. Usually, grading the exam is done by whoever wrote a particular question, but the module head will weigh in too.

### **Exam Answer Keys**

After each exam, the faculty leader of each section will deliberate with the other instructors of the section in order to generate a final answer key before final scores are released. The answer key may also include short written explanations as to why the 'correct' choice is the correct answer. The key and explanations to answers will be finalized before the scores are released, and before the scheduled date of possible post-exam look-overs. Each section head can use students' drop-down box ambiguity comments and the discrimination index to possibly adjust the key before the scores are initially released. The section heads have the ultimate authority on his/her section answer key. After the key is finalized, then scores will be released to the students who complete faculty evaluations in order to access their score. It is the policy of the Department of Physiology faculty that the answer key used for the post-exam look-overs is immutable; only in the unlikely extreme case of an egregious oversight could the answer key be changed once it is posted for the look-over session.

### **Post-Exam Look-over Sessions**

A post-exam look-over review may be available following each exam, depending on testing center policies and personnel at the time. These are optional-attendance informal one hour online self-assessment sessions in Testing Center room CG-28 whereby students may look over their exam responses along with the answer key. These sessions will occur within approximately a week after each exam as shown. The objective is to be a learning opportunity for students to learn facts or concepts that they may have missed on the exam. The sessions cannot be utilized by students to argue for points, and students are expected to exercise professional behavior during these sessions. For a given missed question, the correct answer may be shown along with a brief

explanation on the computer. This is primarily intended to be a self-help session. However, for students who still do not understand the answer to a missed question, a faculty instructor(s) will be present to offer a verbal explanation. Additional explanation of a correct answer can be amplified by making an office appointment with the appropriate faculty author of a given question—due to the nature of such explanations, the faculty cannot respond to ongoing misunderstandings by email.

### **Summative Evaluation and Grades:**

A numerical grade will be given at the end of the course and will be scored as follows:

93-100%	= A
90-92.9%	= A-
87-89.9%	= B+
83-86.9%	= B
80-82.9%	= B-
77-79.9%	= C+
73-76.9%	= C
70-72.9%	= C-
67-69.9%	= D+
63-66.9%	= D
< 63%	= E

### **GRADING POLICY**

There are no make-up exams unless otherwise granted by the course coordinator prior to an examination date. Failure to take an exam without prior permission from the course coordinator will be recorded as 0. Note that there are no Physiology grades "given" to students by faculty; there are only grades "earned" by students in accordance with performance reflecting the core competency criteria for the course. This important verb distinction shall guide the tone of student/faculty exchange of knowledge.

### **POLICY FOR ACCOMMODATING STUDENTS WITH DISABILITIES**

Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

**POLICIES FOLLOWED IN THIS COURSE:** <http://osa.med.ufl.edu/policies/>

**TESTING CENTER POLICIES:** <http://docs.medinfo.ufl.edu/policies/testing-center-policy-and-procedures/>

### **ACADEMIC HONESTY**

Please review the complete policy of the University of Florida regarding academic dishonesty, found in the online student handbook at: <http://graduateschool.ufl.edu/student-life-and-support/student-handbook>

**Students are expected to abide by the [University of Florida Academic Honesty Guidelines](#) and to adhere to the following pledge:**

“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.

On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

# ENDOCRINE PHYSIOLOGY (GMS 6405)

Section Coordinator Kirk Conrad M.D. ([kpconrad@ufl.edu](mailto:kpconrad@ufl.edu))

**Each recorded content block is roughly 25 minutes; a 'standard' 50 minute lecture is broken up into two 25 minute Parts.**

Introduction to Endocrinology	Sumners
Receptors and Signaling – Part I	Sumners
Receptors and Signaling – Part II	Sumners
Hypothalamus and Pituitary – Part I	Sumners
Hypothalamus and Pituitary – Part II	Sumners
Adrenal Medulla – Part I	Sumners
Adrenal Medulla – Part II	Sumners
Adrenal Cortex – Part I	Wood
Adrenal Cortex – Part II	Wood
Thyroid Hormones – Part I	Sumners
Thyroid Hormones – Part II	Sumners
Clinical Correlation: Thyroid – Part I	Winter
Clinical Correlation: Thyroid – Part II	Winter
Calcium/Phosphate Regulation - Part I	Sumners
Calcium/Phosphate Regulation – Part II	Sumners
Calcium/Phosphate Regulation – Part III	Sumners
Calcium Phosphate Regulation – Par IV	Sumners
Fluid Balance & Cardiovascular Control	Sumners
Quiz 1	Faculty
Growth Hormone – Part I	Raizada
Growth Hormone – Part II	Raizada
Blood Glucose Regulation – Part I	Raizada
Blood Glucose Regulation – Part II	Raizada
Blood Glucose Regulation – Part III	Raizada
Reproduction (Sexual Differentiation – Part I)	Conrad
Reproduction (Sexual Differentiation - Part II)	Conrad
Reproduction Male – Part I	Conrad
Reproduction Male – Part II	Conrad
Reproduction Female – Part I	Conrad
Reproduction Female – Part II	Conrad
Reproduction Female – Part III	Conrad
Reproduction Female – Part IV	Conrad
Reproduction Pregnancy – Part I	Conrad
Reproduction Pregnancy – Part II	Conrad
Reproduction Pregnancy – Part III	Conrad
Reproduction Pregnancy – Part IV	Conrad
Special Topic: Carbohydrate Metabolism in Pregnancy	Conrad
Clinical Correlation : Assisted Reproductive Technologies – Part I	Rhoton
Clinical Correlation: Assisted Reproductive Technologies – Part II	Rhoton
Quiz 2	Faculty

**\* Multiple Choice Exam on Endocrine Physiology**

**\* Essay Exam on Endocrine Physiology**

# MUSCLE AND CARDIOVASCULAR (GMS6411)

Section Coordinator Judy Delp Ph.D., ([jdelp@ufl.edu](mailto:jdelp@ufl.edu))

**Each recorded content block is roughly 25 minutes; a 'standard' 50 minute lecture is broken up into two 25 minute Parts.**

Introduction to Muscle and Cardiovascular Section	Delp
The Structure of Muscle	Walter
The Molecular Structure of Muscle	Walter
Muscle Function and Regulation – Activation	Walter
Muscle Function and Regulation – Force Modulation Part I	Walter
Muscle Dysfunction and Disease – Force Modulation Part II	Walter
Comparing Skeletal and Cardiac Muscle	Walter
Comparing Skeletal, Cardiac and Smooth Muscle	Walter
Clinical Correlation-Muscular Dystrophy	Walter
Overview of Cardiovascular Physiology	Delp
Cardiac Cycle – Part I	Delp
Cardiac Cycle – Part II	Delp
Electrocardiogram – Part I	Delp
Electrocardiogram – Part II	Delp
Cardiac Ion Channels – Part I	Delp
Cardiac Ion Channels – Part II	Delp
Quiz 1	Faculty
Hemodynamics, Arteries – Part I	Wood
Hemodynamics, Arteries – Part II	Wood
Venous Return	Wood
Fetal Circulation	Wood
Pulmonary Circulation- Part I	Scheuer
Pulmonary Circulation- Part II	Scheuer
Neural Control – Part I	Scheuer
Neural Control – Part II	Scheuer
Neural Control – Part III	Scheuer
Local control of flow	Delp
Modulators of blood flow	Delp
Microcirculation – Part I	Delp
Microcirculation – Part II	Delp
Heart Failure-Clinical correlation	Delp
Quiz 2	Faculty

**\* Multiple Choice Exam on Muscle and Cardiovascular Physiology**

**\* Essay Exam on Muscle and Cardiovascular Physiology**



# RESPIRATORY PHYSIOLOGY (GMS 6406)

Section Coordinator: Peter P. Sayeski, Ph.D. ([psayeski@ufl.edu](mailto:psayeski@ufl.edu))

**Each recorded content block is roughly 25 minutes; a 'standard' 50 minute lecture is broken up into two 25 minute Parts.**

Introduction to Respiratory Physiology	Sayeski
Lecture: Functional Anatomy	Sayeski
Lecture: The Respiratory Pump and Lung Volumes	Sayeski
Lecture: Lung Compliance Part I	Sayeski
Lecture: Lung Compliance Part II	Sayeski
Lecture: Airway Resistance Part I	Sayeski
Lecture: Airway Resistance Part II	Sayeski
Lecture: The Work of Breathing Part I	Sayeski
Lecture: The Work of Breathing Part II	Sayeski
Lecture: Alveolar Ventilation and Gas Composition Part I	Sayeski
Lecture: Alveolar Ventilation and Gas Composition Part II	Sayeski
Lecture: Gas Diffusion Part I	Sayeski
Lecture: Gas Diffusion Part II	Sayeski
Lecture: Oxygen Transport Part I	Sayeski
Lecture: Oxygen Transport Part II	Sayeski
Quiz 1	Sayeski
Lecture: Oxygen Content Part I	Sayeski
Lecture: Oxygen Content Part II	Sayeski
Lecture: CO <sub>2</sub> Transport and Content	Sayeski
<i>Clinical Correlation: O<sub>2</sub> Assessment</i>	Sayeski
<i>Clinical Correlation: CO<sub>2</sub> Assessment</i>	Sayeski
Lecture: Pulmonary Circulation Part I	Sayeski
Lecture: Pulmonary Circulation Part II	Sayeski
<i>Clinical Correlation: Pulmonary Edema Part I</i>	Sayeski
<i>Clinical Correlation: Pulmonary Edema Part II</i>	Sayeski
Lecture: Acid-Base Part I	Sayeski
Lecture: Acid-Base Part II	Sayeski
Lecture: Respiratory Control Part I	Sayeski
Lecture: Respiratory Control Part II	Sayeski
Lecture: High Altitude Respiration	Sayeski
Quiz 2	Sayeski
<i>Clinical Correlation: Case Studies Part I</i>	Sayeski
<i>Clinical Correlation: Case Studies Part II</i>	Sayeski

**\* Multiple choice Exam on Respiratory Physiology**

**\* Essay exam on Respiratory Physiology**

# RENAL (GMS 6408)

Section Coordinator Chris Baylis Ph.D. ([baylisc@ufl.edu](mailto:baylisc@ufl.edu) )

**Each recorded content block is roughly 25 minutes; a 'standard' 50 minute lecture is broken up into two 25 minute Parts.**

Introduction to Renal Physiology Section	Baylis
Body Fluids I	Baylis
Body Fluids II	Baylis
General Functions of the Kidney. Renal Anatomy	Baylis
Clearance- Part I	Baylis
Clearance Part II	Baylis
Renal Hemodynamics – Part I	Baylis
Renal Hemodynamics – Part II	Baylis
Renal Hemodynamics – Part III	Baylis
Renal Hemodynamics – Part IV	Baylis
Renal epithelial sodium transport	Baylis
Control of sodium balance – Part I	Baylis
Control of sodium balance – Part II	Baylis
Control of sodium balance – Part III	Baylis
Control of sodium balance – Part IV	Baylis
Quiz 1	Baylis
Renal handling of Calcium and Phosphate	Baylis
Renal handling of Potassium	Baylis
Concentration and Dilution – Part I	Baylis
Concentration and Dilution – Part II	Baylis
Concentration and Dilution – Part III	Baylis
Concentration and Dilution – Part IV	Baylis
Acid/Base Balance – Part I	Baylis
Acid/Base Balance – Part II	Baylis
Acid/Base Balance – Part III	Baylis
Kidney Diseases	Baylis
Quiz 2	Baylis
<b>* Multiple choice exam on Renal Physiology</b>	
<b>* Essay exam on Renal Physiology</b>	

# GASTROINTESTINAL (GMS 6415)

Section coordinator Bruce Stevens Ph.D. ([stevensb@ufl.edu](mailto:stevensb@ufl.edu))

**Each recorded content block is roughly 25 minutes; a 'standard' 50 minute lecture is broken up into two 25 minute Parts.**

Introduction to Gastrointestinal Physiology Section	Stevens
Gastrointestinal Nervous System & Motility Part I	Stevens
Gastrointestinal Nervous System & Motility Part II	Stevens
Gastrointestinal Nervous System & Motility Part III	Stevens
Gastrointestinal Nervous System & Motility Part IV	Stevens
Phases of Digestion and Salivary Gland Physiology	Stevens
Exocrine Pancreas	Stevens
Gastric Physiology Part I	Stevens
Gastric Physiology Part II	Stevens
Small Intestine Epithelium and Protein Digestion/Absorption	Stevens
Carbohydrate Digestion/Absorption	Stevens
Liver and Gallbladder Part I	Stevens
Liver and Gallbladder Part II	Stevens
Lipid Digestion and Absorption Part I	Stevens
Lipid Digestion and Absorption Part II	Stevens
GI Electrolytes and Fluids Part I	Stevens
GI Electrolytes and Fluids Part II	Stevens
Summary map of digestion and absorption	Stevens
Study guides: GI hormones and GI regulators	Stevens
Gastrointestinal Commensal Microbiota – Part I	Mai
Gastrointestinal Commensal Microbiota – Part II	Mai
Quiz	Stevens

**\* Multiple choice exam on Gastrointestinal Physiology**

**\* Essay exam on Gastrointestinal Physiology**

**Note: In the case of the 6 credit GMS6400c course only, the last multiple choice exam covers both GI material plus Integrated Physiology material)**

# INTEGRATED PHYSIOLOGY

(Note: this Integrated Physiology material is only included in the 6 credit GMS6400C package)

Section Coordinator Chris Baylis Ph.D. ([baylisc@ufl.edu](mailto:baylisc@ufl.edu))

**Each recorded content block is roughly 25 minutes; a 'standard' 50 minute lecture is broken up into two 25 minute Parts.**

Introduction to Integrated Physiology Section	Baylis
Pregnancy Physiology: Maternal – Part I	Baylis
Pregnancy Physiology: Maternal – Part II	Baylis
Pregnancy Physiology: View from the Fetus	Wood
Aging Physiology: Kidney	Baylis
Aging Physiology: Cardiovascular	Delp
Integration: Muscle and the cardiovascular system	Walter
Exercise Physiology and Cardiovascular – Part I	Delp
Exercise Physiology and Cardiovascular – Part II	Delp
Exercise Physiology and Lungs	Sayeski
Stress Physiology	Wood
Quiz	Faculty

**\* Multiple choice Exam covering Gastrointestinal plus Integrated Physiology.**

**Note: In the case of the 6 credit GMS6400c course only, the last multiple choice exam covers both GI material plus Integrated Physiology material.**

**\* There is no essay exam covering Integrated Physiology.**