# Advanced Renal Physiology and Pathophysiology

## Course Syllabus

**Course Number:** **GMS 6414**

**Credit Hours:** 2 credit hours

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

**COURSE DESCRIPTION**

This is an advanced graduate class, also suitable for postdoctoral students, which will expose students to several aspects of kidney function, as follows: Physiological control of glomerular filtration and glomerular function in renal disease; regulation of renal sodium excretion; morphology of renal transporters; renal mechanisms of acid-base balance; the renal physiologic responses to normal pregnancy. The teaching faculty is drawn from a wide range of disciplines and all are actively involved in research on their areas of expertise.

The structure of this course involves 1) Lectures by research faculty on areas of their expertise; 2) assigned readings; 3) examinations on the lecture material; and 4) a term paper.

**TARGET AUDIENCE**

This course is designed for individuals wishing for an in-depth understanding of kidney physiology and pathophysiology. This course will be useful for students who have not met the entry requirements for medical school and who are interested in a career in cardiovascular and/or nephrology medicine, and for those wishing to enhance their applications into Masters and Ph.D. programs in the medical sciences in renal research.

**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. In addition, Principles of Medical Physiology (GMS6400) is required.

To access the journal articles from off-campus, students must use UF's VPN (virtual private network). Instructions and installers for various operating systems can be found at: https://net-services.ufl.edu/provided-services/vpn/clients/ (use your Gatorlink account to log in).

To view the online videos, a high-speed internet connection is required, as well as a web browser with the latest Microsoft Silverlight plugin installed.

**CONTACT**
The director of the course is Jaya Kolli, M.D., Lecturer in Physiology. He can be contacted using Canvas messaging.

**SCHEDULE**
This is a semester long course that is offered each semester. It is designed to be taken as part of the Medical Physiology Certificate course and should be preceded by GMS 6400C and GMS6410. The course can be taken concurrently with GMS6410 and/or GMS6413.

**COURSE GOALS**
The kidney is the primary regulator of all the body fluid compartments and controls both volume and composition. The course explores: 1) the mechanisms by which filtration of fluid occurs at the glomerulus; 2) some current ideas on the causes of progression of chronic kidney disease; 3) molecular aspects of structural and functional regulation of renal sodium excretion; 4) advances in the molecular understanding of the kidney and acid base balance; 5) the complex renal adaptations that occur in renal hemodynamics and sensing and control of sodium balance during normal pregnancy.

**LEARNING OUTCOMES**
Upon completion of this course, students will be able to:

1. Understand how the renal circulation and the tubular epithelium play unique and interdependent roles in the regulation of body fluid balance and composition.
2. Understand the hemodynamic control of GFR and that nitric oxide (NO) and angiotensin II (Ang II) exert opposing physiological actions. Also, to appreciate how an imbalance between NO and Ang II contributes to chronic kidney disease.
3. Understand the consequences of a loss of renal function and how this may progress in chronic kidney disease.
4. Understand how the collecting duct plays a key role in the final regulation of total body sodium.
5. Understand the importance of ammonia transporters in the renal mechanism of acid base balance.
6. Learn how renal hemodynamics and sodium balance are controlled in normal pregnancy.
7. Develop and in depth understanding of some of the research contributions that are shaping our current views on kidney physiology and pathophysiology.

**LEARNING RESOURCES**

1. Recorded lectures with PowerPoint presentations and PDF handouts of the lectures (which may include additional explanatory material) is provided on the course website.
2. **Recommended text** (not required, but highly recommended): "*Ganong's Review of Medical Physiology, 26th Edition*" 2019. Authors: Kim E. Barrett, Susan M. Barman, Heddwen L. Brooks, & Jason X.J. Yuan. ISBN: 9781260122404.
   **Free online:** https://accessmedicine.mhmedical.com/book.aspx?bookid=2525.
3. **Recommended text** (not required, but useful): Student may wish to supplement the course videos and PDF handout by purchasing an online version of "Berne & Levy Physiology, 7th Edition" 2018. Authors: BruceM.Koeppen & Bruce A. Stanton. ISBN: 9780323393942.

**EXAMINATIONS AND GRADING**
There are 2 examinations. Both exams are open book. You will receive an MS Word document with questions and space for answers. This will be provided 2 ½ weeks before the exam is due.

You will be assigned a topic for an assigned essay. You will be expected to write a short essay (5-10 pages of text, double spaced; no more than 30 references). The topic will be assigned to you, but you will also be given the opportunity to choose your own topic with the approval of the course director.

A numerical grade will be given for each graded component of the course.

**Grading scale:**

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

| | |
|---|---|
| 93-100% | = A |
| 90-92% | = A- |
| 87-89% | = B+ |
| 83-86% | = B |
| 80-82% | = B- |
| 77-79% | = C+ |
| 73-76% | = C |
| 70-72% | = C- |
| 67-69% | = D+ |
| 63-66% | = D |
| <63% | = E |

**GRADING POLICY**

The 2 open book exams will consist of "short note" questions, and each is worth 35% of the final grade. The assigned essay will be worth 30% of the final grade.

**ACADEMIC HONESTY**
Please review the complete policy of the University of Florida regarding academic dishonesty, found in the online student handbook at:
https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/

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, the following pledge is either required or implied: ***"On my honor, I have neither given nor received unauthorized aid in doing this assignment."***

**IMPORTANT NOTICE ABOUT PLAGIARISM**

Plagiarism is not tolerated at the University of Florida. Plagiarism may be punishable by expulsion from the course or the certificate program. If the plagiarism is detected after the certificate has been awarded, the certificate may be rescinded.

The University of Florida has an honor code that defines plagiarism as follows:

> Section 3a: Plagiarism.
>
> A student shall not represent as the student's own work all or any portion of the work of another. Plagiarism includes but is not limited to:
>
> 1. Quoting oral or written materials including but not limited to those found on the internet, whether published or unpublished, without proper attribution.
> 2. Submitting a document or assignment which in whole or in part is identical or substantially identical to a document or assignment not authored by the student.
>
> Please note that intent is not an element of this kind of violation so it is important to take great care to complete the written assignments in your own words.
>
> For a complete description of the UF Honor Code and procedures, please visit: https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/
>
> For a good discussion about plagiarism and how to properly cite your sources, please visit: http://mediasite.video.ufl.edu/Mediasite/Play/adaa44500eaf460a84f238e6b9a558f9

**COURSE EVALUATION POLICY**

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

## GMS 6414 – Advanced Renal Physiology and Pathophysiology

2 credits

**LECTURES:**

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|---|---|
| 1. Renal Hemodynamics I | Dr. Baylis |
| 2. Renal Hemodynamics II | Dr. Baylis |
| 3. Renal Hemodynamic Adaptations in Normal Pregnancy I | Dr. Conrad |
| 4. Renal Hemodynamic Adaptations in Normal Pregnancy II | Dr. Baylis |
| 5. Renal Sodium Transport: Signaling Events | Dr. Gumz |
| 6. Circadian Clock and Kidney Function | Dr. Gumz |
| 7. Sodium Handling in Pregnancy | Dr. Baylis |
| 8. States of Dysregulated Sodium Handling | Dr. Gumz |
| 9. Nitric Oxide and Angiotensin II in Renal Hemodynamics | Dr. Baylis |
| 10. Derangements of NO and AngII in Renal Disease | Dr. Baylis |
| 11. Chronic Kidney Disease | Dr. Tantravahi |
| 12. Pathogenesis of Glomerular Diseases | Dr. Clapp |
| 13. Acid Base Physiology I: General Considerations | Dr. Weiner |
| 14. Acid Base Physiology II: Ammonia Transporters | Dr. Weiner |
| 15. Morphology of the Tubule and Renal Transporters | Dr. Verlander |

Examinations: There will be 2 short-note examinations that will be take-home examinations based on the lectures. The first exam will cover lectures 1-6, and the second examination will cover lectures 7-15.

Term paper (assigned essay): Please use the following as a guide for your term paper. Remember that this is not an examination. It is a paper, in which you will search the appropriate literature and cite primary literature or reviews (not basic textbooks). You are limited to a total length (without references) of 5-10 pages double-spaced, and you are limited to 30 references.

Assigned topic for term paper:
Chronic kidney disease (CKD) is a life-threatening condition with significant mortality.

Specific assignment: 1) write a short review of CKD; 2) explain the treatment options for CKD; and 3) use your knowledge of physiology to identify one discovery would be most beneficial for designing new treatments for CKD.