

# Homeostasis and the Brain

Course Handbook for GMS7795

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## **COURSE DESCRIPTION**

**Course Number:** GMS7795

**Credit Hours:** 3 credit hours

This semester online course is organized into 12 modules, each focusing on a facet of homeostatic regulation of the body by the brain. The primary focus of this course is developing a deeper understanding of how neurological processes regulate various physiological systems to maintain a balance compatible with life and the environment.

### **Course Goals / Learning Outcomes**

Homeostasis is a fundamental concept in biology and neurobiology, and three of the most-studied themes are Thermoregulation, Body Fluid Balance (including drinking), and Energy Balance (including eating). Major strides have been made in the past few years in going from a description of the behavioral and physiological responses that underlie these mechanisms of homeostasis, to understanding the detailed brain mechanisms involved.

At the end of this course, you will have a working knowledge how the brain regulates homeostatic processes of the body and a greater understanding and appreciation of how the nervous system interacts with other physiological systems.

### **Target Audience**

This semester course has been specifically designed for students enrolled in the UF Biomedical Neuroscience Certificate Program. Graduate students attending UF in programs outside of the IDP Neuroscience Program and interested postgraduate and advanced undergraduate students are encouraged to inquire about registration.

### **Prerequisites**

If you are an Online Certificate student or an Online Master's student, GMS 6007 is an absolute prerequisite for taking this course. If you are enrolled somehow without having taken GMS 6007 course, please contact the instructor or drop the course immediately.

### **The Syllabus**

We call the current document the course handbook and this document contains most of the information that is normally found in a typical syllabus. The reason this document is not officially a "syllabus", is, that there is no precise schedule herein. The precise class schedule is found in Canvas and is dynamically updated automatically if a change in the schedule is instituted. You can find the syllabus as shown below.



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**Syllabus**


Outcomes

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Modules

Rubrics

Collaborations



## Course Director and Instructor

Nick Musselwhite, Ph.D.

*Instructional Assistant Professor*

Email: Via Canvas (see directions below)

## COURSE FORMAT

### Course Modules & Units

This course is divided into 12 Modules, each lasting one week starting on Monday mornings. Each module is broken down into 1-3 Units, each dealing with a subset of the material that week. Each Unit is accompanied by a Voice Thread presentation, and sometimes with additional reading material. [There is no required text for this course, so the readings are crucial]. Each Module concludes with a multiple-choice quiz on the entire Module (due Saturday 11:59 pm) and a written paper on a relevant topic (due Sunday at 11:59 pm). In addition, each Monday morning you will be assigned a paper submitted by one of your peers for peer review, and this will be due the next day, Tuesday by 11:59 pm. All of these times are in Eastern Standard time: if you are in a different time zone, then YOU must make the conversion/adjustment.

## GENERAL COURSE SCHEDULE

### Module 1 Thermoregulation Basics

Unit 1 Introduction to Homeostasis

Unit 2 Temperature Receptors

Unit 3 Brain Mechanisms in Fish

### Module 2 Thermoregulation in Mammals

Unit 1 Mammalian Thermoregulation & Endotherm Strategies

Unit 2 Molecular Neurobiology

Unit 3 Comparative Thermoregulation

### Module 3 Human Thermoregulation

Unit 1 Basics of Human Thermoregulation

Unit 2 Adaptation

Unit 3 Cognitive Aspects of Thermoregulation

### Module 4 Body Fluids and Osmoregulation

Unit 1 Body Fluid Composition and Distribution

Unit 2 Osmoregulation

Unit 3 Osmoreceptor Location and Pathways

### Module 5 Body Fluid – Volume Regulation



Unit 1 Volume Regulation and Angiotensin  
Unit 2 Hypotension Thirst and Aging  
Unit 3 Molecular Neurobiology and Hypovolemia

**Module 6** Integration of Thirst Sources

Unit 1 Hybrid Dehydrations  
Unit 2 Brain Substrates of Hybrid Thirst  
Unit 3 Prandial Drinking and Circadian Factors

**Module 7** Sodium Homeostasis and Appetite

Unit 1 Characteristics of Sodium Appetite  
Unit 2 Brain Mechanisms of Sodium Appetite

**Module 8** Macronutrients, Micronutrients, and Metabolism

Unit 1 Eater Classes, Energy, and Energy Balance  
Unit 2 Macronutrients  
Unit 3 Basic Brain Mechanisms of Feeding

**Module 9** Chemosensation: Nose, Tongue, and Gut

Unit 1 Olfaction  
Unit 2 Taste  
Unit 3 Gut: Enteroendocrine

**Module 10** Brain Mechanisms of Eating

Unit 1 Brainstem  
Unit 2 Hedonic Mechanisms

**Module 11** Special Topics in Feeding

Unit 1 Microbiome  
Unit 2 Genetics and Epigenetics  
Unit 3 Learning about Food

**Module 12** Intersections and Integration

Unit 1 Temperature, Fluid, and Energy Homeostasis

## LEARNING RESOURCES

### Required Texts

NONE! There is no required text for this course, however each unit has a provided selection of required reading comprised of papers from the literature that are vital for your understanding of the material, so these readings are crucial.

### VoiceThread/Canvas

- All VoiceThread lectures are accessed directly through the Canvas course website. VoiceThread is an asynchronous interaction platform that **allows you to post questions about the material directly within the lectures** using the text, audio, or video + audio commenting feature of VoiceThread. VoiceThread is easy to use and you will become familiar with it as you work through the Start Module of the course.
- Discussion boards for each Module are available for posting questions about the course materials covered in that Module.
- Online or face-to-face meetings with instructors are available upon request.

## ASSIGNMENTS AND EXAMINATIONS

For each of the 12 modules, students will complete a Module Test, Writing Assignment, and Peer Review.

### Module Tests (Using Lockdown Browser)

Module Test multiple choice and are due Saturday at midnight (11:59 pm) Once a question is answered and submitted, you will not be able to return to that question. You must answer each question to view the next question. You will be given 60 secs to answer each question on average.



**Therefore, it is imperative that you leave yourself enough time on Saturday to take this test.**

We highly recommend that you take the online tests during UF Help Desk hours whenever possible so that you can obtain assistance if needed. Moreover, remember that the Canvas server does not have unlimited bandwidth. Therefore, if you wait until 11pm on Saturday night to begin your assignments, many other people around the UF campus are doing the same thing. This stresses the server on our end which may slow loading of test pictures and take away from your time. Taking assessments at the last minute also does not allow for unexpected problems that may occur.

**Importantly**, the time limit for completing the exam starts when you start the exam. *For example, if you begin a 40 min exam 20 minutes before it is due, you will be given only 20 min to complete the exam because it automatically submits your exam when it is due.*

### **Writing Assignments**

Each Module contains one Writing Assignment where you will be tasked with discussing a prompt pertaining to that weeks content/subject. Papers should be approximately 800 words in length (not including references). Each paper should contain at a minimum 5 scholarly references, most of which should be from original research papers. These writing assignments are due Sunday at midnight (11:59 pm). References and citations should adhere to the Journal of Neuroscience style guide (this is a very easy and clean looking reference style). **All references should contain a hyperlink to the material used** (preferably by hyperlinking the DOI). The rubric used for grading these papers can be found on Canvas by clicking the "Rubrics" link in the course sidebar.

### **Peer Review**

The Monday morning following the submission of a writing assignment you will be assigned a fellow student's paper to peer review. You will use the same rubric used by the instructors to grade the peer review essay. There is a great deal of evidence that these peer review assessments greatly improve your comprehension of the materials. These peer reviews are due the next day (Tuesday) at midnight (11:59 pm).

### **Assignments, quizzes and tests will not be accepted late.**

As a rule, unless you have a medical excuse or a confirmed family emergency with appropriate documentation, late assignments, quizzes, and tests will not be accepted. We recognize that personal circumstances arise that may interfere with your ability to meet a deadline. If this occurs, please let us know as soon as you know. We will not be receptive to retrospective requests for deadline extensions. Your emails will be responded to within 24 business hours (typically sooner).

**If you encounter computer technical difficulties, be sure to include a UF helpdesk ticket number in your request for a deadline extension if you plan to request one. The extension request MUST be submitted within 24 hours of the technical difficulty.**

### **GRADING POLICY**

There is a lot of material covered in this course. Thus, it is **VERY IMPORTANT** that you set aside sufficient time each week to complete the required work. Students will be expected to complete all requirements for one module each week. There will be no deadline extensions for completion of a module unless granted by the course directors prior to the scheduled completion date. Failure to



submit a module assignment by the course deadlines will be recorded as a zero. Once final grades are published, there are no alterations allowed. If a student has an issue with an individual graded assignment, they must address that concern the week of the assignment. Therefore, individual assignment grade changes will not be considered at the end of the course.

### Grading Scale

The grade for the course will be based on total points, with the A-B+ boundary probably near 90% and the B-C+ near 80%. I will let you know more about any adjustments to this nearer the end of the course. Each **QUIZ** will be worth about **15 points**, essay **papers 50** points, and **peer reviews 10** points. Thus, each module (except #12 which has no quiz) will have 75 points associated and the 12 module total will be 885 points.

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

### REQUIRED TECHNOLOGY

- Laptop or desktop computer equipped with microphone and video camera. A microphone and video camera will be used for video conferencing with instructors if you choose to do this. You must have stable internet of > 50 Mbps at your disposal. A computer with at least 12 Mb of internal RAM, running a CPU of at least 1 GHz is recommended. All the images in this course were created with a PC using Windows. While everything *should* work on a Mac OS system, if there are problems with images, PC to Mac OS encoding difficulties are probably at fault and it is unlikely that you get to retake questions where images don't appear.
  - There is a Canvas app that can be used to access the course using your portable devices. The app is not as good as laptop or desktop computers. Under no circumstances should you take any quiz using a portable device.
  - There are VoiceThread apps that are available for iOS and Android devices that can be used to view and post comments on VTs. While these portable devices are excellent for watching lectures and asking questions, we strongly recommend that you use laptop or desktop computers when working on this course. (While I often use the iOS VT app myself, I have found it to be terribly unreliable. VT often fixes issues rapidly and please feel free to contact their support which is very responsive.)
  - This is an online course. Therefore, travel during the course is the student's choice but because this course is extremely challenging with many time sensitive assignments due every week, optional travel is strongly discouraged. The requirements for high-speed internet and appropriate level computer with a modern operating system are still absolute requirements during travel and are the students' responsibility. Unexpected *emergency* travel to areas with poor infrastructure can be an excused absence but the course instructors must be advised either prior to or as soon as possible during the emergency travel. Optional travel cannot be disallowed but, again, it is the student's responsibility to ensure the availability of reliable high-speed internet and appropriate



computer equipment. Internet failure during optional travel may not be deemed an excused absence.

- **Installation of LockDown Browser** – installation instructions and a practice quiz are under Task 3 of Unit 2 in the Start Module. Prior to starting LockDown Browser, quit all other programs on your computer.
- High speed, broad band internet connection such as DSL or cable. **When using LockDown Browser your computer should be directly connected to the internet rather than accessing using WiFi.** A broadband Internet connection is strongly recommended. Slower connections should still be able to access e-Learning, but will take longer to load.
- It is highly recommended that you work with Canvas and VT using either the **Firefox or Chrome Browsers.** Only Chrome can be used for Honorlock on a majority of the assessments in this course.
- For specific questions about browser compatibilities and general questions about e-learning at UF please go to <https://wiki.helpdesk.ufl.edu/FAQs/E-Learning>.

## Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

## NOTIFICATIONS

The complicated nature of this course in Canvas necessitates the liberal use of announcements. Moreover, after tests are graded and released, you can get notifications of the test opening. Without these notifications, you may miss important course information or your chance to go over your test results in detail. Therefore, it is critical that you set up your notifications in Canvas under your account to your own specifications. Below are 2 figures showing you the location of your notifications in Canvas and suggested settings.

	Email rmandel@ufl.edu	Push Notification For All Devices
<b>Due Date</b>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Grading Policies	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Course Content	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Files	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>Announcement</b>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Announcement Created By You	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Grading</b>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Invitation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
All Submissions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Late Grading	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Submission Comment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Blueprint Sync	<input checked="" type="checkbox"/>	<input type="checkbox"/>



## **COURSE CONDUCT (What is expected of you)**

In all course related activities, students are expected to respect one another and use proper language. Students need to be aware that online learning can present significant challenges, particularly to individuals who are not 'self-starters' or those who do not possess good time management skills.

The online classroom is available to you 24 hours a day. Unlike traditional instructional settings in which each student gets the same class, the online setting means that every student gets a different class, the class of his or her choosing. In theory, this type of instruction should be more adaptable to a variety of learning styles. The reality is, however, that some students seem unwilling (we believe all are able) to create their own virtual classroom. This results in procrastination and low quality performance. Recognizing that everyone learns differently, it is impractical to prescribe a 'best way' to approach this course.

You are expected to adhere to the class calendar. If you have a calendar app that you prefer to use, it is recommended that you put the due dates in your app as reminders. The assignments, quizzes and tests associated with the Modules are due on the days and times stipulated on the syllabus and in the Modules section accessed through the Modules menu button in the left-hand menu. While class interaction and group study are encouraged (it is a very effective way to learn in this course), there are no group projects and all assignments should be prepared and completed individually.

### **Academic Honesty**

As a result of completing the registration form at the University of Florida, every student has signed the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work. I agree to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University."

We fully support the intent of the above statement and will not tolerate academic dishonesty.

All students enrolled in GMS 7795 are expected to follow the University of Florida Honor Code (excerpt above). The full text can be found at: <http://regulations.ufl.edu/chapter4/4041-2008.pdf>

Student guidelines for ethical behavior can be found at:  
<http://www.registrar.ufl.edu/catalog/policies/students.html>.

Please also review the use of copyrighted materials, which can be found on the Health Science Center Library's web page:  
<http://www.library.health.ufl.edu/services/copyright.htm>

### **A Note on Generative and other AI tools.**

The use of artificial intelligence (AI) technologies, including AI-generated content and automated tools, is strictly prohibited for the purpose of completing assignments, projects, or any other course-related tasks. The intention behind this restriction is to ensure that students engage directly with the course material, demonstrate their individual understanding and critical thinking, and foster a fair and equitable learning environment. Any violation of this AI usage restriction may result in academic penalties, as determined by the course instructor and the academic integrity policies of the University of Florida. Students are encouraged to seek clarification from the instructor if there are any questions





about the scope of this restriction or the appropriate methods of completing course assignments. Additionally, while AI tools are very exciting, current models are not great at graduate level neuroscience.

### **Additional Conduct Policy for this online course PLEASE READ THIS SECTION CAREFULLY**

It is strictly forbidden to use a second device such as a cellphone camera to take images of assessments. A first violation of this rule will result in the student receiving a zero for that assessment. A second violation of this rule will result in the student failing the course and this violation being reported to the University. This rule applies in all situations and even applies to taking a screenshot of a completed assignment in order to send to the instructor a dispute about a question. To avoid the need to take screenshots, you can use the comment feature within the test while viewing your results. In the comment, include the assessment title, question number, and issue at hand. Again, this policy is absolute. **There are no exceptions.**

### **Attendance and Make-up Policy**

This is an asynchronous 100% online course so attendance is never required. However, as indicated above, various assessments have hard deadlines. In order to make up an assessment, you must have an excused absence. In general, we want all our students to succeed and are willing to allow wide latitude regarding excused absences. However, in the spirit of fairness to all classmates, we must have some reasonable form of documentation. **Pre-clearance of an absence with the approval of the instructor is the best way to deal with obtaining an excused absence.** If you have an excused absence, extensions will be granted.

#### *Potential excused absences:*

- Medical emergencies require documentation.
- Family emergencies require some sort of documentation.
- Intervention of work or military deployment: We extremely value our students who also have careers, therefore, sometimes the students' career can intervene. **In this case, it is critical that prior approval for an extension be obtained** from the instructor with some form of documentation. Most times, finishing assignments well prior to their deadline ameliorates this type of problem.
- Internet outages: internet outages in your town or neighborhood can be an excused absence. However, a copy of a chat with your ISP or some other strict form of documentation must be provided. Again, finishing assignments early reduces the chances of internet outages affecting your ability to submit assignments.
- Power outages: severe storms occur especially in the spring. Paying attention to weather reports indicating potential severe storms should allow you to plan in advance so that a power outage does not derail your on-time completion of assignments. However, if a power outage does affect your submission deadline, some form of proof from your provider, the internet, or a newspaper must be provided. See also travel policy above.
- This list is not completely inclusive and other types of absences can be considered with documentation on a case by case basis.

Excused absences must be consistent with university policies in the [Graduate Catalog](#) and require appropriate documentation. Additional information can be found in [Attendance Policies](#).

## **GETTING HELP**

**When Do I Contact The Uf Helpdesk?**



In the event that you have **technical difficulties with E-learning**, please contact the UF helpdesk at [learning-support@ufl.edu](mailto:learning-support@ufl.edu), or (352) 392-4357. If your technical difficulties will cause you to miss a due date, you **MUST** report the problem to E-learning. Include the ticket number that you are given in an e-mail to the instructor to explain the late assignment/quiz/test.

Types of questions that should be directed to the Help Desk:

1. I can't log into E-learning
2. I have clicked on the "submit" button for my quiz and nothing is happening
3. I can't upload an assignment (be sure that you have reviewed the tutorial on how to do this **BEFORE** you contact the Help Desk)
4. E-learning has given me an error message and I can't submit my assignment.

**NOTE:** *Late work that involves technical difficulties with E-learning MUST be accompanied by a ticket number from the Help Desk.*

**ALSO** - Be sure to be familiar with the hours of operation for the UF help desk. There hours are posted at <http://helpdesk.ufl.edu/about/business-hours/>

### **When Do I Post Questions To The Course Questions Discussion Board?**

Questions that deal with the course content itself should be submitted to the Course Questions board. Posted questions should NOT be about grades or a private matter. Do not post personal grade questions on the Course Questions discussion board.

Before posting a question, check those already posted to be sure that you are not duplicating a question. These should be things that other students in the class might have trouble with. For example:

1. I am unable to post comments to VoiceThread.
2. One of the quiz questions did not display properly.

Posting on the Course questions board is the fastest way to get an answer to your question. Be sure to give it a meaningful heading!

Questions of a private nature should be e-mailed to the course instructor (see below on how to e-mail within E-learning).

In all cases, please allow 24 hours for a response. Every effort will be made to answer questions posted over the weekend with 24 hours. If not addressed, they will be addressed on the following Monday.

### **When Do I Email My Instructor?**

**Questions about the course should be e-mailed to the instructor through the e-mail tool in E-learning (Canvas).**

Examples of e-mail questions for the instructor to get clear, concise responses:

1. I think there is an error in my grade for the assignment in module 3 (be sure to explain exactly why you think there is an error and provide documentation)
2. I am behind in the course and I would like to know how I may catch up (in such a case, your instructor may ask you to set up a Zoom meeting.
3. If you have questions about the course itself, please reread this handbook before asking a question. If the answer is not in the handbook, check the Course Questions discussion board (this discussion board can be located by clicking on the discussions menu tab on the left of the



course home page). If the answer to your question is not there, please post the question on the Course Questions discussion board.

Late work that involves technical difficulties with E-learning MUST be accompanied by a ticket number from the Help Desk.

### **How To Email Your Instructor Via Canvas**

To send an e-mail from the course:

1. Click on the mail icon that is located the left side of your screen.
2. Click the "Compose Message" button.
3. "To: window" will display.
4. Locate your instructor's name.
5. Always include a description in your subject line in the best case this will include the course number, the module and unit in question, and the item (writing assignment, VT, etc). While this subject line may seem overly complicated it will allow the instructor to easily collate and search for specific questions throughout the course.
6. Type your message and add any necessary attachments. Be sure that your subject line adheres to the format indicated above.
7. Click "send."

### **Student Support Services**

For any technical issues you encounter with your course please contact the UF computing Help Desk at 352-392-4357. For Help Desk hours visit: <http://helpdesk.ufl.edu/> .

For a list of additional student support services links and information please visit:

<http://www.distance.ufl.edu/student-services>.

Special Accommodations - Students requesting disability-related academic accommodations must first register with the Disability Resource Center (<http://www.dso.ufl.edu/drc/>). This should be done as early in the semester as possible. The Disability Resource Center will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation. The Disability Resource Center is located in 001 Building 0020 (Reid Hall). Their phone number is 352-392-8565.

