University of Florida
College of Health & Human Performance Syllabus
PET 5936: Motor Control
(3 credit hours)
Fall Semester, 2021
Thursdays, Class periods 6-8 (12:50 PM- 3:50 PM)
Delivery Format: On-Campus (Weimer Hall 1094)

Instructor Name: Zheng Wang, Ph.D.
Office Number: FLG146
Phone Number: 352-273-6450
Email Address: zheng.wang@ufl.edu
Office Hours: by appointment
Teaching Assistants: N/A
Preferred Course Communication: by email

Prerequisites This course is open to all Applied Physiology and Kinesiology, Rehabilitation Science, and Biomedical Engineering Ph.D. students. Admission to each of the graduate programs is a prerequisite. Graduate students from other programs are encouraged to register this course with prior permission from the instructor.

PURPOSE AND OUTCOME

Course Overview

This course introduces fundamental theories related to motor control and movement science and discusses these concepts in the context of neurorehabilitation. The course also emphasizes atypical motor control functions and underlying neurophysiological mechanisms following disease/injury. Students will practice scientific writing and presentation skills through weekly in-class presentations.

Relation to Program Outcomes

This course relates to the following student learning objectives in the graduate program:

1. Develop critical reading, thinking and scientific communication skills
2. Learn how to present research data to a diverse audience through written formats and academic presentations
3. Learn how to receive and answer research questions through academic presentations
4. Learn how to critically evaluate research theories, methodologies, findings, conclusions, and study limitations
5. Learn how to evaluate different clinical assessments, evaluations, and interventions in the context of rehabilitation science

Course Objectives and/or Goals

Following completion of the course, the student will be able to:

1. Discuss fundamental theories and concepts related to motor control and movement science
2. Utilize foundational knowledge of motor control to evaluate atypical behavioral and physical deficits observed in neurodegenerative and neurodevelopmental conditions
3. Propose areas of further studies in basic science and clinical & translational research to examine gaps in current knowledge relevant to disease diagnosis, clinical evaluations, and interventions
4. Communicate scientific research and activities through written formats and academic presentations

Instructional Methods
This course will utilize a seminar format. All students will read directed articles each week before the class. Two students will be assigned for PPT presentations of the readings. These students will create PPT presentations providing detailed descriptions of the readings before the class. They also will create three questions (or three highlights) for each assigned article and disseminate the questions to the rest of the class no later than each **Wednesday**. They will present their PPT slides and lead the discussion during the class. The rest of the students will participate in the discussion related to these readings and contribute their insights to those questions sent by the speaker.

Required: Directed readings (see Topical Outline/ Course Schedule)

Optional:
- Rosenbaum, D. A. (2010). Human Motor Control (2nd Ed.). Elsevier.
- Latash, M. L. (2008). Synergy. Oxford University Press.

DESCRIPTION OF COURSE CONTENT
The first ~ 1/2 of the course will be covering foundational knowledge about motor control and movement coordination. This includes theories of how movement is controlled and basic discussions of central and peripheral nervous system properties. The remainder of the course will focus on specific motor behaviors/outputs and their control in health and disease states. Each of these units will review the current understanding of motor control of a particular system in health, and then in a specific disease situation.

Topical Outline/Course Schedule

Week (Date)	Topic(s)	Readings
1 (8/26)	Introduction	**Lecture:** Overview of Course Syllabus (Q & A) Overview of Motor Control Theories
2 (9/2)	Theories of motor control: Dynamic systems approach	Thelen, E. (1996). Normal infant stereotypies: a dynamic systems approach. In R. L. Sprague & K. M. Newell (Eds.), Stereotyped movements: Brain and behavior relationships (Vol. xxvi, pp. 139-165). Washington, DC: American Psychological Association. Kelso, J. A. (1984). Phase transitions and critical behavior in human bimanual coordination. Am J Physiol 246 (6 Pt 2): R1000-1004. Kelso, J. A. S. (2012). Multistability and metastability: understanding dynamic coordination in the brain. Philosophical Transactions of the Royal Society B: Biological Sciences, 367(1591), 906-918.

Week (Date)	Topic(s)	Readings
3 (9/9)	Theories of motor control: Internal Model	Kawato, M. (1999). Internal models for motor control and trajectory planning. Current Opinion in Neurobiology, 9(6), 718-727. Wolpert, D. M., Ghahramani, Z., & Jordan, M. I. (1995). An internal model for sensorimotor integration. Science, 269(5232), 1880-1882. Doya, K. (1999). What are the computations of the cerebellum, the basal ganglia and the cerebral cortex? Neural networks, 12(7-8), 961-974.
4 (9/16)	Theories of motor control: Reflexes vs. Voluntary control	Molnar, Z. and R. E. Brown (2010). "Insights into the life and work of Sir Charles Sherrington." Nat Rev Neurosci 11(6): 429-436. Prochazka, A., Clarac, F., Loeb, G. E., Rothwell, J. C., & Wolpaw, J. R. (2000). What do reflex and voluntary mean? Modern views on an ancient debate. Exp Brain Res, 130, 417-432. Agostino, R., Bologna, M., Dinapoli, L., Gregori, B., Fabbrini, G., Accornero, N., & Berardelli, A. (2008). Voluntary, spontaneous, and reflex blinking in Parkinson's disease. Movement disorders, 23(5), 669-675.
5 (9/23)	Theories of motor control: Concept of motor redundancy and abundance and Uncontrolled manifold analysis	Latash, M. L. (2012). The bliss (not the problem) of motor abundance (not redundancy). Exp Brain Res, 217(1), 1-5. Scholz, J. P., & Schoner, G. (1999). The uncontrolled manifold concept: identifying control variables for a functional task. Exp Brain Res, 126(3), 289-306. Hsu, W. L., Scholz, J. P., Schoner, G., Jeka, J. J., & Kiemel, T. (2007). Control and estimation of posture during quiet stance depends on multijoint coordination. Journal of neurophysiology, 97(4), 3024-3035.

Week (Date)	Topic(s)	Readings
6 (9/30)	Postural control: Anticipatory postural adjustment and Central programming theory (i.e., Hierarchical control of movement)	Aruin, A. S. (2002). The organization of anticipatory postural adjustments. Journal of automatic control 12: 31-37. Horak, F. B. and L. M. Nashner (1986). "Central programming of postural movements: adaptation to altered support-surface configurations." J Neurophysiol 55(6): 1369-1381. Klous, M., Mikulic, P., & Latash, M. L. (2011). Two aspects of feedforward postural control: anticipatory postural adjustments and anticipatory synergy adjustments. Journal of neurophysiology, 105(5), 2275-2288.
7 (10/7)	Locomotion / gait Disease: Stroke Leader: David Clark	TBD
8 (10/14)	**Mid-term** Student presentations based on Weeks 1-7. Assignment: create a PPT presentation as follows (see an example on Canvas)	1. Pick one of the topics covered in weeks 1-7 and discuss how it relates to your primary research interest. 2. The presentation shall include: Background (Specific research questions and hypotheses); Significance; Approach & Method; Preliminary Data (Optional) Relevance (i.e., How this course relates to your research or contributes to your research studies) 3. At least 10 slides (~15 min presentation) 4. Save the file to pdf and Name file: **RSD6710_2021Fall_Mid_LastName** **Due date**: Upload the PPT slides to Canvas on **10/14** before midnight
9 (10/21)	Grasping and gripping	Castiello, U. (2005). "The neuroscience of grasping." Nat Rev Neurosci 6(9): 726-736. Prodoehl, J., et al. (2009). "Basal ganglia mechanisms underlying precision grip force control." Neurosci Biobehav Rev 33(6): 900-908.

Week (Date)	Topic(s)	Readings
10 (10/28)	Reaching Disease: Autism Spectrum Disorder	Schmitz, C., Martineau, J., Barthélémy, C., & Assaiante, C. (2003). Motor control and children with autism: deficit of anticipatory function? Neuroscience Letters, 348(1), 17-20. Wang, Z., Lane, C., Terza, M., Khemani, P., Lui, S., McKinney, W. S., & Mosconi, M. W. (2021). Upper and Lower Limb Movement Kinematics in Aging FMR1 Gene Premutation Carriers. Brain sciences, 11(1), 13.
11 (11/4)	Pain Disease: TBD Leader: Mark Bishop	TBD
12 (11/11)	**Holiday Break**	
13 (11/18)	Driving and driving rehab Disease: Aging Leader: Justin Mason	TBD
14 (11/25)	**Holiday Break**	
15 (12/2)	Tremor Disease: Essential Tremor Leader: Bradley Wilkes	TBD
16 (12/9)	**Reading day**	

Week (Date)	Topic(s)	Readings
17 (12/16)	**Final Exam:** Student presentations based on Weeks 1-15. Assignment: create a research statement as follows (see an example on Canvas)	1. Pick one of the topics covered in weeks 2-15 and discuss how it relates to your primary research interest. 2. The research statement shall include: Research focus; Research Project 1 Research Project 2 3. Potential problems, alternative strategies 4. Requirement: 1-2 pages; Margins: Narrow Font: Arial; Font size: 11; Save the file to pdf; Name the file: **RSD6710_2021Fall_Final_LastName** **Due date:** Upload the PPT slides to Canvas on **12/20** before midnight

For technical support for this class, please contact the UF Help Desk at:

- Learning-support@ufl.edu
- (352) 392-HELP - select option 2
- https://lss.at.ufl.edu/help.shtml

ACADEMIC REQUIREMENTS AND GRADING

Grading

The grade for the course will be calculated based on the following criteria:

1. **Presentation of directed reading (35%):** Each student will present 3 original research articles to the class during the semester. Each paper will be worth 8.3% of the grade. The student will prepare a 30-minute presentation. The presentation needs to include: i) a general introduction (background) of the topic being discussed; ii) a statement on the goal(s) and central question(s) of the paper; iii) a critical evaluation of the experimental techniques/methodologies presented in the paper; iv) a clear explanation of the figures presented in the paper; v) an explanation as to how the data addressed or did not address the hypotheses/goals of the paper; vi) an overview of the strengths and weaknesses of the study; vii) a discussion of the scientific implications of the work; viii) a discussion as to whether the interpretations/conclusions were justified based on the data/results, and; ix) a final evaluation of the paper. The student will upload his/her ppt slides on Canvas for grading (100 points of each ppt file).

2. **Students guided discussion (15%):** Questions distributed by the presenter - Each week, the student who presents will distribute at least 3 questions on Canvas (100 points). The questions need to be directly related to the assigned readings. In class discussion - Approximately 10-20 minutes will be dedicated to discussing each selected article. Each student must contribute a question/discussion item related to the research article being presented (100 points).

3. **Mid-term PPT presentation and final written exam (25% each):**

Mid-term PPT presentation (100 points) will be evaluated based on the following criteria:

- Topic: the topic shall be related to the student's research projects. Topics will be reviewed and discussed with the instructor to ensure they are suitable for the students' backgrounds and research experience.
- The content of the presentation:
  - Background (i.e., research focus/interest)
  - Significance (i.e, the impact of the proposed study; how this proposed study significantly contributes to our current understanding of rehabilitation science)
  - Research Questions & Hypotheses (detailed explanation of your research questions and hypotheses)
  - Approach & Method (detailed explanation of the approaches/methodologies that will be used in this proposed study)
  - Preliminary Data (Optional)
- Relevance (i.e., How this course relates to your research projects? How to integrate the knowledge you've learned to your research studies)
- Presentation skills

Final written exam (100 points) is a written research statement which students will prepare at home and upload to Canvas before the due date. Students shall pick up at least one of the topics covered in weeks 2-15 and discuss how it relates to their primary research interest. A research statement can be a summary of research achievements (for senior graduate students) and a proposal for upcoming research (for both junior and senior graduate students). It often includes both current aims and findings, and future goals. An example of the research statement is available for students in Canvas to use as a reference.

The research statement will be evaluated based on the following criteria:

- Topic: the topic shall be related to the student's research studies/projects as well as the course topics
- The content of the presentation shall include:
  - Background (i.e., an introduction of the research focus)
  - Significance (i.e, a statement re the impact of the proposed study; how this proposed study significantly contributes to our current understanding of the selected topic)
  - Research Questions & Hypotheses (i.e., specific research questions that the proposed studies intend to address and hypotheses related to these questions)
  - Approach & Method (detailed explanation of approaches/methodologies you will use for this proposed study)
  - Preliminary Data (Optional)
  - Potential problems and alternative strategies
- Relevance
- The research statement needs to be well-written to receive the full points

Point system used (i.e., how do course points translate into letter grades).

Example:

Points earned	**93-100**	**90-92**	**87-89**	**83-86**	**80-82**	**77-79**	**73-76**	**70-72**	**67-69**	**63-66**	**60-62**	**Below 60**
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E

Please be aware that a C- is not an acceptable grade for graduate students. The GPA for graduate students must be 3.0. based on all 5000 level courses and above to graduate. A grade of C counts toward a graduate degree only if a sufficient number of credits in courses numbered 5000 or higher have been earned with a B+ or higher.

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	WF	I	NG	S-U
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0.0	0.0	0.0	0.0	0.0

More information on UF grading policy may be found at: https://catalog.ufl.edu/graduate/regulations/

Exam Policy
Policy Related to Make up Exams or Other Work
Excused absences will be handled in accordance with UF policy for excused absences.

For other cases, if you are unable to present on your scheduled day, it is your responsibility to inform both course director and lead speakers by email and make arrangement to switch with another student. If you are unable to make proper arrangement before the class, you still need to prepare for the ppt presentation as well as schedule an individual meeting with the instructor to present your slides to receive the grade. Coordination of any make-up work with instructor is encouraged to take place in advance whenever possible and must be approved by the instructor.

Policy Related to Required Class Attendance
Attendance and participation in group discussions is mandatory and will determine successful completion of this course.
Please note all faculty are bound by the UF policy for excused absences

Excused absences must be consistent with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations/) and require appropriate documentation. Additional information can be found here: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Policy Related to Guests Attending Class:
Only registered students are permitted to attend class. However, we recognize that students who are caretakers may face occasional unexpected challenges creating attendance barriers. Therefore, by exception, a department chair or his or her designee (e.g., instructors) may grant a student permission to bring a guest(s) for a total of two class sessions per semester. This is two sessions total across all courses. No further extensions will be granted. Please note that guests are **not** permitted to attend either cadaver or wet labs. Students are responsible for course material regardless of attendance. For additional information, please review the Classroom Guests of Students policy in its entirety. Link to full policy: http://facstaff.phhp.ufl.edu/services/resourceguide/getstarted.htm

Policy Related to Class Lecture Recordings:
A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture **does not** include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third-party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code."

STUDENT EXPECTATIONS, ROLES, AND OPPORTUNITIES FOR INPUT

Expectations Regarding Course Behavior
Professional behavior is exemplified by:

1. Attendance to all classes
2. Proper mask wearing
3. Not using electronic devices for personal use during class
4. Timeliness
5. Respectful and polite interaction with peers and instructors
6. Active learning as demonstrated by questions and discussion

Communication Guidelines
Laptop / tablet policy
Please bring a laptop or tablet to class with a copy of your assignment loaded on it. Please do not use these devices for personal internet use (e.g. email) during class.
Phones
Professionalism is expected. Please do not use these devices for personal internet use (e.g. email) during class.

Academic Integrity

Students are expected to act in accordance with the University of Florida policy on academic integrity. As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes 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**."

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit 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."

It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For additional information regarding Academic Integrity, please see Student Conduct and Honor Code or the Graduate Student Website for additional details:
https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/
http://www.graduateschool.ufl.edu/about-us/vision-mission-values-and-goals/

Please remember cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior. All suspected violations of the UF Honor Code will be reported to the Dean of Students.

Online Faculty Course Evaluation Process

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/.

SUPPORT SERVICES

Accommodations for Students with Disabilities

If you require classroom accommodation because of a disability, it is strongly recommended you register with the Dean of Students Office https://disability.ufl.edu/get-started/ within the first week of class or as soon as you believe you might be eligible for accommodations. The Dean of Students Office will provide documentation of accommodations to you, which you must then give to me as the instructor of the course to receive accommodations. Please do this as soon as possible after you receive the letter. Students with disabilities should follow this procedure as early as possible in the semester. The College is committed to providing reasonable accommodations to assist students in their coursework.

Counseling and Student Health

Students sometimes experience stress from academic expectations and/or personal and interpersonal issues that may interfere with their academic performance. If you find yourself facing issues that have the potential to or are already negatively affecting your coursework, you are encouraged to talk with an instructor and/or seek help through University resources available to you.

- The Counseling and Wellness Center 352-392-1575 offers a variety of support services such as psychological assessment and intervention and assistance for math and test anxiety. Visit their web site for more information: http://www.counseling.ufl.edu. On line and in person assistance is available.
- You Matter We Care website: http://www.umatter.ufl.edu/. If you are feeling overwhelmed or stressed, you can reach out for help through the You Matter We Care website, which is staffed by Dean of Students and Counseling Center personnel.
- The Student Health Care Center at Shands is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at Shands offers a variety of clinical services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the web site at: https://shcc.ufl.edu/
- Crisis intervention is always available 24/7 from:
  Alachua County Crisis Center:
  (352) 264-6789
  http://www.alachuacounty.us/DEPTS/CSS/CRISISCENTER/Pages/CrisisCenter.aspx

Do not wait until you reach a crisis to come in and talk with us. We have helped many students through stressful situations impacting their academic performance. You are not alone so do not be afraid to ask for assistance.