
COURSE DESCRIPTION:

Human neuroanatomy and neurophysiology with emphasis on motor theory and the sensory and motor systems involved in the acquisition and control of movement. Discussion of normal functions as well as the clinical signs and symptoms of pathological lesions affecting the nervous system. Applicable health conditions, impairments, and activity limitations of the nervous system relevant to current practice are introduced.

CAPTE Standards & Elements:

Example Standard 7: Elements 7A, 7B, 7C, and 7D

DEPARTMENT OFFERING THE COURSE:

UND School of Medicine and Health Sciences - Department of Physical Therapy

CREDIT HOURS: 3 Credit Hours

ABOUT THE PROFESSOR & CONTACT INFORMATION:

Name: David Relling, PT, PhD; Mohamed Elhamadany, PT, DPT, PhD, PCS; Cindy Flom-Meland, PT, PhD, NCS; Amanda Wilson, PT, DPT, NCS.

Phone: (701)777-2831

Email: david.relling@und.edu

Office Location: UND-SMHS Suite E321, Room 347

Student Hours: *By appointment and/or see "Faculty" section in Blackboard.*

COURSE CONTACT HOURS:

Schedule (Clock hours): 51

Lecture: M W 11-12; F 8-9.

COURSE PREREQUISITES:

Registered in the professional Physical Therapy program.

COURSE OBJECTIVES:

After successfully completing this course, you should be able to:

- A. **Discuss normal and abnormal nervous system development and the relationship to developmental abnormalities.**
 1. Describe the various stages of nervous system development, and identify important anatomical structures.
 2. Identify disorders caused by incomplete closure of the neural tube and their effect on neuromuscular function.

- B. **Identify gross anatomical structures of the nervous system.**
 1. Describe the location of the meninges within the central nervous system.
 2. Describe component parts of the spinal cord, brain stem, cerebral cortex, cerebellum and diencephalon.
 3. Identify the four ventricles and describe the production and circulation of cerebrospinal fluid.
 4. Recognize abnormalities in the ventricular system which can give rise to hydrocephalus.
 5. Name the cranial nerves and describe their anatomical relationship in the brainstem.

- C. **Discuss basic nerve physiology, and evaluate clinically related problems.**
 1. Discuss normal neuron anatomy, development of the resting membrane potential, nerve excitation and

transmission.

2. Compare and contrast nerve conduction in myelinated and unmyelinated nerves.
3. Identify and describe physiological events which occur at the nerve synapse.
4. Identify some common neurotransmitters, their agonists and antagonists.
5. Describe the process of Wallerian degeneration and regeneration following injury.
6. Identify the main types of neuroglia cells.
7. Given a clinical scenario involving an electrolyte imbalance, explain the effect on nerve conduction.
8. Given a clinical scenario involving neurotransmitter agonists and antagonists, explain the effect on synaptic transmission.
9. Explain how demyelination affects nerve conduction and neuromuscular function.

D. Discuss the physiology of the peripheral receptors and explain their role in proprioception and reflex activity.

1. Identify the various sensory modalities, and discuss the receptors that are thought to be responsible for each modality.
2. Discuss the basic aspects of receptor physiology including generator potentials, receptor coding and adaptation.
3. Discuss the physiology of the muscle spindle and its effect on muscle tension, velocity of shortening and reflex activity.
4. Explain the physiology of the Golgi tendon organ and its role in muscle tension development.
5. Explain the role of peripheral receptors in the stretch reflex, flexor withdrawal reflex and the crossed extension reflex.

E. Describe the major sensory pathways, discuss the physical signs and symptoms associated with pathologies of those systems, evaluate signs and symptoms and determine most probable sites of lesions.

1. Identify the structures, and describe the pathways involved in temperature, pain, touch, proprioception and vibration sensations.
2. Given the results of a patient's examination, evaluate the results and determine the most probable location of a lesion affecting the sensory pathways.
3. Compare and contrast a complete spinal cord transection, Brown-Sequard, syringomyelia, and a peripheral neuropathy in terms of sensory loss.

F. Discuss the functions of all the cranial nerves, discuss the physical signs and symptoms associated with pathologies of the cranial nerves, evaluate signs and symptoms and determine most probable sites of lesions.

1. Identify the location of the cranial nerve nuclei.
2. Describe the function of each cranial nerve, especially how it relates to a physical therapy examination.
3. Describe the pathways of the visual reflexes and their clinical significance.
4. Given the results of a patient's examination, evaluate the results and determine the most probable location of a lesion affecting the cranial nerves.

G. Describe the major motor pathways, and discuss the physical signs and symptoms associated with pathologies of those systems, evaluate signs and symptoms and determine most probable sites of lesions.

1. Identify the structures, and describe the pathways involved in the corticospinal, corticobulbar, rubrospinal, tectospinal, vestibulospinal and reticulospinal tracts.
2. Compare and contrast a lesion affecting the peripheral nervous system, pyramidal system, extrapyramidal system and basal ganglia.
3. Differentiate in terms of tests and measures between an upper and lower motor neuron lesion, athetosis, chorea, dystonia, ballism and Parkinson's disease.
4. Differentiate between decorticate and decerebrate posture.
5. Given the results of a patient's examination, evaluate the results and determine the most probable location of a lesion affecting the motor systems.

H. Describe the major cerebellar pathways, and discuss the physical signs and symptoms associated with pathologies of the cerebellum, evaluate signs and symptoms and determine most probable sites of lesions.

1. Compare the effects of lesions affecting the cerebellum, pyramidal system and basal ganglia.
 2. Differentiate in terms of tests and measures between a cerebellar lesion affecting the median, paramedian and lateral zones.
 3. Given the results of a patient's examination, evaluate the results and determine the most probable location of a lesion affecting the cerebellum and its pathways.
- I. **Describe the major cerebral cortex pathways, and discuss the physical signs and symptoms associated with pathologies of the cerebral cortex, evaluate signs and symptoms and determine most probable sites of lesions.**
1. Describe the effects of lesions to various areas (Brodmann's) of the cerebral cortex affecting motor and sensory pathways.
 2. Compare between lesions affecting the cerebellum, pyramidal tract basal ganglia, and cerebral cortex.
 3. Compare fluent and non-fluent aphasia, and right and left hemisphere lesions.
 4. Identify the blood supply to the major areas of the brain, and describe the clinical implications of a problem with circulation of each major vessel.
 5. Given the results of a patient's examination, evaluate the results and determine the most probable location of a lesion affecting the cerebral cortex.
- J. **Describe the major auditory, olfactory and taste pathways, and discuss the physical signs and symptoms associated with pathologies of those systems.**
1. Identify and describe the major auditory, olfactory and taste pathways.
 2. Describe the vestibular-ocular reflex.
- K. **Describe the major autonomic nervous system pathways, and discuss the major physical signs and symptoms associated with pathologies of the system.**
1. Discuss the effect of the parasympathetic and sympathetic nervous system activation on major body organs.
 2. Discuss the causative factors, systemic effects and intervention for autonomic dysreflexia.
- L. **Discuss the models of disablement and be able to apply them to clinical situations.**
- M. **Discuss various theories behind the neuromuscular basis of controlled, coordinated activity including:**
1. Basic premise for higher and lower centers of motor control.
 2. Basic assumptions for each motor control theory:
 - Reflex Model
 - Hierarchical Model
 - Systems Model
 3. Basic concepts of motor learning:
 - Identify accurate ways of measuring motor learning
 - Knowledge of stages of motor learning and therapist and patient's role at each stage
 - Discuss key principles of structuring practice sessions and designing practice schedules for given case studies
 - Define various types of feedback used in motor learning (intrinsic and extrinsic).
 4. Recognize the differences between the Traditional and Task-Oriented Models of Neurological Rehabilitation.

COURSE SCHEDULE AND OUTLINE OF CONTENT:

- All students must be available on Friday December 20, 2024 for retake final examinations if required. See schedule on last page of syllabus.

DESCRIPTION OF TEACHING METHODS AND LEARNING EXPERIENCES:

Teaching methods in this course include lecture, application, case scenario, and critical thinking relative to case scenarios.

COURSE MODE OF DELIVERY:

Course mode of delivery is in-person, synchronous.

MATERIALS – TEXT, READINGS, & SUPPLEMENTARY READINGS:

Materials include course notes, powerpoints, and Access Physiotherapy textbooks (*Neuroscience for Rehabilitation* by T. Mosconi and V. Graham).

METHODS OF STUDENT EVALUATION:

In this course, your learning will be assessed in the following ways:

- In class participation/assignments
- Quizzes
- Written and Final Exams

GRADING SCALE:

Grading Scale		Breakdown
A	90% to 100%	Exam I -----15% Exam II -----25%
B	80% to 89.9%	Exam III-----25%
C	76% to 79.9%	Exam IV/Final ---25%
F	< 76%	Quizzes ----- 5% Assignments----- 5%

For more information on grading policies, please refer to the [UND-PT Scholastic Standards Document](#)

COURSE ACCESS & TECHNICAL REQUIREMENTS

This course was developed and will be facilitated utilizing Blackboard. For access go to: <http://blackboard.UND.edu> and log in with your NDUS.Identifier. If you do not know your NDUS Identifier or have forgotten your password, please visit [Your NDUS Account Webpage](#)

Visit the [UND Technical Requirements](#) webpage for more information. Students are expected to use their official UND email in the course. For technical assistance, please contact [UND Technical Support](#) at 701.777.2222

ARTIFICIAL INTELLIGENCE (AI)

Artificial Intelligence tools are allowed in this course as approved by the instructor(s). Students are required to disclose if they use AI-generated text or images and how they apply it in their work. Failure of students to acknowledge their use of AI or using fabricated information could result in their violation of the Academic Integrity Policy. Students must ensure the originality of their work, maintain academic integrity, and avoid any type of plagiarism. The students need to understand the material and complete assignments on their own, using AI tools as a supplement rather than a replacement for their work. Students should not use sources that are cited by AI tools without having read them because generative AI tools can either create fake citations or cite a real piece of writing, but the cited content may be inaccurate. The faculty reserves the right to use various plagiarism-checking tools in evaluating students' work, including those screening for AI-generated content, and impose consequences accordingly.

For more information on AI Policies, please visit [Artificial Intelligence Resources](#).

UNIVERSITY OF NORTH DAKOTA POLICIES & RESOURCES:

Notice of Nondiscrimination

It is the policy of the University of North Dakota that no person shall be discriminated against because of race, religion, age, color, gender, disability, national origin, creed, sexual orientation, gender identity, genetic information, marital status, veteran's status, or political belief or affiliation and the equal opportunity and access to facilities shall be available to all. Concerns regarding Title IX, Title VI, Title VII, ADA, and Section

504 may be addressed to Donna Smith, Assistant Vice President for Equal Opportunity and Title IX/ADA Coordinator, 102 Twamley Hall, 701.777.4171, UND.EO.TitleIX@UND.edu or the Office for Civil Rights, U.S. Dept. of Education, 230 S. Dearborn St., 37th Floor, 500 West Madison, Suite 1475, Chicago, IL 60611 or any other federal agency.

Academic Integrity

Academic integrity is a serious matter, and any deviations from appropriate behavior will be dealt with strongly. At the discretion of the professor, situations of concern may be dealt with as a scholastic matter or a disciplinary matter.

As a scholastic matter, the professor has the discretion to determine appropriate penalties for the student's workload or grade, but the situation may be resolved without involving many individuals. An alternative is to treat the situation as a disciplinary matter, which can result in suspension from the University, or have lesser penalties. Be aware that I view this as a very serious matter and will have little tolerance and/or sympathy for questionable practices. A student who attempts to obtain credit for work that is not their own (whether that be on a paper, quiz, homework assignment, exam, etc.) will likely receive a failing grade for that item of work, and at the professor's discretion, may also receive a failing grade in the course. For more information read the [Code of Student Life](#).

Accessibility Statement

The University of North Dakota is committed to providing equal access to students with documented disabilities. To ensure access to this class and your program, please contact Student Disability Resources to engage in a confidential discussion about accommodations for the classroom and clinical settings. Accommodations are not provided retroactively. Students are encouraged to register with Student Disability Resources at the start of their program. More information can be obtained by email UND.sdr@UND.edu or by phone at 701.777.2100.

Religious Accommodations

UND offers religious accommodations, which are reasonable changes in the academic environment that enable a student to practice or observe a sincerely held religious belief without undue hardship on the University. Examples include time for prayer or the ability to attend religious events or observe a religious holiday. To request an accommodation, complete [student religious accommodation request form](#). If you have any questions, you may contact the [Equal Opportunity & Title IX Office](#).

Pregnancy Accommodations

Students who need assistance with academic adjustments related to pregnancy or childbirth may contact the [Equal Opportunity & Title IX Office](#) or Academic Affairs to learn about your options. Additional information and services may be found at [Pregnancy Resources](#).

Resolution of Problems

Should a problem occur, you should speak to your instructor first. If the problem is not resolved by speaking with your instructor, refer to the college grievance policy by contacting the department chair or the dean's office. [Link to college grievance policy.] Should the problem persist after taking these initial steps, you have the right to go to the provost next, and then to the president.

Reporting of Discrimination, Harassment, or Sexual Misconduct

If you or a friend has experienced sexual misconduct, such as sexual harassment, domestic violence, dating violence, or stalking, please contact the Equal Opportunity & Title IX Office or UND's Title IX Coordinator, Donna Smith, for assistance at 701.777.4171 or donna.smith@UND.edu.

You may also contact the Equal Opportunity & Title IX office if you or a friend has experienced discrimination or harassment based on a protected class, such as race, color, national origin, religion, sex, age, disability, sexual orientation, gender identity, genetic information, pregnancy, marital or parental status, veteran's status, or political belief or affiliation.

Faculty Reporting Obligations Regarding Discrimination, Harassment, or Sexual Misconduct

It is important for students to understand that faculty are required to share with UND's Title IX Coordinator any incidents of sexual misconduct or of discrimination or harassment based on a protected class that they become aware of, even if those incidents occurred in the past or are disclosed as part of a class assignment. This does not mean an investigation will occur if the student does not want that, but it does

allow UND to provide resources to help the student continue to be successful at UND. If you have been impacted by discrimination, harassment, or sexual misconduct, you can find information about confidential support services at the Equal Opportunity and Title IX webpage.

Health and Safety

UND is committed to maintaining a safe learning environment while providing quality learning experiences for our students. As such, UND asks students and instructors to be flexible when necessary to promote a safe environment for learning. Please do not attend an in-person class or lab if you are feeling ill or if you have been directed by health professionals to quarantine or isolate. UND follows isolation and quarantine guidelines recommended by the [CDC and the North Dakota Department of Health](#). If you are not able to attend class or lab, please notify your instructor as soon as possible and discuss options for making up any missed work in order to ensure your ability to succeed in the course. If you will have an extended absence due to serious illness or other uncontrollable circumstances, you may request an absence notification through the [Office of Community Standards](#). Similarly, if your instructor is ill they may need to cancel class or temporarily move your course to online delivery to ensure that you are able to complete the course successfully. Please consult the [COVID-19 at UND](#) webpage for information regarding on-campus COVID-19 testing, isolation and quarantine guidelines, and vaccines.

**PT 609 NEUROSCIENCE FOR CLINICAL PRACTICE I
FALL SEMESTER, 2024**

Instructor: David Relling, Mohamed Elhamadany, Cindy Flom-Meland, Amanda Wilson
Monday & Wednesday 11 am to 12 pm; Friday 8 to 9 am

DATE	TOPIC
AUGUST	
28	Embryology (DR)
30	CNS Topography and Circulation (DR)
SEPTEMBER	
2	Labor Day Holiday – No Class
4	CNS Topography & Neurophysiology(DR)
6	Neurophysiology (DR)
9	Peripheral receptors (DR)
11	Muscle afferents (DR)
13	Spinal cord reflexes (DR)
16	Clinical cases/Review (ME)
18	Written Exam
20	Cerebral Cortex (recorded) (DR)
23	Cerebral Cortex (DR)
25	Sensory Systems (DR)
27	Sensory Systems (DR)
30	Motor Systems (DR)
OCTOBER	
2	Motor Systems (DR)
4	Cranial Nerves (DR)
7	Cranial Nerves (DR)
9	Clinical Cases (ME)
11	Clinical Cases (DR)
14-18	Midterm Exam Week
21	Cerebellum (ME)
23	Cerebellum (ME)
25	Clinical Cases (DR)
28	Autonomic Nervous System (DR)
30	Clinical Cases/Review (ME)
NOVEMBER	
1	Clinical Cases/Review (TBD)
4	Written Exam
6	Introduction to Motor Control & Models (AW)
8	Introduction to Motor Control & Models (AW)
11	No Class – Veteran’s Day
13	Introduction to Motor Control & Models (AW)
15	Motor Control Theories (AW)
18	Motor Control Theories (AW)
20	Motor Control Theories (AW)
22	Quiz--Motor Control Theories (AW)
25	Motor Learning (CFM)
27	No Class – Thanksgiving Holiday
29	No Class – Thanksgiving Holiday
December	
2	Motor Learning (CFM)
4	Recovery of Function (CFM)
6	Recovery of Function (CFM)
9	Motor Learning (CFM)
11	Motor Learning (CFM)
13	Reading & Review Day
16-20	Final Exam Week