

PT 609: NEUROSCIENCE FOR CLINICAL PRACTICE I

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.

Department Offering the Course:

Physical Therapy

Credit Hours: 3 credit hours

Instructor(s):

David Relling PT, PhD; Mohamed Elhamadany, PT, DPT, PhD, PCS; Meridee Danks, PT, DPT, NCS

Clock Hours:

Lecture: 48 lecture/Discussion Hours

Course Prerequisites:

Registered in Professional Physical Therapy curriculum

GOALS AND OBJECTIVES

After the completion of this course, the student will 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-Se'quard, 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, vestibular, olfactory and taste pathways, and discuss the physical signs and symptoms associated with pathologies of those systems.

1. Identify and describe the major auditory, vestibular, olfactory and taste pathways.
2. Describe the vestibule-ocular reflex.
3. Describe the pathophysiology of benign positional vertigo.

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.

GRADING SCALE: A (90 – 100%), B (80 – 89.9%), C (76 – 79.9%). Grades are based on written examinations and quizzes.

Disability/Access Statement:

Contact me (David Relling, PT Dept) to request disability accommodations, discuss medical information, or plan for an emergency evacuation. To get confidential guidance and support for disability accommodation requests, students are expected to register with DSS at UND.edu/disability-services 180 McCannel Hall, or 701.777.3425.

COVID 19 STATEMENT:

UND is committed to maintaining a safe learning environment while providing quality learning experiences for our students. COVID-19's continued presence within our UND community may necessitate changes in classroom management as the academic year progresses. 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, particularly if you are experiencing symptoms of COVID-19, or if you have been directed by health professionals to quarantine or isolate. Students who test positive for COVID-19 are expected to immediately self-

isolate/quarantine. Doing so will ensure students have the support they need to continue with their academic goals and to protect others. 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 Student Rights and Responsibilities](#). 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. Instructors may require students to wear masks in the classroom or in the laboratory as a preventative measure designed to facilitate uninterrupted classroom engagement and to facilitate health and safety in the classroom. If your instructor does require masks in class or in a laboratory, you are expected to comply with that request.

UND also strongly encourages all members of the University community, including students, to get vaccinated, seek out testing when needed, and model positive behavior both on- and off-campus to foster a healthy and safe learning environment for all students. Individuals who would like to discuss disability accommodations regarding masks should contact the Disability Services for Students (DSS) office at 701-777-2664 or UND.dss@UND.edu. Individuals who are unable to wear a mask due to a sincerely held religious belief should contact the UND Equal Opportunity and Title IX Office at 701.777.4171 or UND.EO.TitleIX@UND.edu.

Academic Integrity:

In accordance with the rules concerning scholastic dishonesty in the *Code of Student Life** at the University of North Dakota, I affirm that I understand these rules and I agree to comply with them. I will not:

- a) receive any additional information or assistance for any exam other than what was provided during class or approved tutor sessions
- b) copy from another student's test
- c) collaborate with or seek aid from another student who may have previously taken the exam
- d) knowingly use, buy, sell, steal, or solicit in whole or in part the contents of any exam
- e) bribe another person to obtain information about any exam

Description of Teaching Methods and Learning Experiences:

Lecture - traditional lecture with team based active learning and functional application of knowledge

Textbook: PowerPoint presentations (Blackboard) and printed notes. *Neuroscience for Rehabilitation* by Tony Mosconi and Victoria Graham.

University Policies on Discrimination and Sexual Violence

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, Director of Equal Employment Opportunity/Affirmative Action and Title IX Coordinator, 401 Twamley Hall 777-4171 or email at und.affirmativeactionoffice@UND.edu.

If you or a friend has experienced sexual violence, such as sexual assault, domestic violence, dating violence or stalking, or sex-based harassment, please contact UND's Title IX Coordinator, Donna Smith, for assistance: 701.777.4171; donna.smith@UND.edu or go to UND.edu/affirmative-action/title-ix.

The [UND Cares Response Team](#) is available to assist with incidents involving UND students 24 hours a day, seven days a week. They respond to incidents such as major accidents, missing students, sickness that interferes with attending classes, death, suicidal ideations, situations involving self-harm, psychological trauma and sexual violence. Contact directly at 701.777.2664 during regular business hours OR University Police Department 701.777.3491 after hours.

PT 605 NEUROSCIENCE FOR CLINICAL PRACTICE I
FALL SEMESTER, 2022
 Instructor: Relling, Elhamadany, Danks
 Monday, Wednesday and Friday 8:00 to 9:00 am

DATE	TOPIC
AUGUST	
24	Embryology
26	CNS Topography and Circulation
29	CNS Topography Lab (9-10 am Anatomy Lab)
31	Neurophysiology
SEPTEMBER	
2	Peripheral receptors
5	Labor Day Holiday – No Class
7	Muscle afferents
9	Spinal cord reflexes
12	Clinical cases
14	Written Exam
16	Cerebral Cortex
19	Cerebral Cortex
21	Sensory Systems
23	Sensory Systems
26	Clinical Cases
28	Motor Systems
30	Motor Systems
OCTOBER	
3	Clinical Cases
5	Cranial Nerves
7	Cranial Nerves
10-14	Midterm Exam Week
17	Cranial Nerves
19	Cerebellum
21	Cerebellum
24	Autonomic Nervous System
26	Clinical Cases (ME)
28	Clinical Cases (ME)
31	Clinical Cases (ME)
NOVEMBER	
2	Clinical Cases
4	Written Exam (end of Week 11)
7	Introduction to Motor Control & Models (start of Week 12)
9	Introduction to Motor Control & Models
11	No Class – Veteran’s Day
14	
16	Motor Control Theories
18	Motor Control Theories
21	Quiz--Motor Control Theories
23	No Class – Thanksgiving Holiday
25	No Class – Thanksgiving Holiday
28	Motor Learning
30	Motor Learning
December	
2	Recovery of Function
5	Recovery of Function
7	Motor Learning
9	Motor Learning
12-16	Final Exam Week