

PT 423: NEUROSCIENCE FOR PHYSICAL THERAPY

GOALS AND OBJECTIVES – Fall, 2021

After the completion of this course, the student will be able to:

- A. **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.

- B. **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.

- C. **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.

- D. **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.

- 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 concept of pain modulation and the theories which attempt to explain the modulation of pain.**
1. Differentiate between the gate control theory and opiate theory of pain modulation.
 2. Differentiate between actions of enkephalins and endorphins.
 3. Describe the effects of central sensitization.
- M. **Describe clinical signs and symptoms related to degenerative diseases of the nervous system, stroke and traumatic brain injury.**
1. Identify modifiable and non-modifiable risk factors for stroke.
 2. Describe PT scope of practice related to rehabilitation of a patient who has had a stroke.
 3. Describe types of traumatic brain injuries and their clinical signs.
 4. Describe common, standardized scales used to measure cognitive, behavioral and status of consciousness in patients who have had a stroke or traumatic brain injury.
 5. Describe major nervous system areas that are affected and significant clinical signs associated with amyotrophic lateral sclerosis, Huntington's disease, multiple sclerosis, Guillain-Barre', and myasthenia gravis.
 6. Describe major nervous system areas that are affected and significant clinical signs associated with Alzheimer's disease.

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:

In this course, students are expected to wear face coverings while in the classroom and/or laboratory. Students electing not to comply with these expectations will not be permitted to enter the room. UND strongly encourages all members of the University community, including students, to get vaccinated and model positive behavior both on- and off-campus in order to foster a healthy and safe learning environment for all students. Individuals who would like to discuss disability accommodations regarding face coverings 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 face covering due to a sincerely held religious belief should contact the UND Equal Opportunity and Title IX Office at 701.777.4171 or UND.affirmativeactionoffice@UND.edu.

All members of the University community have a role in creating and maintaining a COVID-19 resilient campus. There are several expectations from the School of Medicine and Health Sciences that require compliance, including: Wear face coverings during interactions with others and in the classroom; Wash hands often and use hand sanitizer; Properly clean spaces; and, if you are experiencing any symptoms, Stay home and call your health care provider. Students who fail to comply with any of the COVID related requirements will not be permitted in the classroom and may be subject to disciplinary action. We encourage all members of the University community to model positive behavior both on- and off-campus. Any changes in the SMHS COVID related requirements will be communicated to you through the Friday weekly email "For your health" from the Dean's office and email from the program director or chair.

Students who test positive for COVID-19 are expected to immediately self-isolate/quarantine. If you have tested positive for COVID-19 we strongly recommend that you report the information to the Office of Student Rights and Responsibilities at 701.777.2664 or online at <https://veoci.com/veoci/p/w/ss2x4cq9238u>. Doing so will ensure students have the support they need to continue with their academic goals and to protect others. The policy related to COVID-19 may change throughout the semester due to community spread and updated CDC guidelines. Please check the policy frequently and ask faculty if you have any questions.

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

Course Number and Title: PT 423 Neuroscience for Physical Therapy

Description:

Structure and function of the human nervous system including pathophysiology and clinical applications relevant to physical therapy practice. Prerequisite: Registered in Professional Physical Therapy Curriculum.

Department Offering the Course:

Physical Therapy

Credit Hours: 4 credit hours

Instructor(s):

David Relling PT, PhD & Mohamed Elhamadany, PT, DPT, PhD, PCS

Clock Hours:

Lecture: 64 lecture/Discussion Hours

Course Prerequisites:

Registered in Professional Physical Therapy curriculum

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 423: NEUROSCIENCE - PHYSICAL THERAPY

FALL SEMESTER, 2021

Instructors: David Relling, PT, Ph.D. & Mohamed Elhamadany, PT, DPT, Ph.D., PCS
Monday and Friday 1:00 to 2:00 and Wednesday 1:00 - 3:00*

DATE	TOPIC
AUGUST	
25	Neurophysiology
27	Peripheral Receptors
30	Muscle Afferents
SEPTEMBER	
1	**12:00-1:00 pm Spinal Cord Reflexes
3	Embryology
6	Labor Day Holiday – No Class
8	CNS Topography
10	Clinical Correlation I
13	Review for written examination
14	Cerebral Cortex in W206 (PT 402 time)
15	Written Exam I
17	PT402 1-3pm with Cindy room E221
20	Cerebral Cortex
22	Sensory Systems
24	Sensory Systems
27	Motor Systems
29	Motor Systems
OCTOBER	
1	Clinical Correlation II
4	Cranial Nerves
6	Cranial Nerves
8	Clinical Correlation II (Case 1, 2, 8)
11	Clinical Problems and Review for Exam
13	Written Exam II
15	Cerebellum
18	Cerebellum
20	Clinical Problems (4,12,13,14, LIS)
22	Clinical Problems (7,15,16)
25	Clinical Problems
27	Autonomic Nervous System and CNS Circulation
29	Pain Pathways and Modulation
NOVEMBER	
1	Clinical Problems (19,22,23)
3	Special Senses
5	Special Senses
8	Traumatic Brain Injury
10	Traumatic Brain Injury
12	Degenerative Diseases
15	Degenerative Diseases
17	Stroke
19	Stroke
22	Clinical Problems (10, 11 in TBL)
24	No Class – Thanksgiving Holiday
26	No Class – Thanksgiving Holiday
29	Clinical Problems (3,9,20)
December	
1	Review Session Final Examination TBA