**DPT 713 Clinical Neuroscience**

3 credits (2 credits lecture; 1 credit lab)
Fall – Year 1

Syllabus

Time and Location: Monday, 9:00-10:50 AM, Science B130/140

# **Course Instructor:** Sheri Bunyan, PT, PhD

E-mail: sbunyan@uwsp.edu

Office: Science Building, B145

Phone: (715) 346-4870

# **Course Lab Assistant:** Kellie Collins, PT, PCS

**Course Description:** The course will introduce the foundational concepts of neuroanatomy and neurophysiology with application to client populations. Theories of motor control, movement science, and motor learning will be introduced with applications to developing principles of therapeutic interventions.

**Course Prerequisites:** Enrollment in the Doctor of Physical Therapy Program or consent of instructor. For students outside of the DPT program at least 2 semesters of undergraduate anatomy/physiology (with lab) and one semester of biology are required to enroll in the class.

# **Course Learning Outcomes**

1. Incorporate major components of the human central nervous system including structures and functions as they relate to the control of movement (7A)
2. Relate anatomy of the blood supply of the central nervous system to findings in clinical examinations (7C)
3. Predict systems impairments based on known pathologies to structures in the spine and brain (7C)
4. Review key conditions associated with neurologic system impairment (spinal cord injury, stroke, Parkinson’s disease, cerebral palsy, spina bifida, traumatic brain injury, cancers) (7A)
5. Identify neural contributions to memory, consciousness, and intellect including simple assessments. (7A)
6. Perform assessments of central nervous system integrity including:
	1. Cranial nerve examination (7D19 G)
	2. Peripheral nerve examination (7D19 G)
	3. Balance and coordination assessment (7D19 D)
	4. Sensory assessment (tactile, visual, auditory, proprioception) (7D19 U)
	5. Reflex integrity (7D19 T)
	6. Mental Function (7D19 L)
	7. Motor Function (7D19 N)
7. Relate development of the central nervous system including histologic underpinnings to structure and function (7A)
8. Explain relationship between sensory and motor nerves to the central nervous system in lay and professional terms (7B,7C)
9. Explore the neurological control of locomotion including simple assessments of gait parameters (7D19 M, I)
10. Describe the neurologic basis of pain perception and review pain assessment tools (7A, 7D19 Q)

# **Teaching Methods:** Asynchronous lecture, video, independent reading, lab activities, small group discussion, assignments.

# **Methods of Evaluation/Course Requirements**

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| --- | --- | --- | --- |
| **Assessment Mode** | **Brief Description** | **Percentage** | **Learning Outcome(s) Assessed**  |
| Program Competencies | Competencies specified in Fall, Year 1 competency workbook. | Pass/Fail | 6, 9, 10 |
| Assignments | All assignments, including those in the ‘Assignments’ tab of Canvas and graded in-class assignments | 20% | 1-10 |
| Discussion boards | Four discussion board conversations, equally weighted  | 20% | 1-10 |
| Written examinations | Three written exams, equally weighted  | 60% | 1-10 |

**Additional evaluation/assessment information:**

* **Program competencies:** Competency mastery will be assessed in the combined laboratory session. Students must earn a score of ‘pass’ in each competency. See the Fall – Year 1 competency handbook for the list of competencies and deadlines for completion.
* **Assignments:** Students will complete two types of assignments, academic readiness assignments to assess comprehension *before* face-to-face class meetings, and learning reinforcement assignments, to assess comprehension, application, and synthesis of content *after* face-to-face class meetings.
	+ Academic Readiness Assignments consist of short pre-class quizzes to facilitate adequate preparation for face-to-face sessions. Students may use textbooks, lecture videos, and any other desired resources to complete quizzes. Quizzes may be completed collaboratively, but each student must submit their own quiz. Attempts are unlimited. The highest earned score before the due date is used to calculate the score. A score of zero is earned when attempts have not been submitted prior to the due date. **Important:** Note that the quizzes will be in a folder titled “Readiness Quizzes” and will match the ‘Content’ description for the class schedule.
	+ Learning reinforcement assignments will be posted to the ‘Assignments’ field of Canvas. The format of reinforcement assignments will vary depending upon the nature of the content and may include short answer, essays, research article summaries, and concept maps. These assignments will be based upon the needs of the course. For example, if the instructor leaves a face-to-face class session with the impression that students have not mastered specific content, she will create an assignment based upon that. Although the format of the assignments varies, the instructor will be mindful of student time. Assignment expectations and deadlines will consider the overall semester workload.
* **Discussion boards:** Small student groups, assigned by the instructor, will engage in thoughtful discussion and debate. The instructor will pose a question to each discussion board that provides students with the opportunity to connect course content to human movement and the practice of physical therapy. See the ‘Discussions’ tab in Canvas for details regarding expectations, including the discussion rubric.
* **Written examinations:** The format consists primarily of multiple-choice questions. Short answer and essay questions may be included.

# **Grading Scale**

Courses in the DPT program have adopted the following grading scale.

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| --- | --- | --- |
| 94 – 100% =A  | 77 – 79% = C+  | 60 – 63% = D- |
| 90 – 93% = A-  | 74 – 76% = C  |  < 60% = F |
| 87 – 89% = B+  | 70 – 73% = C- |  |
| 84 – 86% = B  | 67 – 69% = D+ |  |
| 80 – 83% = B-  | 64 – 66% = D |  |

# **Grading of Competency Portfolio**

# Student competencies are graded as Pass/Fail. Students must receive a pass on all required competencies for that academic term to pass the class. For a list of competencies associated with this course, please refer to the competency portfolio.

* The combined lab will have a sign-up process for instructor assessment of competencies. Students are encouraged to proactively schedule assessments to avoid end of semester difficulty in getting the competencies completed.
* Grading policies for competencies:
	+ Assessments by Peers: Students are allowed unlimited attempts
	+ Assessment by Instructors: Students are allowed unlimited attempts. Students who do not pass an attempt are required to get an additional peer assessment prior to scheduling a re-assessment with an instructor. Students are not allowed to schedule a re-assessment for the same lab period. At instructor discretion, additional preparation may be required prior to scheduling a re-assessment.
	+ Assessment in the clinic (Level 2b assessments): Students are allowed unlimited attempts. Because level 2b assessments involve community members in the clinic or in the classroom, these assessment opportunities are not fully replicable. As 2b assessments involve community members, student preparation for a second attempt requires at minimum a 2a level of re-evaluation prior to a scheduled second attempt in the clinic environment. Conditions for a re-assessment after a second attempt are at the discretion of the course instructor.
	+ Level 3 assessments organized in the clinic or as part of the combined lab are unique and not replicable. Because level 3 assessments are not required for all competencies, these are scheduled by the course instructor. Students must have level 2 competencies completed before participating in a level 3 competency.

# **Required Course Materials**

**Required** **Texts**:

*Note: The electronic version of the Lazaro text is available for free through the UWSP library.*

Lazaro RT. Umphred’s Neurological Rehabilitation. 7th edition. Elsevier, Inc; 2019.

Lundy-Ekman L. Neuroscience: Fundamentals for Rehabilitation. 5th edition. Elsevier; 2018.

**Required Readings:**

Eisinger RS, Cernera S, Gittis A, Gunduz A, Okun MS. A review of basal ganglia circuits and physiology: Application to deep brain stimulation. Parkinsonism & Related Disorders. 2019;59:9-20.

Goudman L, Huysmans E, Ickmans K, et al. A modern pain neuroscience approach in patients undergoing surgery for lumbar radiculopathy: a clinical perspective. Physical Therapy. 2019;99(7):933-945.

Guertin PA. The mammalian central pattern generator for locomotion. Brain Research Reviews. 2009;62(1):45-56.

Gulati S, Sondhi V. Cerebral palsy: An overview. Indian Journal of Pediatrics. 2018;85(11):1006-1016.

Kimberley TJ, Lewis SM. Understanding neuroimaging. Physical Therapy. 2007;87(6):670-683.

MacKay-Lyons, M. Central pattern generation of locomotion: A review of the evidence. Physical Therapy & Rehabilitation Journal. 2009;82(1): 69-83.

**Supplemental Materials:**

*Note: Both supplemental texts are required in future courses. Both will be the primary texts for courses in Fall, Year 2 and Spring, Year 2. For your cohort, the edition of these textbooks will not change from what is shown below, even if a new edition is released in the next year. Both of these textbooks are on reserve in the library and can be checked out for three hours.*

Fell DW, Lunnen KY, Rauk RP. *Lifespan Neurorehabilitation: A Patient-Centered Approach from Examination to Interventions and Outcomes*. Philadelphia, PA: F.A. Davis Company; 2018.

Shumway-Cook A. Motor Control: Translating Research into Clinical Practice. 6th edition. Wolters Kluwer; 2022.

# **Office hours:**

# Drop in office hours are: Monday 11:00AM-12:00PM and 1:00PM-2:00PM.

# Drop in office hours are available without an appointment. Drop in can be either face to face or electronic. If electronic, I will be available through e-mail, or videoconference during the office hours window. I will monitor e-mail during my office hours.

# **Individual meetings can be arranged through an email request, phone call, or conversation directly before or after class.** Normal office hours will not be held during Thanksgiving week, Spring Break, Finals Week.

**Course Schedule:**

*The instructor reserves the right to modify the course schedule to meet the learning needs of the course.*

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| **Date**  | **Content (Module #)** | **Learning Activity**  | **Learning Outcomes** |
| Week 1**FRIDAY****SEPT 9** | Neuroanatomy (1)Electrical Properties of Neural Cells (2)Neural Communication (3) | **Before:** Read: Lundy Ekman Chapters 2, 5, 6Assignment: Readiness QuizVideos:* Neuroanatomy
* Physical and Electrical Properties of the Nervous System
* Neural Communication
 | 1 |
| **During:** * Welcome and course overview
* Guided questions
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| **After:**Assignments:* About me
* Syllabus quiz
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| Week 2Sept 12 | Neuroplasticity (4)Development of the nervous system (5) | **Before:**Read: Lundy Ekman, Chapters 7, 8Assignment: Readiness QuizVideo: Neuroplasticity | 1, 7 |
| **During:*** Guided questions
* Activity – Neuroplasticity and PT interventions
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| **After:** Discussion Board 1  |
| Week 3Sept 19 | Peripheral Region (6)Peripheral somatosensory system (7)Central somatosensory system (8) | **Before:** Read: Lundy Ekman, Chapter 18, 10, 11Assignment: Readiness QuizVideos: * Peripheral Region
* Peripheral somatosensory system
* Central somatosensory system
 | 3, 6a, 6b, 6d, 8 |
| **During:** Guided questions |
| Week 4Sept 26 | Visual system (9)Vestibular system (10) | **Before:** Read: Lundy Ekman, Chapters 22, 23Assignment: Readiness QuizzesVideos:* Visual System
* Vestibular System
 | 1, 3, 6a, 6b, 6c, 6d, 6e, 8 |
| **During:** Guided questions, Activity – VOR, Balance and Environmental Complexity |
| Week 5Oct 3 | **EXAM 1**Includes content through Week 4 (Neuroanatomy through vestibular system) | 1, 3, 6a-e, 7, 8 |
| Week 6Oct 10 | Lower and Upper Motor Neuron Systems (11)Cerebellum (12) | **Before:** Read: Lundy Ekman, Chapters 13, 14, 15Assignment: Readiness QuizzesVideos:* Motor Neurons and Spinal Motor Function
* Cerebellum and Spinocerebellar Pathways
 | 1, 3, 6e, 6g |
| **During:** Guided questions |
| Week 7Oct 17 | Peripheral region (13)Autonomic nervous system (14)Brainstem (15) | **Before:** Read: Lundy Ekman, Chapter 17, 9, 21Assignment: Readiness QuizzesVideos:* Peripheral region
* Autonomic nervous system
* Brainstem
 | 1, 3, 6e, 6g |
| **During:** Guided questions | 1 |
| **After:** Discussion board 2  |  |
| Week 8Oct 24  | Cranial nerves (16) Spinal region (17)Central pattern generators (18) | **Before:**Read: Lundy-* Lundy-Ekman, Chapter 19, 20
* Guertin (2009)
* MacKay-Lyons (2009)

Assignment: Readiness QuizzesVideos: * Cranial Nerves
* Spinal Region
* Central Pattern Generators
 | 1, 2, 9 |
| **During:** Guided questions |
| Week 9Oct 31 | Neurologic conditions – spinal region (19)* Spina bifida
* Spinal cord injury

Pain (20) | **Before:**Read: * Lazaro, Chapters 13, 14
* Lundy-Ekman, Chapter 12
* Goudman (2019) – Skim abstract, Figures 1, 5, 6

Assignment: Readiness quizVideos:* Spinal region
* Spina bifida
* Spinal cord injury
 | 1, 2, 3, 6e, 6g, 10 |
| **During:** Guided questions |
| **After:**  Discussion Board 3 |
| Week 10Nov 7 | Dizziness & Unsteadiness (21)Cerebrospinal fluid system (22)Blood supply and fluid dynamics (23) | **Before:**Read: Lundy-Ekman, Chapter 24, 25, 26 (p. 466-471)Assignment: Readiness Quiz Videos: * Dizziness and Unsteadiness
* Cerebrospinal fluid system
* Blood supply, fluid dynamics, intracranial pressure
 | 1, 2 |
| **During:** Guided questions |  |
| Week 11Nov 14 | **EXAM 2**Includes content from Week 6 through Week 10(Peripheral Region through Blood Supply and Fluid Dynamics) | 1, 2, 3, 6e, 6g, 9, 10 |
| Week 12Nov 21  | Cerebrum (24)Neurologic conditions – Brain 1 (25) * Occlusive stroke
* Cerebral palsy

Basal Ganglia (26) | **Before:**Read: * Lundy-Ekman, Chapters 16, 26 (p. 456-466), 27
* Gulati (2018)

Assignment: Readiness QuizzesVideos: * Cerebrum
* Cerebral palsy
* Stroke
* My stroke of insight – Jill Bolte-Taylor
* Basal ganglia
 | 1, 4 |
| **During:**  Guided questions |
| Week 13Nov 28 | Neurologic conditions- Basal Nuclei (26)* Disorders of the basal nuclei
* Medical intervention- Deep brain stimulation

Memory, consciousness, intellect (27) | **Before:** Read:* Lazaro, Chapter 18
* Lundy-Ekman, Chapter 28
* Eisinger (2019)

Videos: * Disorders of basal nuclei
* Memory, consciousness, intellect

Assignment: Readiness quizzes | 3, 4, 5, 6f |
| **During:** Guided questions |
| Week 14Dec 5 | Neurologic conditions – Brain 2 (28)* Traumatic brain injury
* Brain tumors

Prefrontal and anterior temporal lobes (29) | **Before:**Read: * Lazaro, Chapters 22, 25
* Lundy-Ekman, Chapter 29

Assignment: Readiness quizzesVideos: * Traumatic brain injury
* Brain tumors
* Prefrontal and anterior temporal lobes
 | 1, 4  |
| **During:** Guided questions |
| **After:** Discussion Board 4 |
| Week 15Dec 12 | Temporoparietal association cortex and inferior frontal gyrus (30)Neuroimaging (31) | **Before:** Read: * Lundy-Ekman, Chapter 4, 30
* Lazaro, Chapter 37
* Kimberly (2007)

Assignment: Readiness quizzesVideo: * Temporal association cortex and inferior frontal gyrus
* Neuroimaging
 | 1, 2, 5 |
| Week 16  | **FINAL EXAM – EXAM 3**Includes content from Week 12 through Week 15(Cerebrum thorough Neuroimaging)Specific date to be determined. | 1, 2, 3, 4, 5, 6f |