Description: Theory and application of therapeutic electrical currents, biofeedback, electromyography, and nerve conduction velocity in physical therapy.

Department of Physical Therapy:
Faculty: Steven Halcrow, PT, DPT; Schawnn Decker, PT, DPT

Credit Hours: 2 credit hours

Clock Hours: Tuesday 1-5pm

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

A. **Apply the principles of electrical currents.**
   1. Define terms, such as current, voltage, resistance, impedance, frequency, pulse rate, rise and decay times.
   2. Compare and contrast stimulus waveforms such as monophasic, biphasic and polyphasic.
   3. Describe the stimulus characteristics of pulse and phase duration, intensity, interpulse interval, modulation, burst duration, interrupted current, ramp, pulse charge, peak current and beat frequency.
   4. Compare and contrast AC and DC currents, their electrical properties and clinical usage.
   5. Compare symmetrical and asymmetrical waveforms, balanced and unbalanced waveforms and select the most appropriate waveform for specific clinical applications.

B. **Discuss the physiology of electrical stimuli as related to excitable tissue, and apply these principles to the clinical application of electrical stimulation.**
   1. Define the criteria required for an adequate stimulus to excitable tissue.
   2. Discuss the interrelationship between intensity, duration and rate of change of a stimulus.
   3. Compare the precautions and contraindications for the use of electrical stimulation.

C. **Discuss the effect of electrical stimulation on denervated muscle and select the proper current waveform for clinical application.**
   1. Contrast the electrical reaction of normally innervated and denervated muscles.
   2. Describe denervation atrophy and discuss its effect on contracture formation.
   3. Describe the physiological changes that occur in the neuromuscular system with denervation.
   4. Discuss the evidence and possible effects of electrical stimulation on denervation atrophy.
   5. Select the proper waveform characteristics for the treatment of denervation atrophy.

D. **Demonstrate appropriate clinical techniques for the use of electrical stimulation.**
   1. Compare monopolar and bipolar stimulation and decide on the proper clinical usage of each.
   2. Demonstrate proper patient position, electrode preparation and electrode placement, in the clinical application of electrical stimulation.
   3. Explain the effect of skin resistance on patient current flow and describe methods to reduce skin resistance.
E. Discuss the basic theory and demonstrate proper techniques using HVPS stimulation.
   1. Describe the stimulus characteristics of high volt pulsed stimulators (HVPS).
   2. Identify contraindications for the use of high volt pulsed stimulation.
   3. Identify appropriate and evidence based clinical applications for the use of HVPS.
   4. Select the appropriate stimulus parameters utilized in applying HVPS to clinical cases.

F. Discuss the basic theory and demonstrate proper techniques using functional electrical stimulation (FES).
   1. Identify general stimulus characteristics common to FES.
   2. Demonstrate various electrode placements utilized with FES, and give rationale for placement schemes.
   3. Identify appropriate and evidence based clinical applications for the use of FES.
   4. Select the appropriate stimulus parameters that are utilized in applying FES to clinical cases.
   5. Explain and demonstrate the use of FES as part of a home program.

G. Discuss the basic theory and demonstrate proper techniques using transcutaneous electrical nerve stimulation (TENS).
   1. Identify general stimulus characteristics common to TENS.
   2. Explain the possible physiological effects of TENS.
   3. Demonstrate various electrode placements utilized with TENS, and give rationale for placement schemes.
   4. Identify appropriate and evidence based clinical applications for the use of TENS.
   5. Select appropriate stimulation parameters that are utilized in applying TENS to clinical cases.
   6. Explain and demonstrate the use of TENS as part of a home program.

H. Discuss the basic theory and techniques of electrodiagnosis including electromyography and nerve conduction studies.
   1. Identify clinical uses of EMG.
   2. Describe the development and characteristics of the motor unit action potential.
   3. Explain the pathological EMG activity occurring in neuropathies, myopathies, myasthenia and myotonia.
   4. Explain the occurrence of EMG waveforms such as: fibrillation, fasciculation, positive sharp waves, polyphasics and giant motor unit action potentials.
   5. Define the term nerve conduction velocity.
   6. Define the terms distal and proximal latencies.
   7. Describe proper skin preparation and placement for EMG electrodes.
   8. Describe the procedure used to stimulate for proximal and distal latencies and the procedure for measuring anatomical distances required to calculate nerve conduction.
   9. Calculate nerve conduction velocity, and differentiate between normal and abnormal values.
   10. List normal ranges of nerve conduction velocity for the upper and lower extremities.
   11. Identify common clinical uses of nerve conduction velocity.
   12. Identify pathological conditions which might alter nerve conduction velocity.
   17. Describe the H reflex

I. Discuss the basic theory and demonstrate proper techniques using biofeedback training.
   1. Discuss the different types of biofeedback including: EEG, EMG and thermal.
   2. Discuss the clinical application of biofeedback and indications for use.
   3. Discuss the use of biofeedback as it applies to such clinical uses as: muscle re-education and
muscle relaxation.
4. Demonstrate electrode proper electrode preparation and placement.
5. Explain the proper use of the sensitivity controls and the audio and visual feedback controls in the clinical use of biofeedback.
6. Adjust the biofeedback unit using appropriate parameters appropriate for biofeedback used in clinical cases
7. Explain and demonstrate the use of biofeedback as part of a home program.

J. **Discuss the basic theory and demonstrate proper techniques using iontophoresis.**
1. Define the term iontophoresis, and describe the current type needed for iontophoresis.
2. Describe the basic procedure for iontophoresis and the process of ion transfer.
3. Select the appropriated equipment, electrodes and medications used in iontophoresis.
4. Select the proper dosage in terms of intensity and time of current application.
5. Discuss indications and contraindications of iontophoresis use.
6. Identify appropriate and evidence based clinical applications for the use of iontophoresis.
7. Explain the pharmacological effects of common medications used in iontophoresis.

**PT 519: LABORATORY OBJECTIVES**

A. **Demonstrate the application of neuromuscular electrical stimulation (NMES) protocols and home programs as indicated for selected clinical conditions.**
   1. Select appropriate NMES stimulation parameters for a given patient problem.
   2. Demonstrate proper electrode preparation and placement on a given subject.
   3. Demonstrate the location of motor points for superficial muscles using NMES
   4. Demonstrate proper use of all controls and outputs on NMES stimulators.
   5. Perform a stimulation protocol as indicated for a given clinical condition.
   6. Demonstrate a home program using NMES for a patient with denervation.

B. **Demonstrate the application of TENS protocols and home programs as indicated for selected clinical conditions.**
   1. Demonstrate proper electrode preparation for TENS stimulation using gel media and adhesive.
   2. Demonstrate various electrode placements that might be used for a given clinical condition.
   3. Demonstrate proper TENS electrode placement on a given subject for a given clinical condition.
   4. Demonstrate proper setup of TENS equipment and select the proper pulse duration, pulse rate, intensity, correct stimulus mode and modulation features.
   5. Demonstrate proper TENS stimulation protocol as indicated for a given clinical condition.
   6. Prepare, write and demonstrate a home program for a patient using TENS.

C. **Demonstrate the application of biofeedback protocols and home programs as indicated for selected clinical conditions.**
   1. Demonstrate proper electrode preparation for biofeedback using gel media and adhesive.
   2. Demonstrate various electrode placements that might be used for a given clinical condition including muscle relaxation and facilitation.
   3. Demonstrate proper electrode placement on a given subject for a given clinical condition.
   4. Demonstrate proper setup of biofeedback equipment regarding proper adjustment of sensitivity and biofeedback signals.
   5. Demonstrate proper use of a biofeedback protocol as indicated for a given clinical condition
   6. Prepare, write and demonstrate a home program for a patient using biofeedback.
D. **Demonstrate the application of protocols for high volt pulsed stimulation (HVPS) indicated for selected clinical conditions (wound healing).**  
   1. Select appropriate HVPS stimulation parameters for a given patient problem.  
   2. Demonstrate proper electrode preparation and placement on a given subject.  
   3. Demonstrate proper use of all controls and outputs on HVPS stimulators.  
   5. Perform a stimulation protocol as indicated for a given clinical condition.  
   6. Discuss the role of HVPS as an intervention to enhance wound healing and demonstrate an appropriate stimulation protocol.

E. **Demonstrate the application of iontophoresis protocols as indicated for selected clinical conditions.**  
   1. Select proper electrode for area and condition being treated.  
   2. Demonstrate electrode setup and select proper medication, dosage, time and polarity choice for application.  
   3. Discuss contraindications and prescription requirements for medications.  

F. **Demonstrate the application of low volt stimulation for selected clinical conditions.**  
   1. Select proper electrode for area and condition being treated.  
   2. Demonstrate electrode setup appropriate for the condition being treated  
   3. Demonstrate motor point location and stimulation using low volt stimulation.  
   4. Discuss the limitations of low volt stimulation.

G. **Evaluate, critique and apply published literature regarding electrotherapy to physical therapy practice.**

H. **Describe the legal obligations and restrictions that might apply the use and application of electrotherapeutic modalities, medications and electrodiagnostic testing.**

I. **Demonstrate proper examination of the patient’s skin prior to and upon removal of electrodes and explain to patient proper skin care procedures when using electrical stimulation at home.**

**GRADING:** Grades will be determined both on lecture tests, participation in laboratory activities and discussion and laboratory practical examinations.

**Grading Scale (%):** 90 – 100% = A; 80 – 89.9% = B, 76 – 79.9% = C, 75.9% or less = F

**NOTE:** the Graduate School requires an average GPA of at least a 3.00 to continue on in graduate school without probation.
WRITTEN EXAMS:
Written examinations will require a 76% or above to avoid remediation. Remediation will include discussion with a faculty member and WILL INCLUDE a re-take of the examination at the discretion of faculty. The first attempt will be used for all grading purposes.

LAB PRACTICAL EXAMS:
The student must receive a passing grade (80%) on ALL laboratory practical examinations in order to successfully complete this course. A failed lab practical examination must be repeated and a passing grade received; however the grade received on the first attempt will be used for all grading purposes. If the student fails the retake lab practical examination, procedures from the Scholastics Standards document will be initiated.

ATTENDANCE:
Attendance is required for all lectures and labs. If you are aware of an upcoming absence, you must provide a written notification (email) to Steven (steven.halcrow@und.edu), prior to absence. Missed material will be your responsibility to make up. Excessive absences may have a negative impact on your final grade. Follow PT guidelines for contacting department with acute illness or injury. If problems occur, students are required to work through channels of communication to resolve the problem before going to the chair or dean. The channel is student, instructor, chair, dean.

BLACKBOARD
Information in regard to PT 519 will be made available on Blackboard.

REFERENCE MATERIAL
Material provided via Blackboard

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Disability Access Statement
Contact Steven Halcrow at steven.halcrow@med.und.edu or 701-777-3857 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.
Reporting Sexual Violence

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.

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It is important for students to understand that faculty are required to share with UND’s Title IX Coordinator any incidents of sexual violence 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 the victim of sexual violence, you can find information about confidential support services at UND.edu/affirmative-action/title-ix.

Ensure Accessibility

To comply with the latest accessibility guidelines, documents posted online, including, but not limited to, Adobe PDF files, Microsoft Word documents, Microsoft PowerPoint presentations, and online flipbooks, must be screen-reader friendly.

For directions on how to make your syllabus and other course materials accessible, go to Blackboard > Services > Atomic Learning > Creating an Accessible Syllabus (for technical assistance with Atomic Learning, contact UND Tech Support at UND.edu/tech-support).
# PT 519: ELECTROTHERAPY AND ELECTRODIAGNOSIS
## Summer Session, 2022
**LECTURE/LABORATORY:** 1:00 to 5:00 Tuesday
Room E312

**Faculty:** Dr. Schawnn Decker, Dr. Steven Halcrow

**TAs:** Nicki Mazour, Bradyn Just/Lindsey Knoll, Sam McMenamy

**Readings:** Course Notes and PowerPoints by Tom Mohr

**Text:** Physical Agents in Rehabilitation by Cameron

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<td>Principles of E-Stim &amp; Stimulation of Normal Muscle</td>
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