# ANDREWS UNIVERSITY
**School of Education**

**Educational and Counseling Psychology**
EDPC 625: Biopsychology

**FALL 2007**

Instructor: Rudi Bailey, Ph.D.
Office:Bell Hall, Room 151
Phone:471-3346

Classroom: Bell Hall 183
Class Hours: T 6:30 pm - 9:20 pm
Office Hours: W 11-12 am, 2-3 pm

## Course Description:
A survey of the physiological basis of human behavior including considerations of sensory phenomena, motor coordination, emotion and higher order thought processes.

## Philosophy and Integration of Faith and Learning:
Because Andrews University students are encouraged to develop their spiritual, mental, physical, and social life as part of a balanced Christian lifestyle, this class will provide activities which are intended to prepare psychologists for excellence in research and understanding of the brain and it's influences on all aspects of our lives. By precept and example, the course is intended to demonstrate respect for human diversity and the uniqueness of each person as one created by God. As companions in learning, students and faculty are committed to global Christian service. These purposes are reflected in the specific objectives and content of this course

## School of Education - Knowledge Bases:
1. *Worldview* - Addresses the appreciation of the perspectives of others and a personal development of a personal philosophy from which action and service arise.
2. *Human Growth and Change* - Addresses the principles of growth, development and learning and the use of these principles to effect positive change.
3. *Groups, Leadership, and Change* - Addresses the principles of individual behavior and the use of these principles to effect positive change for individuals and organizations.
4. *Communication and Technology* - Addresses oral, written, intrapersonal and interpersonal communication as an essence of human behavior, and technology as it enables, supports and enhances human interaction, learning and development.
5. *Research and Evaluation*- Addresses valuing and conducting disciplined inquiry for decision making
6. *Personal and Professional Growth* - Addresses the commitment to holistic personal and professional growth

## Course Knowledge Base:

This course utilizes the combined study and research in neuroanatomy, neurochemistry, neuroendocrinology, neuropathology, neuropharmacology and neurophysiology, and their applications in the study of behavior. As a whole, biopsychology utilizes a comparative approach across different living species.

**Study Sources:**

Breedlove, S.M., Rosenzweig, M.R. and Watson N.V. (2007) Biological Psychology: An Introduction to Behavioral, Cognitive, and Clinical Neuroscience. Sunderland, Mass: Sinauer Associates, Inc. (Required, BK1)

Berninger, V and Richards, T. L. Brain Literacy for Educators and Psychologists. San Diego: Academic Press (optional)

Coch, D., Dawson, G. and Fischer, K. W. (Editors). (2007)

Hale, J. B. and Fiorello, C. A. School Neuropsychology: A practitioner's Handbook. New York: Guildford (Optional)

Articles as assigned.

**Grading Criteria:**

There will be a test for every three chapters covered. Each test will be based on textbook, lecture, and audio-visual material. Letter grades will be assigned based on the following percentages:

| | | |
|---|---|---|
| A = 90-100 | B- = 78-79 | C- = 68-69 |
| A-= 88- 89 | C+= 75-77 | D = 60-67 |
| B+= 85-87 | C = 70-74 | F = 0-59 |

These percentages may be adjusted downwards in students' favor if tests are too difficult.

**Course Objectives:** Course Objective for EDPC 625: **Students will have an understanding and knowledge mastery of the following as demonstrated by exam and paper:**

| **SED Knowledge Base** | **Counseling Psychology Program** | |
|---|---|---|
| 2 | 11 | the field of biopsychology, its scope and range |
| 2 | 11 | research methods of biopsychology |
| 2 | 11 | the role of genetics and environment in the biology of behavior |
| 2 | 11 | the anatomy of the nervous system |
| 2 | 11 | neural conduction and synaptic transmission |
| 2 | 11 | causes and nature of brain damage and brain pathology |
| 2 | 11 | the visual system |
| 2 | 11 | mechanisms of perception |

| | | |
|---|---|---|
| 2 | 11 | the sensorimotor system |
| 2 | 11 | the biopsychology of eating and drinking |
| 2 | 11 | hormones and the biopsychology of sexual gender, orientation, and behavior |
| 2 | 11 | sleep, dreaming, and circadian rhythms |
| 2 | 11 | the biological basis of drug addiction |
| 2 | 11 | neuroplasticity |
| 2 | 11 | lateralization, language and the split brain, |
| | | the biological basis of emotion, stress and mental illness, ADHD, Autism, and Reading. |
| 2 | 11 | memory and amnesia |

**COURSE REQUIREMENTS:**

**Four exams (50% of Grade), Paper (30%), Reading Response (20%)**

**Rationale for requirements: This is an academic Specialist and Doctoral level course, therefore, greater emphasis is placed on acquiring knowledge and comprehension of material, thus 50% of your grade is from exams. Since it is a graduate course, students must become familiar with the literature in the field. Writing a paper with an emphasis on primary literature sources will allow you to become familiar with the research and demonstrate understanding. Your Reading Responses help you to think about what you read and gives you the opportunity to learn as you go.**

**Class Schedule and reading assignments : Book 1 must be read by October 25**
**Book 2 by December 6**

| | | | |
|---|---|---|---|
| **August 30** | **Introduction and Structure of the Nervous System** | | **Ch. 2,3 1(Bk2)** |
| **Sept. 6** | **Cells of the nervous system and psychopharmacol** | | **Ch. 4, ,2&3Bk2)** |
| **Sept 13** | **Development, Drugs and Addiction** | | **Ch. 6,7 4(Bk2)** |
| **Sept. 20** | **Senses** | **Test #1** | **Ch. 8,9** |
| **Sept. 27** | **Movement and Emotions** | | **Ch. 10, 11** |
| **Oct. 4** | **Sleep and Memory** | **Test #2** | **Ch. 12,13** |
| **Oct. 18** | **Learning and Thinking** | | **Ch. 14,** |
| **Oct. 25** | **Behavioral Disorders, ADHD and Autism** | | **Ch. 15,** |
| **Nov. 1** | **Reading** | **Test#3** | **Ch. 5&8 (BK2)** |
| **Nov. 8** | **Writing** | | **Ch. 6, 9 “** |
| **Nov. 15** | **Math** | | **Ch. 7, 10 “** |
| **Nov. 22** | **Implications for Policy and practice** | | **Ch. 11, 12 “** |
| **Nov. 29** | **Student presentations of reviews** | | **Articles** |

**Dec. 6 Student presentation of reviews Test#4 Articles**

The professor reserves the right to change the schedule as necessary for student understanding.

**Disability concerns.** U.S. law as well as the policy of the University provide that reasonable steps be taken to accommodate students who have a disability that may impede academic functioning. If you are disabled in some way and need to be accommodated, please speak to me immediately, or call the Counseling and Testing Center (471-3470).

**Honesty** in all academic work is expected. Any student who, for individual assignments, is found to have submitted work done by others, or who engages in or contributes to cheating or plagiarism will receive no marks for such work and may be subject to further disciplinary measures by the University.

**Cooperation**. Students are encouraged to collaborate in **group** activity and to make the class a cooperative rather than a competitive experience. One way of doing this is to study in groups. This course is NOT graded on the curve. Therefore, helping someone to improve will have no negative effect upon your grade. On the contrary, you may improve your score by helping other class members to do well. However, students are encouraged NOT to give other students class notes when they habitually miss class. When students miss class on a regular basis, to catch up on other courses or to participate in other activities, this is regarded as poor work ethic and is taken as a sign of a weak student both ethically and academically. Individual exercises are also meant to be written by the individual. Similarity in wording of papers will be investigated with reference to plagiarism.

**EXAM DAYS: Students are expected to take all exams on the days they are given. If you plan to miss class on an exam day, please notify the professor at least the day before the exam. This will help you to know before hand whether you will be allowed to take it at a later date. Only extreme emergencies will be accommodated. Saying, AI am not ready for the test!@ will not be a good excuse, please read all chapters well in advance. You will be given study questions at the beginning of the semester, studying them early will be helpful to you if you get busy the week of the exam. Simply missing class on the day of the exam will earn you a zero for that exam.**

Suggested Topics for Papers:

1. A comparison of news report and scientific journal reports on the biological basis of sexual orientation.
2. The neurobiology of ADHD.
3. The neurobiology of Autism.
4. The neurobiology of Schizophrenia
5. The neurobiology of Dyslexia
6. Music and the brain

7. Sleep, learning and dreams – their neurobiological connections
8. Cerebral specialization – knowledge in flux
9. We are a result of our chemical exposure – or how hormones influence brain development and structure.
10. Experience builds brains – sorting out the roles of genes and experience on the function and structure of the brain.
11. Are neurons it – new roles of glial cells.
12. The neurobiology of anxiety
13. The neurobiology of reading
**14.** Other topics as suggested by students**.**

## Bibliography


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The following is a very good article on writing a review of current research. Please study this and note that it is not my work but the work of someone who wishes that you are properly trained in writing review articles. This class does not propose to train you in writing review articles but requires you to read and integrate primary research on Human Development. The article is intended to assist you with this task.

Psychological Bulletin
1995, Vol. 118, No. 2, 172-177.

The following is a compilation of Biological Psychology questions from the past for your instruction. No attempt has been made to remove duplicate questions.

1. Please explain the role of the following processes, chemicals, and biological structures in facilitating communication within a neuron: diffusion, electrostatic pressure, intercellular fluid, extracellular fluid, action potential, resting potential, depolarization, hyperpolarization, ion, sodium potassium transporter, ion channel, all-or-none law, rate law and cable properties.

2. How are strong muscular contractions caused if the all-or-none law operates?

3. Describe how the flow of electrical current across an axon is similar and different to a telegraph cable.

4. Describe the action sequence at the synapse starting with the firing of an axon.

5. How is the safety of a drug measured?

6. Please describe some brain mechanism that prevents a neuron from firing continuously.

7. Please explain the role of neurotransmitters and neuromodulators and give examples of each and the functions they perform.

Dopamine cannot cross the blood brain barrier, therefore, it must be developed in the brain. Please explain what we know about its development in the brain.

Review Questions
Biopsychology

Why is it likely that sex differences in aggression are at least partially biologically determined? What evidence is there that hormones are directly involved in human aggression? Describe the ethical and methodological problems with these studies.

Describe the relationship between serotonin and aggression. Discuss studies that support this relationship including drugs that act on brain serotonin.

Explain the importance of ACh for learning.

Discuss long-term potentiation. How is it produced and what is its relevance to memory formation?

Describe the roles of NMDA receptors and non-NMDA receptors in long-term potentiation.

Cite evidence that suggests that people with anterograde amnesia have difficulties with declarative but not nondeclarative memories.

Discuss the role of the following in relational learning: a) the amygdala, b) the mammillary bodies, and c) the thalamus. Support your answer with specific examples.

Describe the role of the hippocampus in nonspatial relational tasks.

Explain the concept of brain lateralization. How have studies of human subjects contributed to understanding of this concept?

Describe the specialized functions of the left and right hemispheres in terms of their contributions to language.

Describe pure alexia. Cite evidence that suggests this disorder is caused by damage to two brain regions.

Differentiate between whole and phonetic reading. Describe five types of acquired dyslexias and indicate how these syndromes support the hypothesis that people can read words without sounding them out.

Describe three positive symptoms and three negative symptoms of schizophrenia. Which physiological mechanisms underlie

each type of symptom?

Explain the dopamine hypothesis of schizophrenia. Detail how the effects of dopamine agonists and antagonists support this theory.

Explain the monoamine hypothesis of depression. Discuss the evidence that supports this theory.

Describe the susceptibility hypothesis of schizophrenia and cite evidence that supports it.

List several side effects of antipsychotic medications and explain why they occur. Of what benefit is the drug clozapine in terms of effects on schizophrenia?

Explain the role of "hypofrontality" in schizophrenia.

Explain why eating certain foods can be dangerous for a person taking a drug that inhibits MAO.

Explain how the uterine chorionic environment can lead to dissimilarities in MZ twins with regard to concordance of schizophrenia.

How might PCP be important for understanding schizophrenia?

Describe the typical pharmacological treatment for panic disorder. How do these drugs exert their effects on the nervous system?

Compare and contrast the symptoms and possible genetic bases of obsessive compulsive disorder and Tourette's syndrome.

Discuss some of the affective, cognitive, and behavioral abnormalities that may accompany autistic disorder.

Discuss findings that suggest that autism involves damage and/or developmental abnormalities in the hippocampus, cerebellum, and cerebral cortex.

Identify some of the adverse effects of long-term exposure to glucocorticoids.

Cite three pieces of evidence which show that stress impairs the function of the immune system

Describe the neural and hormonal components of the stress response.

Discuss the behavioral, autonomic, and hormonal components of an emotional response and the role of the amygdala in controlling them.
Discuss the role of the orbitofrontal cortex in the analysis of social situations and the effects of damage to this region, including those produced by psychosurgery.
Discuss cross-cultural studies on the expression and comprehension of emotions.
Discuss the neural control of the recognition of emotional expression in normal people and people with brain damage.
Discuss the neural control of emotional expression in normal people and people with brain damage.
Discuss the James-Lange theory of feelings of emotion and evaluate relevant research.

Describe the four basic forms of learning: perceptual learning, stimulus-response learning, motor learning, and relational learning.
Discuss the research on how learning affects neural structures, the induction of long-term potentiation, and the role of NMDA receptors.
Discuss the mechanisms responsible for the increase in synaptic strength that occurs during long-term potentiation.
Describe research on the role of the primary visual cortex in visual perceptual learning.
Describe the research on the role of acetylcholine in auditory learning.
Discuss the physiology of the classically conditioned emotional response to aversive stimuli.
Describe the role of the basal ganglia and premotor cortex in instrumental conditioning and motor learning.
Describe the role of dopamine in reinforcing brain stimulation; discuss the effects of systemic administration of dopamine antagonists and agonists.
Discuss how the reinforcement system may detect reinforcing stimuli and strengthen synaptic connections.

Describe the nature of human anterograde amnesia and the type of brain damage that causes it.
Discuss the distinction between declarative memories and nondeclarative memories and their relation to anterograde amnesia.
Review the connections of the hippocampal formation with the rest of the brain and describe evidence that damage to the hippocampal formation and related structures causes anterograde amnesia.
Describe the role of the hippocampus in relational learning including spatial learning.
Discuss the function of place cells in the hippocampal formation and the role of the limbic cortex of the medial temporal lobe.
Describe how changes in synaptic strength and monoaminergic and acetylcholinergic input may affect hippocampal functioning.
Outline a possible explanation of the role of the hippocampal formation in learning and memory.

Describe the use of subjects with brain damage in the study of language and explain the concept of lateralization.
Describe Broca's aphasia and the three major speech deficits that result from damage to Broca's area: agrammatism, anomia, and articulation difficulties.
Describe the symptoms of Wernicke's aphasia, pure word deafness, and transcortical sensory aphasia and explain how they are related.
Discuss the brain mechanisms that underlie our ability to understand the meaning of words and to express our own thoughts and perceptions in words.
Describe the symptoms of conduction aphasia and anomic aphasia, including aphasia in deaf people.
Describe pure alexia and explain why this disorder is caused by damage to two specific parts of the brain.
Describe whole-word and phonetic reading and discuss five categories of acquired dyslexias.
Explain the relation between speaking and writing and describe the symptoms of phonological dysgraphia, orthographic dysgraphia and semantic (direct) dysgraphia.
Describe research on the neurological basis of developmental dyslexias.

Describe the symptoms of schizophrenia and discuss the evidence that some forms of schizophrenia are heritable.
Discuss drugs that alleviate or produce the positive symptoms of schizophrenia; discuss research into the nature of a possible dopamine abnormality in the brains of schizophrenics.
Discuss evidence based on population studies that the negative symptoms of schizophrenia may result from brain damage.
Discuss direct evidence that schizophrenia is associated with brain damage.
Describe the two major affective disorders, the heritability of these diseases, and their physiological treatments.
Summarize the monoamine hypothesis of depression and review the long-term changes in receptor sensitivity.
Explain the role of circadian and seasonal rhythms in affective disorders: the effects of REM sleep deprivation and total sleep deprivation and seasonal affective disorder.

Describe the symptoms and possible causes of panic disorder.
Describe the symptoms and possible causes of obsessive-compulsive disorder.
Describe the symptoms and possible causes of autism.
Describe the physiological responses to stress and their effects on health.
Discuss some of the long-term effects of stress: posttraumatic stress disorder, cardiovascular disease, and the coping response.
Discuss psychoneuroimmunology and the interactions between the immune system and stress.
Please understand the role of Kainic Acid

Distinguish between brain function and behavior

Know the type of information produced by different methods of studying the brain, how these methods work, and the level of explanation provided by each method.

Understand positive and negative reinforcement and the role they play in dug abuse.

What is a craving?

Understand the role of the limbic system and the midbrain in drug abuse.

Understand how the commonly abused drugs affect the functions of the brain and the specific neurotransmitters and synaptic structures they affect.

## Examples of specific questions you may be asked:

Describe the symptoms of opiate withdrawal. What homeostatic mechanism are involved in tolerance and withdrawal?

What do all addictive substances have in common? Describe the physical and behavioral effects of cocaine and amphetamine, and nicotine and caffeine.

Cite evidence that cocaine and amphetamine may produce long-term changes in the nucleus accumbens.

Describe how alcohol produces both positive and negative reinforcement. Where does it exert it's effect in the nervous system.

Discuss the work by Seigel and colleagues that suggest heroin addicts run an increased risk of death from overdose when they take drugs in unfamiliar settings. Include in your answer an explanation of a classically conditioned drug craving.

Cocaine and amphetamine both exert their effects by being _____which_____.

A. Norepinephrine agonist; block reuptake
B. Dopamine anatagonist; decrease synthesis
C. Norephinephrine antagonists; block receptors
D. Dopamine agonists; block reuptake

Describe the roles of perfusion, fixation, sectioning and staining the brain for examination purposes.

What chemicals are used to stimulate neural tissue? Explain why chemical stimulation is sometimes preferred over electrical stimulation.

Explain how the results of twin studies and adoption studies suggest the contributions of genetics and environment to a specific behavior.

Compare the MRI and CT scans for studying the living brain, list the advantages and limitations of each method.

Compare methods for tracing efferent and afferent axons. What types of information are learned from each?

What limitations must be placed on interpreting results from lesion study? Explain.

The student will be able to:

I. Describe the specialized functions of the left and right hemispheres in terms of their contributions to language.

II. Discuss findings that suggest that autism involves damage and/or developmental abnormalities in the hippocampus, cerebellum, and cerebral cortex.

III. Discuss how drugs exert their effects on the nervous system, paying particular attention to mechanisms.

IV. Discuss long-term potentiation. How is it produced and what is its relevance to memory formation and learning?

V. Explain the concept of brain lateralization, how it is produced developmentally and its implications for counseling.

VI. Discuss the role of brain imaging techniques in the study of brain functioning and be able to summarize the research for either ADHD or Learning Disabilities.

VII. Discuss the role of dopamine in learning, movement, attention, and reinforcement.

VIII. Discuss the neural control of aggressive behavior.

IX. Discuss what we presently know about gender differences in brain structure and function.

X. What is the neural basis of schizophrenia?

XI. Explain addiction and discuss the neural basis of addiction.

XII. Discuss our present understanding of aggression.

Explain the concept of brain lateralization, how it is produced developmentally and its implications for learning. Then, discuss how lateralization functions in the area of language.

Answer both parts A and B.

A. Explain addiction and discuss the neural basis of addiction.

B. Discuss how drugs exert their effects on the nervous system, paying particular attention to mechanisms.

Answer both parts A and B.

A. Discuss long-term potentiation. How is it produced and what is its relevance to memory formation and learning?

Discuss the role of dopamine in learning, attention, and reinforcement.

Compare and Contrast hormones and neurotransmitters

Know how hormones affect behavior

Know which glands produce which hormones and which systems are affected by these hormones.

Know how hormone activity occurs and systems that modify their effect and production

Compare the human brain to non-human primates in terms of structure and junction

Know and be able to explain the nine stages of prenatal and early postnatal development

Discuss changes in brain development through the lifespan