# **Neuroscience III Course (2018)**

# **Syllabus**

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| **Department:** | Psychology |
| **Course:** | Neuroscience III |
| **Professor:**  | Jorge Mario Andreau |
| **Year:** | 2018 |

1. **Brief introduction to the course:**

Neuroscience III is a four-month course belonging to the Psychology and Psychopedagogy Departments at Salvador University. It is a mandatory course during the 2nd year of studies. It follows Neurosciences I and II courses.

Neuroscience III is closely related to other courses like Basic Cognitive Processes I, II, III and IV, and Psychopathology.

Neuroscience III course reviews the main hypotheses regarding how the brain is related to many psychological functions (e.g., memory, language, emotions, etc.). The acquisition of the contents of Neuroscience III course is fundamental in order to better understand human cognition and behavior.

1. **Neuroscience and Psychology:**

Psychology was born as a science in 1879 with the creation of the Experimental Psychology Laboratory by Wilhelm Wundt at Leipzig. Therefore, Psychology became an independent science since it defined its own method and subject of study. Current scientific and technological developments made it possible to study many psychological functions scientifically by observing the neural activity which underlies several cognitive processes. Therefore psychology can regain its scientific status.

New advances in Neuroscience research comes from a group of different disciplines with a common purpose: the study of the nervous system. The ultimate goal of those researches is the understanding of the link between the nervous system and cognition in order to create behavior. To that extent, psychologists must learn all the different levels in which the nervous system can be studied (molecular, cellular, systemic and behavioral). Hence, neuroscience course is critical for psychologists in order to develop a scientific way to study psychology.

1. **Purpose of Neurosciences III course:**

The main purposes of Neuroscience III are:

* To teach to place psychology inside the group of disciplines contributing to/and benefiting from neuroscience’s discoveries.
* To study behavior, emotions and cognition from a scientific perspective.
* To develop a new field of knowledge concerning the link between the neural activity and cognition.
* To study different cognitive impairments and their neural correlates (e.g., amnesia, aphasia, agnosia, apraxia, dementia, etc).
1. **Contents:**

**Lesson 1: REVIEW OF THE BASIC CONTENTS OF NEUROSCIENCE I COURSE**

**Contents:**

Definition of basic neuroscience terms. Neuroscience’s history. A comprehensive introduction to the field of neuroscience and the basic principles of organization and functions of the nervous system. An exploration of the neural basis of behavior from cellular to cognitive level. Anatomy and development of the neural system. Neurophysiology. Membrane potential. Synaptic transmission. Sensory and motor systems and higher brain function (memory, language, etc.).

**References**

Pinel, J. *Biopsychology*. Ch. 3.

**Lesson 2: REVIEW OF THE BASIC CONTENTS OF NEUROSCIENCE II**

**Contents:**

Biological processes involved in neuronal function. Architectural elements and functional processes of neurological systems. Motor behavior, neural development, neural plasticity and neuroendocrine system.

**References**

Pinel, J. *Biopsychology*. Ch. 4.

**Lesson 3: ATTENTION AND CONSCIOUSNESS.**

**Contents:**

Definition. Selective, sustained and divided attention. Controlled vs automatic processes. Theoretical models of attention. Posner’s attentional network review. Anatomical and neurophysiologic bases of attention. Attention impairments (e.g., neglect). Neuropsychological assessment of attention (Trail Making Test). Consciousness. Definition. New perspectives in the scientific study of consciousness.

**References:**

Bear, M., Paradiso, M., Connors, B.W. (2007) Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins. Philadelphia.ISBN: 0-7817-6003-8

Gazzaniga, M.. (2009) The Cognitive Neurosciences. Massachusetts Institute of Technology.ISBN 978-0-262-01341-3

**Lesson 4: EXECUTIVE FUNCTIONS.**

**Contents:**

Definition. Cognitive Models of Executive Functions. Frontal Syndromes, characteristics. Neurobiological Bases. Executive Functions assessment.

**References:**

Bear, M., Paradiso, M., Connors, B.W. (2007) Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins. Philadelphia.ISBN: 0-7817-6003-8

**Lesson 5: LEARNING AND MEMORY.**

**Contents:**

Definition of Learning. Kind of learning (associative, non associative). Neurophysiology of learning and memory. Animal models. Memory systems. Definition of memory. Types of memories (declarative/non declarative). Neurobiological basis of memory as viewed from an integrative framework. Mechanisms of memory at cellular and molecular levels, through behavioral and physiological experimental studies, and in neuropsychological case studies.

**References**

Bear, M., Paradiso, M., Connors, B.W. (2007) Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins. Philadelphia.ISBN: 0-7817-6003-8

**Lesson 6: LANGUAGE**

**Contents:**

Language: Communication system. Hemispheric Lateralization. Language impairments: Aphasia.Definition and types:(Broca, Wernicke, global, conduction, etc.). Classic models. Language assessment.

**References**

Bear, M., Paradiso, M., Connors, B.W. (2007) Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins. Philadelphia.ISBN: 0-7817-6003-8

**Lesson 7: AGNOSIA AND APRAXIA.**

**Contents:**

Gnosia and recognition. Agnosia (visual, sensorial and auditive). Definition, types. Classic models. Assessment. Difference between sensorial impairment and gnosic impairments. Movement generation models. Apraxia. Definition, types. Classic models. Praxia assessment.

**References:**

Bear, M., Paradiso, M., Connors, B.W. (2007) Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins. Philadelphia.ISBN: 0-7817-6003-8

**Lesson 8: NEUROSCIENCE AND INTELLIGENCE.**

**Contents:**

Definition of intelligence. Brief history of intelligence tests. Multiple intelligences. Practical and creative intelligence. Geniuses and mental retardation. .

Distributed brain networks and intelligence. White matter and intelligence.

**References:**

Bear, M., Paradiso, M., Connors, B.W. (2007) Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins. Philadelphia.ISBN: 0-7817-6003-8

**Lesson 9: EMOTIONS AND STRESS.**

**Contents:**

Definition of stress. Stress response. Neuroendocrine system and the regulation of behavior in humans and animals. Interaction between brain structures and the endocrine system as related to stress responding. Example topics include neuroendocrine signaling pathways such as the hypothalamic-pituitary-adrenal axis. Amygdala and fear conditioning. Anxiety disorders. Depression and apathy.

**References:**

Bear, M., Paradiso, M., Connors, B.W. (2007) Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins. Philadelphia.ISBN: 0-7817-6003-8

**Lesson 10: PSYCHOPHARMACOLOGY.**

**Contents:**

Neurobiological processes which underlie drug effects, addiction, treatment and relapse. Neural and physiological effects of the most commonly abused drugs at the cellular level. An introduction to basic pharmacology, including the pharmacodynamics and pharmacokinetics of the most highly abused drugs. Current research that is being performed in the neuroscientific community in the area of addiction, as our understanding of the brain and causes of addiction are continually changing as the technology used to examine neurobiology continually evolves.

**References:**

Bear, M., Paradiso, M., Connors, B.W. (2007) Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins. Philadelphia.ISBN: 0-7817-6003-8

**Lesson 11: APPLIED NEUROSCIENCES.**

**Contents:**

Advancing integrative neuroscience, including novel applications such as neurofeedback (EEG, fMRI, NIRS), autonomic nervous system biofeedback, neuro-rehabilitation, brain-computer interface (BCI), transcranial magnetic stimulation (rTMS), virtual reality feedback, vagus nerve stimulation, electro-cranial stimulation, audio-visual stimulation, etc. Fostering education in applied neuroscientific techniques. Enhancing integrative practice in clinical treatment, education and optimal performance. Promoting evidence-based practice to optimize functions in both health and disease Increasing public knowledge of neuroscientific applications.

**References:**

Gazzaniga, M.. (2009) The Cognitive Neurosciences. Massachusetts Institute of Technology.ISBN 978-0-262-01341-3

**Lesson 12: NEUROSCIENCES OF FREE WILL.**

**Contents:**

Implications for our sense of agency, moral responsibility, and our understanding of consciousness in general. Clinical cases. Consequences on law and guilt. Is free will an illusion?

**References:**

Gazzaniga, M.. (2009) The Cognitive Neurosciences. Massachusetts Institute of Technology.ISBN 978-0-262-01341-3

1. **METHODOLOGICAL RESOURCES.**

Lessons have a duration of 3 hours per week. They consist of theoretical classes and practices based on the reading of cases, papers and news.

1. **EVALUATION:**

Students will be evaluated in three (3) ways: Two (2) written exams, and one (1) research work in collaboration with the research institute. Students who do not pass one or both exams have the chance to take them again one more time. Furthermore, an attendance of 75% is required to approve the curse.

Final examination will consist of an oral or written exam (multiple choice), or both.

1. **Neuroscience III Schedule**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Week** | **Lesson**  | **Theory** | **Practice** | **Counseling** | **Evaluations** |
| **1** | REVIEW OF THE BASIC CONTENTS OF NEUROSCIENCE I  | **X** |  |  |  |
| **2** | REVIEW OF THE BASIC CONTENTS OF NEUROSCIENCE II  | **X** |  |  |  |
| **3** | ATTENTION AND CONSCIOUSNESS. | **X** |  |  |  |
| **4** | EXECUTIVE FUNCTIONS. LEARNING AND MEMORY. | **X** |  |  |  |
| **5** | LANGUAGE | **X** |  |  |  |
| **6** | AGNOSIA AND APRAXIA.  | **X** |  |  |  |
| **7** | FIRST EXAM | **X** |  |  |  |
| **8** | NEUROSCIENCE AND INTELLIGENCE. |  |  |  | **X** |
| **9** | EMOTIONS AND STRESS | **X** |  |  |  |
| **10** | PSYCHOPHARMACOLOGY. | **X** |  |  |  |
| **11** | APPLIED NEUROSCIENCES. | **X** |  |  |  |
| **12** | SECOND EXAM | **X** |  |  |  |
| **13** | MAKE-UP EXAMS |  |  |  | **X** |
| **14** | NEUROSCIENCES OF FREE WILL | **X** |  |  |  |
| **15** |  FINAL EXAMINATION  |  |  |  | **X** |
| **16** |  FINAL EXAMINATION |  |  |  | **X** |
| **17** |  FINAL EXAMINATION |  |  |  | **X** |
| **18** |  FINAL EXAMINATION |  |  |  | **X** |