# SYLLABUS

## 1. Information about the study program

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| 1.1 Higher education institution | Babeș-Bolyai University |
| 1.2 Faculty | Faculty of Psychology and Educational Sciences |
| 1.3 Department | Department of Psychology |
| 1.4 Field of study | Psychology – Cognitive Sciences |
| 1.5 Study cycle | Bachelor level |
| 1.6 Study program / Qualification | Psychologist |

## 2. Information about the course

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|---|---|---|---|---|---|---|---|
| 2.1 Title of the course | Introduction to Neuroscience | | | | | | |
| 2.2 Teacher in charge of the lecture | Dr. Lavinia Carmen Uscatescu | | | | | | |
| 2.3 Teacher in charge of the seminar | Dr. Ana-Maria Ichim<br>Dr. Andrei Catalin Ciuparu | | | | | | |
| 2.4 Study year | 1 | 2.5 Semester | 1 | 2.6. Examination type | E | 2.7 Course type | DS |

**3. Estimated total time** (number of hours of teaching activities per semester)

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|---|---|---|---|---|---|
| 3.1 Number of hours per week | 4 | out of which: 3.2 lecture | 2 | 3.3 seminar / laboratory | 2 |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 seminar / laboratory | 28 |
| Distribution of the allocated amount of time: | | | | | hours |
| Individual study (textbook, course support, bibliography, and notes) | | | | | 56 |
| Supplementary documentation at the library using specialized electronic platforms in the field | | | | | 22 |
| Preparing for seminars / laboratories, homework, papers, portfolios, and essays | | | | | 20 |
| Tutoring | | | | | 4 |
| Exams | | | | | 2 |
| Other activities: research activities | | | | | 1 |
| 3.7 Total number of hours of individual study | 98 | | | | |
| 3.8 Total number of hours per semester | 125 | | | | |

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| 3.9 Number of credits (ECTS) | 5 |

**4. Prerequisites** (if applicable)

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| 4.1 Curriculum | - |
| 4.2 Competencies | - |

**5. Requirements** (if applicable)

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| 5.1 For the lecture | • Classroom with at least 180 seats, computer and video projector / Online course conducted through the MS Teams platform. |
| 5.2 For the seminar / laboratory | • Room with at least 50 seats, computer and video projector / Online seminar conducted through the MS Teams platform. |

**6. Specific skills acquired**

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| **Professional skills** | **Knowledge and understanding**<br>• Understanding the place and role of neuroscience within the study of human behaviour<br>• Knowledge of fundamental aspects and the role of the neuroscience approach in psychology<br>• Characterization of the main neural principles and functional-anatomical structures and processes throughout life<br>• Understanding the neuroscience perspective on various behavioural functions and phenomena<br><br>**Explanation and interpretation**<br>• Arguing the importance of the neuroscience in psychology<br>• Interpretation from a neuroscientific perspective of different phenomena and processes (e.g., seeing, hearing, motor control)<br>• Explaining and arguing the basic functioning principles of the healthy/typical brain<br>• Explaining principles related to brain development and plasticity throughout life<br><br>**Instrumental - applicative**<br>• Learning the main concepts and principles that are necessary to understand the overall brain function<br>• Developing scientific communication skills as well as skills that are necessary to conduct a research project<br><br>**Attitude**<br>• Manifestation of a positive and responsible attitude towards the (neuro)scientific field |

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| | • Cultivating a responsible attitude towards the research activity in the field<br>• Interest in personal development in the field |
| **Transversal skills** | • Written and oral communication skills<br>• Relationship and teamwork skills<br>• Time management skills and the management of resources<br>• Competences in using scientific terminology in the field of neuroscience<br>• Competences for the interdisciplinary use of knowledge and terminology in the fields of neuroscience and psychology |

**7. Objectives of the course** (based on the grid of acquired competencies)

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| 7.1 General objective | • Familiarizing students with neuroscientific approach within the study of psychology |
| 7.2 Specific objectives | • Presentation of neuroscience as an impactful field in psychology<br>• Analysis of the place and role of neuroscience in human behaviour<br>• Discussion of the main neural principles and functional-anatomical structures in neuroscience<br>• Neuroscientific approach to the human basic behaviors (e.g., seeing, hearing, moving)<br>• Presentation of a neuroscientific perspective on life-long development |

**8. Content**

| 8.1 Lecture | Teaching strategies | Remarks |
|---|---|---|
| **Brief history and model organisms in Neuroscience.**<br><br>**Keywords**: neuroscience history, animal and human models, neuroscience myths. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Nervous system structure and organization.**<br><br>**Keywords:** neurons, glial cells, central vs. peripheral nervous system, sympathetic vs. parasympathetic system. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Neural signalling, I.**<br><br>**Keywords:** resting potential, action potential, conductance, myelination. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Neural signalling, II.** | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |

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| **Keywords:** electrical vs. chemical synapses, excitatory vs. inhibitory neurotransmitters. | | |
| **Elements of brain anatomy.**<br><br>**Keywords:** brain lobes, cerebellum, brain axes, subdivisions of the central nervous system, the meninges, the ventricular system. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Anatomy of the spinal cord, brainstem, and cranial nerves.**<br><br>**Keywords:** afferent vs. efferent axons, brainstem, cranial nerves. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Nervous system development: Early life.**<br><br>**Keywords:** neurogenesis, neural migration, neural polarization, topographical maps. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Nervous system development: Mature life**<br><br>**Keywords:** adult neurogenesis, stem cells, regeneration, functional reorganization. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Information processing and functional organization in the brain.**<br><br>**Keywords:** neural maps, neural layers, processing hierarchy. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Visual neuroscience.**<br><br>**Keywords:** eye anatomy, phototransduction, light adaptation, central visual pathways, visual cortex | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Auditory neuroscience.**<br><br>**Keywords:** sound features, ear anatomy, auditory pathway, auditory cortex. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **Movement and motor control.** | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |

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|---|---|---|
| **Keywords:** motor neuron, basal ganglia, cerebellum, motor cortex. | | |
| **The organization and planning of movement.**<br><br>**Keywords:** motor command, forward models, efference copies, sensory-motor interactions. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |
| **The aging brain.**<br><br>**Keywords:** age-related brain changes, cognitive decline, healthy vs. dramatic aging, cognitive training. | Lecture, demonstrative example, synthesis of knowledge, guided discovery | |

**Mandatory references:**

Cabeza, R., Albert, M., Belleville, S., Craik, F., Duarte, A., Grady, C., ... & Rajah, M. N. (2018). Cognitive neuroscience of healthy aging: Maintenance, reserve, and compensation. *Nature Reviews Neuroscience*, 19(11), 701.

Kandel, E. R., Schwartz, J. H., Jessell, T. M., Siegelbaum, S., Hudspeth, A. J., & Mack, S. (Eds.). (2013). *Principles of Neural Science (5th Edition)*. New York: McGraw-Hill.

Purves, D., Augustine, G. J., Fitzpatrick, D., Hall, W. C., LaMantia, A. S., & White, L.E., (Eds.). (2012). *Neuroscience (5th Edition)*. Sunderland, MA: Sinauer Associates.

**!!! Note: only the chapters related to the topics taught in the lecture and the seminar are mandatory from the works mentioned above**

**Optional references:**

Finger, S. (2001). *Origins of neuroscience: A history of explorations into brain function.* New York, USA: Oxford University Press.

Howard-Jones, P. A. (2014). Neuroscience and education: Myths and messages. *Nature Reviews Neuroscience, 15*(12), 817-824.

Lemke, G. (Ed.). (2010). *Developmental Neurobiology*. London, UK: Elsevier Academic Press.

Lin, F. R., Yaffe, K., Xia, J., Xue, Q. L., Harris, T. B., Purchase-Helzner, E., ... & Health ABC Study Group, F. T. (2013). Hearing loss and cognitive decline in older adults. *JAMA Internal Medicine, 173*(4), 293-299.

Miall, R. C., & Wolpert, D. M. (1996). Forward models for physiological motor control. *Neural Networks, 9*(8), 1265-1279.

Park, D. C., & Bischof, G. N. (2013). The aging mind: neuroplasticity in response to cognitive training. *Dialogues in Clinical Neuroscience, 15*(1), 109.

Shadmehr, R., Smith, M. A., & Krakauer, J. W. (2010). Error correction, sensory prediction, and adaptation in motor control. *Annual Review of Neuroscience, 33*, 89-108.

Squire, L. R. (2009). The legacy of patient HM for neuroscience. *Neuron, 61*(1), 6-9.

Toovey, B. R. W., Kattner, F., & Schubert, T. (2021). Cross-Modal Transfer Following Auditory Task-Switching Training in Old Adults. *Frontiers in Psychology, 12*, 486.

| 8.2 Seminar / laboratory | Teaching strategies | Remarks |
|---|---|---|
| **Introduction and organizational details.** | Exposure, conversation | |
| **Lessons from comparative neuroscience.**<br><br>**Keywords:** animals-human research, nervous system evolution, intracranial vs. extracranial neural activity. | Presentation, knowledge synthesis, conceptual clarification, practical activities | |
| **Neural signalling and autoimmune reactions.**<br><br>**Keywords:** demyelination, multiple sclerosis, immune system. | Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, practical activities | |
| **Synaptic plasticity in learning and memory.**<br><br>**Keywords:** short vs. long-term plasticity, hippocampus, long-term potentiation. | Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, practical activities | |
| **Blood supply organization in the nervous system.**<br><br>**Keywords:** anterior and posterior circulation, the blood-brain barrier, stroke. | Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, practical activities | |
| **Nerve degeneration and neuropathic pain.**<br><br>**Keywords:** nerve injury, pain, neuralgia, phantom limb. | Presentation, knowledge synthesis, conceptual clarification, group activities, | |

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| | guided discovery, practical activities | |
| **Neurodevelopment as a result of experience.**<br><br>**Keywords:** critical periods. | Presentation, knowledge synthesis, conceptual clarification, group activities, Guided discovery, practical activities | |
| **Functional reorganization following trauma.**<br><br>**Keywords:** neuroplasticity, post-traumatic brain injury, rehabilitation. | Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, conversation | |
| **Patterns of organization in the sensory-motor cortex.**<br><br>**Keywords:** somatotopic map, ethological action maps. | Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, conversation | |
| **Cognitive influences on high-level visual processing.**<br><br>**Keywords:** object recognition, perceptual constancy, visual memory. | Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, conversation | |
| **Visual-auditory interactions.**<br><br>**Keywords:** perceptual illusions, the McGurk effect, multisensory integration. | Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, conversation | |
| **Movement disorders and motor control.**<br><br>**Keywords:** ataxia, Parkinson's disease, implicit vs. explicit motor learning. | Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, conversation | |
| **Deficient sensory-motor interactions in schizophrenia.**<br><br>**Keywords**: sensory attenuation, positive symptoms, processing failure. | Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, conversation | |
| **Summary seminar – putting it all together**<br><br>**Keywords:** synthesis, integration, recap | Knowledge synthesis, conceptual clarification, conversation | |

**Mandatory references:**

Campbell, J. N., & Meyer, R. A. (2006). Mechanisms of neuropathic pain. *Neuron, 52*(1), 77-92.

Ford, J. M., & Mathalon, D. H. (2012). Anticipating the future: automatic prediction failures in schizophrenia. *International Journal of Psychophysiology, 83*(2), 232-239.

Graziano, M. S. (2016). Ethological action maps: a paradigm shift for the motor cortex. *Trends in Cognitive Sciences, 20*(2), 121-132.

Donchin, O., & Timmann, D. (2019). How to help cerebellar patients make the most of their remaining learning capacities. *Brain, 142*(3), 492-495.

Kandel, E. R., Schwartz, J. H., Jessell, T. M., Siegelbaum, S., Hudspeth, A. J., & Mack, S. (Eds.). (2013). *Principles of Neural Science (5th Edition)*. New York: McGraw-Hill.

Purves, D., Augustine, G. J., Fitzpatrick, D., Hall, W. C., LaMantia, A. S., & White, L.E., (Eds.). (2012). *Neuroscience (5th Edition)*. Sunderland, MA: Sinauer Associates.

Rosa, M. G., & Tweedale, R. (2005). Brain maps, great and small: lessons from comparative studies of primate visual cortical organization. *Philosophical Transactions of the Royal Society B: Biological Sciences, 360*(1456), 665-691.

**!!! Note: only the chapters related to the topics taught in the lecture and the seminar are mandatory from the works mentioned above**

**Optional references:**

Beauchamp, M. S. (2016). Audiovisual speech integration: Neural substrates and behavior. *In Neurobiology of Language (pp. 515-526)*. London, UK: Elsevier Academic Press.

Ford, J. M., Palzes, V. A., Roach, B. J., & Mathalon, D. H. (2014). Did I do that? Abnormal predictive processes in schizophrenia when button pressing to deliver a tone. *Schizophrenia Bulletin, 40*(4), 804-812.

Giummarra, M. J., Gibson, S. J., Georgiou-Karistianis, N., & Bradshaw, J. L. (2007). Central mechanisms in phantom limb perception: the past, present and future. *Brain Research Reviews, 54*(1), 219-232.

Goldenberg, M. M. (2012). Multiple sclerosis review. *Pharmacy and Therapeutics, 37*(3), 175.

Henderson, L. A., Gustin, S. M., Macey, P. M., Wrigley, P. J., & Siddall, P. J. (2011). Functional reorganization of the brain in humans following spinal cord injury: evidence for underlying changes in cortical anatomy. *Journal of Neuroscience, 31*(7), 2630-2637.

Huang Y, Matysiak A, healing P, King R, Brosch M. 2016. Persistent neural activity in auditory cortex is related to auditory working memory in humans and nonhuman primates. *eLife. 5*

Kaas, J. H. (Ed.). (2020). *Evolutionary Neuroscience.* London, UK: Elsevier Academic Press.

Miller, C. T., Hale, M. E., Okano, H., Okabe, S., & Mitra, P. (2019). Comparative principles for next-generation neuroscience. *Frontiers in Behavioral Neuroscience, 13*, 12.

Skipper, J. I., Van Wassenhove, V., Nusbaum, H. C., & Small, S. L. (2007). Hearing lips and seeing voices: how cortical areas supporting speech production mediate audiovisual speech perception. *Cerebral Cortex, 17*(10), 2387-2399.

Tiippana, K. (2014). What is the McGurk effect?. *Frontiers in Psychology, 5,* 725.

**9. Correlations between the content of the course and the expectations of the representatives of the epistemic community, professional associations and representative employers in the field related to the program**

The proposed lecture and seminar offer central topics in fundamental and applied research in the field of neuroscience, while the delivered content is based on the most relevant and recent results found in the literature. The course also offers state of the art research skills that are transferable to any scientific or applied field of research.

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Lecture | | Written exam | 60% |
| | | | |
| 10.5 Seminar / laboratory | | Research project | 30% |
| | | | |
| 10.6 Minimum passing score | | | |

**The final evaluation** will be based on a written exam conducted in the exam session at the end of the second semester and of a research project.
The final grade consists of:

a. score obtained in the written exam in proportion of 60% (maximum 6 points)
b. research project 30% (up 3 points).

The simultaneous conditions for passing the Neuroscience exam are:

a. a minimum of 2.5 points for the written exam out of the 6 maximum possible points
b. a minimum of 5 points from the final grade (combined score: project and exam)

Date

29.09.2023

Signature of the teacher in charge of the lecture and seminar

Approval date in the department

Signature of the Head of the department /director