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|  FLORIDA ATLANTIC UNIVERSITY | NEW COURSE PROPOSAL Graduate Programs | UGPC Approval _____ UFS Approval _____ SCNS Submittal _____ |
| | Department Biomedical Science College Medicine <i>(To obtain a course number, contact erudolph@fau.edu)</i> | Confirmed _____ Banner _____ Catalog _____ |

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| Prefix GMS Number 6021 | <i>(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)</i> Lab Code | Type of Course Lecture | Course Title Neural Plasticity |
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| Credits <i>(Review Provost Memorandum)</i> 3 | Grading <i>(Select One Option)</i> Regular X Sat/UnSat | Course Description <i>(Syllabus must be attached; see Guidelines)</i> Neural Plasticity is a course designed to provide students with a functional understanding of the field of basic neuroscience with application to brain plasticity throughout the lifespan. Emphasis is on the integrated understanding of learning and memory, structural and synaptic plasticity in animal models with relevance to human brain function in health and disease. |
| Effective Date <i>(TERM & YEAR)</i> Spring 2021 | | |

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| Prerequisites NONE <i>Prerequisites, Corequisites and Registration Controls are enforced for all sections of course.</i> | Academic Service Learning (ASL) course Academic Service Learning statement must be indicated in syllabus and approval attached to this form. | |
| | Corequisites NONE | Registration Controls <i>(For example, Major, College, Level)</i> Instructor Permission Required |

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| Minimum qualifications needed to teach course: Member of the FAU graduate faculty and has a terminal degree in the subject area (or a closely related field.) | List textbook information in syllabus or here |
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| Faculty Contact/Email/Phone Dr. Henriette van Praag hvanpraag@health.fau.edu (561) 799-8689 | List/Attach comments from departments affected by new course |
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| Approved by Department Chair _____ <i>Janet D. Bobshaw</i> College Curriculum Chair _____ <i>Marc Kantorow</i> College Dean _____ <i>Phillip M. Brindle, MD</i> UGPC Chair _____ UGC Chair _____ Graduate College Dean _____ UFS President _____ Provost _____ | Date 10/7/2020 10/7/2020 10/12/2020 _____ _____ _____ _____ |
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Email this form and syllabus to UGPC@fau.edu 10 days before the UGPC meeting.

Neural Plasticity- 2021

Instructor: Dr. Henriette van Praag
Course #– 3 credits
Course Requisites: Instructor Permission
Course hours: Wednesdays and Fridays 9:30 – 10:50 PM
Place: TBD
Office hours & place: MC-17, Rm 103, Jupiter Campus
561.799.8689 / office
Email: hvanpraag@health.fau.edu
Office hours- by appointment

Text: Assigned weekly readings of review and research articles

Course Catalog Description:

Neural Plasticity is a course designed to provide students with a functional understanding of the field of basic neuroscience with application to brain plasticity throughout the lifespan. Emphasis is on the integrated understanding of learning and memory, structural and synaptic plasticity in animal models with relevance to human brain function in health and disease.

Additional Information on Course:

Students will be expected to learn course material through presentations made in class, through in-class discussion and through reading reviews and research. paper This graduate-level course emphasizes self-directed and group-learning principals. Students will be assigned original research papers and will present these to the class for discussion. The content of these presentations and in-class discussions will form the basis for the exams. Students will be evaluated based on their performance on one mid-term (25%), one final exam (25%) the quality of their individual case presentations (25%) and class participation (25%). The instructor reserves the right to alter the schedule or content of the course anytime.

Different evaluation method for undergraduates compared to graduates:

For undergraduate students the class presentation of journal articles is not mandatory. If undergraduate students choose not to do a presentation they will be evaluated on the basis of their grades for participation, and their exam scores. However, undergraduate students who do wish to deliver a class presentation have the option to do so. The presentation will be graded and they will receive extra credit.

Course Objectives: To learn the principles and mechanisms of nervous system plasticity, memory function, adult neurogenesis, neurotrophic factor signaling, experience-dependent plasticity, and the effects of neurodevelopmental and neurodegenerative diseases, stress, addiction and aging on these processes. The course will cover both classic studies and recent advances in neural plasticity through reading, presentation and discussion of reviews and research articles.

Course Schedule and readings:

Week 1: Cerebral organization and behavior.

1/13; 1/15/21

- Sperry, RW (1961) Cerebral organization and behavior. *Science* 133:1749-1757.
- Gazzaniga MS. (2005) Forty-five years of split-brain research and still going strong. *Nat Rev Neurosci* 6(8):653-9.

Week 2: Memory systems and plasticity

1/20; 1/22/21

- Squire LR. (1992) Memory and the hippocampus: a synthesis from findings with rats, monkeys, and humans. *Psychol Rev* 99, 195-231.
- Milner B. (2005) The medial temporal-lobe amnesic syndrome. *Psychiatr Clin North Am.* 28(3):599-611, 609.
- Hartley T, Lever C, Burgess N, O'Keefe J. (2013) Space in the brain: how the hippocampal formation supports spatial cognition. *Philos Trans R Soc Lond B Biol Sci.* 369 (1635):20120510.

Week 3: Molecular signaling mechanisms in neural plasticity *Transcriptional and epigenetic mechanisms*

1/27; 1/29/21

- Landry, C. D., Kandel, E. R. & Rajasethupathy, P. (2013) New mechanisms in memory storage: piRNAs and epigenetics. *Trends Neurosci.* 36, 535–542.
- Campbell R.R. & Wood M.A. (2019). DNA methylation and memory formation. *Nature Rev. Neuroscience* 20:133-147, 2019.
- Hwang JY, Aromolaran KA, Zukin RS. (2017) The emerging field of epigenetics in neurodegeneration and neuroprotection. *Nat Rev Neurosci.*18(6):347-361.

Week 4: Molecular signaling mechanisms in neural plasticity *Post-transcriptional mechanisms*

2/3; 2/5/21

- Fiore, R., Siegel, G., Schrott, G. (2008) MicroRNA function in neuronal development, plasticity and disease. *Biochimica & Biophysica Acta* 1779: 471-478.
- Lennox AL, Mao H, Silver DL. (2018) ν RNA on the brain: emerging layers of post-transcriptional regulation in cerebral cortex development. *Wiley Interdiscip Rev Dev Biol.* 7(1):10.1002/wdev.290.
- Smith ACW, Kenny PJ. (2018) MicroRNAs regulate synaptic plasticity underlying drug addiction. *Genes Brain Behav.*17(3):e12424. doi: 10.1111/gbb.12424

Week 5: NMDAR- and non-NMDAR-dependent synaptic plasticity

2/10; 2/12/21

- Bliss, T. V. & Collingridge, G. L. A synaptic model of memory long-term potentiation in the hippocampus. *Nature* 361, 31–39 (1993).
- Citri A, Malenka RC (2008) Synaptic plasticity: multiple forms, functions, and mechanisms. *Neuropsychopharmacology* 33:18–41.
- Kumar A, Foster TC. (2019) Alteration in NMDA Receptor Mediated Glutamatergic Neurotransmission in the Hippocampus During Senescence. *Neurochem Res.* 44(1):38-48
- Ben-Ari Y. Excitatory actions of GABA during development: the nature of the nurture. *Nat Rev Neurosci.* 3(9): 728-39, 2002.

- Kraus, C., Castren, E., Kasper, S., Lanzenberger R. (2017) Serotonin and neuroplasticity – links between molecular, functional and structural pathophysiology in depression. *Neurosci. Biobehav. Rev.* 77: 317-326.

Week 6: Growth factors and neural plasticity

2/17; 2/19/21

- Chao, M.V. (2003) Neurotrophins and their receptors: a convergence point for many signalling pathways. *Nature Reviews Neuroscience* 4 (4), 299-309.
- Burek MJ, Oppenheim RW. (1996) Programmed cell death in the developing nervous system. *Brain Pathol.* 6(4):427-46.
- Cotman C.W., Berchtold N.C. (2002) Exercise: A behavioral intervention to enhance brain health and plasticity. *Trends Neurosci* 25: 295–301.

Week 7: Adult neurogenesis

2/24; 2/26/21

- Ming GL, Song H. Adult neurogenesis in the mammalian brain: significant answers and significant questions. *Neuron* 70, 687-702 (2011)
- Goncalves, J.T., Schafer, S.T., and Gage, F.H. (2016). Adult Neurogenesis in the Hippocampus: From Stem Cells to Behavior. *Cell* 167, 897-914.
- Toda T, Gage FH. Review: adult neurogenesis contributes to hippocampal plasticity. *Cell Tissue Res* 373, 693-709 (2018)
- Kempermann G, et al. (2018) Human Adult Neurogenesis: Evidence and Remaining Questions. *Cell Stem Cell* 23, 25-30

Week 8: Mid-term Exam (first hour)

3/3; 3/5/21

Regulation of adult neurogenesis

- Vivar, C., Potter, M.C., and van Praag, H. (2013). All about running: synaptic plasticity, growth factors and adult hippocampal neurogenesis. *Current topics in Behavioral Neurosciences* 15, 189-210.
- Eisinger BE, Zhao X. Identifying molecular mediators of environmentally enhanced neurogenesis. *Cell Tissue Res* 371, 7-21 (2018)

Week 9: Glial cells and neuroplasticity

3/17; 3/19/21

- Augusto-Oliveira M, Arrifano GP, Takeda PY, Lopes-Araújo A, Santos-Sacramento L, Anthony DC, Verkhatsky A, Crespo-Lopez ME. (2020) Astroglia-specific contributions to the regulation of synapses, cognition and behaviour. *Neurosci Biobehav Rev.* S0149-7634(20)30508-X.
- Wilton DK, Dissing-Olesen L, Stevens B. (2019) Neuron-Glia Signaling in Synapse Elimination. *Annu Rev Neurosci.* 42:107-127.
- Adamsky A, Goshen I. (2018) Astrocytes in Memory Function: Pioneering Findings and Future Directions. *Neuroscience.* 370:14-26.
- Haydon, P.G. (2017) Astrocytes and the modulation of sleep. *Current Opinion in Neurobiology* 44:28-33.

Week 10: Neuro-Developmental disorders

3/24; 3/26/21

- LeBlanc, J.J., and Fagiolini, M. (2011). Autism: a “critical period” disorder? *Neural Plast.* 2011, 921680.

- Geschwind, D., and Levitt, P. (2007). Autism spectrum disorders: developmental disconnection syndromes. *Curr. Opin. Neurobiol.* 17, 103–111. doi: 10.1016/j.conb.2007.01.009.
- Pangrazzi L, Balasco L, Bozzi Y. (2020) Oxidative Stress and Immune System Dysfunction in Autism Spectrum Disorders. *Int J Mol Sci.* 21(9):3293

Week 11: Stress and neuroplasticity

3/31; 4/2/21

- McEwen, B.S. & Akil, H. (2020) Revisiting the stress concept: implications for affective disorders. *Journal of Neuroscience* 40:12-21.
- Price RB, Duman R. (2020) Neuroplasticity in cognitive and psychological mechanisms of depression: an integrative model. *Mol Psychiatry.* 25(3):530-543.
- Robson MJ, Quinlan MA, Blakely RD. (2017) Immune System Activation and Depression: Roles of Serotonin in the Central Nervous System and Periphery. *ACS Chem Neurosci.* 8(5):932-942.

Week 12: Substance abuse and addiction

4/7; 4/9/21

- Madeo G, Bonci A. (2018) Rewiring the Addicted Brain: Circuits-Based Treatment for Addiction. *Cold Spring Harb Symp Quant Biol.* 83:173-184.
- Dong Y, Taylor JR, Wolf ME, Shaham Y. (2017) Circuit and Synaptic Plasticity Mechanisms of Drug Relapse. *J Neurosci.* 37(45):10867-10876
- Nestler EJ, Lüscher C. (2019) The Molecular Basis of Drug Addiction: Linking Epigenetic to Synaptic and Circuit Mechanisms. *Neuron*102(1):48-59.

Week 13: Aging and dementia

4/14; 4/16/21

- Duzel, E., van Praag, H., Sendtner, M. (2016) Can physical exercise in old age improve memory and hippocampal function? *Brain*, 139:662-673, 2016.
- Long JM, Holtzman DM. (2019) Alzheimer Disease: An Update on Pathobiology and Treatment Strategies. *Cell* 179(2):312-339.
- Busche MA, Hyman BT. (2020) Synergy between amyloid- β and tau in Alzheimer's disease. *Nat Neurosci.* doi: 10.1038/s41593-020-0687-6.

Week 14: Review and Final Exam

4/21; 4/23/21

Course Policies: Participation is required for every class. Missing class, changing presentation dates and/or missing exams is not allowable without prior approval of the instructor and an approved physician's letter or a letter of conflict from an approved University Official to attend a mandatory University-approved activity.

Evaluation and Grading: Grading is based on 2 written exams given in class, and 2 journal article presentations/discussions that complement course content and evaluates communication skills (25% each). Attendance matters. 5 pts deducted from final point count per unexcused absence.

Attendance Policy Statement: Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The

effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance.

Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

Classroom etiquette: Please refer to the FAU Catalog and Student Handbook. Compliance with university rules and regulations is expected of all students.

Disability policy statement: In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.
Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to <http://www.fau.edu/counseling/>

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Code of Academic Integrity policy statement

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility.

Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001. If your college has particular policies relating to cheating and plagiarism, state so here or provide a link to the full policy—but be sure the college policy does not conflict with the University Regulation.