

DEREE COLLEGE SYLLABUS FOR: BMS 4515 NEURODEVELOPMENT, NEURODEGENERATION AND THE ENVIRONMENT

3/0/3

UK LEVEL: 6
UK CREDITS: 15

(Previously: **BMS 4415 ENVIRONMENTAL BURDEN IN NEURODEVELOPMENT**)
(Updated: Fall 2024)

PREREQUISITES:

BI 1000 Introduction to Biology I
BI 1101 Introduction to Biology II
BI 2222 Cell Biology
BI 3336 Molecular Biology
BI 3240 Human Anatomy and Physiology

CATALOG DESCRIPTION:

The course focuses on fundamental principles of nervous system organogenesis and integrates information from a variety of model systems, relating them to human nervous system development trajectory, including disorders of development and neurodegenerative disorders. It covers topics such as neuronal determination, axonal navigation and targeting, neuron survival and death, synapse formation and developmental plasticity. The role of environmental exposures, epigenetics, gene expression, cell migration and stem cells, cognitive function, and socioeconomic status are considered.

RATIONALE:

The course provides a detailed review of issues relating to the nature of brain-behavior relationships, development and neurodegeneration. It focuses on fundamental principles of nervous system organogenesis and it integrates information from a variety of model systems, relating them to human nervous system typical and atypical brain development. The student systematically develops knowledge from the description of key experiments and results that guide to understanding the succeeding events in neural development. Experiential hazards that can derail development, such as exposure to early adversity will also be discussed. The patterning and growth of the nervous system, neuronal survival and death, synapse formation and developmental plasticity, as well as key concepts underlying the pathogenesis of neurodegenerative disorders, such as neuroinflammation, are considered. The role of environmental factors in brain development and aging-related diseases is also examined making the course suitable for biomedical students. Both genetic and environmental factors that influence brain development and degeneration will be discussed.

LEARNING OUTCOMES:

As a result of taking this course, the student should be able to:

1. Discuss the mechanisms associated with organogenesis in the nervous system relating them to typical and atypical brain development of the human nervous system.
2. Discuss the main mechanisms (both genetic and environmental) underlying the development of neurodegenerative diseases.
3. Critically evaluate the use of research findings, imaging techniques, tests of physiological function and laboratory data in the identification, etiology, diagnosis and pathogenesis of brain diseases.
4. Demonstrate a critical and analytical approach to specific case histories in relation to neurodevelopment and neurodegeneration and the role of the environment in disease initiation and progression.
5. Discuss the consequences of selected disease states due to environmental toxins exposure.
6. Conduct appropriate literature-based research/evaluation of relevant topics.

METHOD OF TEACHING AND LEARNING:	<p>In congruence with the teaching and learning strategy of the college, the following tools are used:</p> <ul style="list-style-type: none"> • Class lectures, interactive learning (class discussions, group work) video presentations, and practical problems solved in class. • Exercises and primary source documents are assigned as homework, the solutions of which are reviewed in class • Master lectures by esteemed professors and experts in the field. • Lectures on the principles and understanding of the subject matter, including original data from primary research papers and other sources. • Tutorials of an interactive format to establish understanding of topic areas primarily through case studies and experimentally derived data. • Office hours: students are encouraged to make full use of the office hours of their instructor, where they can ask questions, see their exam paper, and/or go over lecture/lab material. • Use of library facilities for further study and preparation for the exams. • Use of the Blackboard course management platform to further support communication, by posting lecture notes, assignment instruction, timely announcements, formative quizzes and online submission of assignments. 										
ASSESSMENT:	<p>Summative:</p> <table border="1"> <tr> <td> 1st assessment: In-class midterm examination (2-hour): Multiple-choice, concept questions, case study questions </td><td> 40 % </td></tr> <tr> <td> 2nd assessment: Portfolio Essay questions aiming to prepare students for their first and final assessments in terms of content, context and time management </td><td> 10 % </td></tr> <tr> <td> Final assessment: Final examination (2-hour), comprehensive: Multiple-choice, concept questions, case study questions </td><td> 50 % </td></tr> </table> <p>Formative:</p> <table border="1"> <tr> <td> Multiple "diagnostic on-line" tests Multiple choice/short answers </td><td> 0 </td></tr> <tr> <td> Essay questions </td><td> 0 </td></tr> </table> <p>The formative MC (on-line) and written essays aim to prepare students for the examination. Students are expected to submit feedback on their performance.</p> <p>The 1st assessment tests Learning Outcomes 1, 2. The 2nd assessment tests Learning Outcomes 1-6. The final examination tests all Learning Outcomes (1-6) and it is comprehensive.</p> <p><i>The final grade for this module will be determined by averaging all summative assessment grades, based on the predetermined weights for each assessment. If students pass the comprehensive assessment that tests all Learning Outcomes for this module and the average grade for the module is 40 or higher, students are not required to resit any failed assessments.</i></p>	1st assessment: In-class midterm examination (2-hour): Multiple-choice, concept questions, case study questions	40 %	2nd assessment: Portfolio Essay questions aiming to prepare students for their first and final assessments in terms of content, context and time management	10 %	Final assessment: Final examination (2-hour), comprehensive: Multiple-choice, concept questions, case study questions	50 %	Multiple "diagnostic on-line" tests Multiple choice/short answers	0	Essay questions	0
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Essay questions	0										
INDICATIVE READING:	REQUIRED READING:										

	<p>1. Michael Aschner Lucio Costa, Environmental Factors in Neurodevelopmental and Neurodegenerative Disorders, 1st Edition, Academic Press (2015), eBook ISBN: 9780128004074, Hardcover ISBN: 9780128002285</p> <p>2. Instructor's lectures notes on blackboard.</p> <p>RECOMMENDED READING:</p> <p>1. Sanes, D., Reh, T. A., & Harris, W. A., Development of the Nervous System, 3rd edition, Elsevier Inc. (2011)</p> <p>2. Mark H. Johnson, Michelle de Haan, Developmental Cognitive Neuroscience: An Introduction, 4th Edition, Wiley-Blackwell (2015), ISBN: 978-1-118-93808-9</p>
<p>INDICATIVE MATERIAL: (e.g. audiovisual, digital material, etc.)</p>	<p>REQUIRED MATERIAL: N/A</p> <p>RECOMMENDED MATERIAL: N/A</p>
<p>COMMUNICATION REQUIREMENTS:</p>	<p>Verbal and written skills using academic / professional English</p>
<p>SOFTWARE REQUIREMENTS:</p>	<p>MS Office and Blackboard CMS</p>
<p>WWW RESOURCES:</p>	<p> https://www.nature.com/articles/nrg3934 https://chdm.duke.edu/research-areas/neurodevelopment-and-neurodegeneration https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4829467/ http://www.dnalc.org https://www.jove.com/visualize https://biologicalproceduresonline.biomedcentral.com/ https://www.bitnos.com/biomedical-protocols https://www.ncbi.nlm.nih.gov/pubmed/ https://www.informaticseducation.org/ http://imia-medinfo.org/wp/welcome-to-imia-2/ http://genomicsandhealth.org https://www.humanbrainproject.eu/en/ http://www.braininitiative.org/ https://www.alleninstitute.org/ http://www.brain-map.org/ </p>
<p>INDICATIVE CONTENT:</p>	<ul style="list-style-type: none"> • Introduction to Brain Development • Neurodevelopmental Disorders: Typical Versus Atypical Brain Development • Mechanisms, Models and Therapeutic Approaches for Neurodevelopmental Disorders • Fetal Alcohol Spectrum Disorders: Effects and Mechanisms of Ethanol on the Developing Brain • Prenatal Infection: Setting the Course of Brain Aging and Alzheimer's Disease? • Neurobehavioral Effects of Air Pollution in Children • The Role of Methylmercury Exposure in Neurodevelopmental disorders

	<ul style="list-style-type: none"> • Developmental Exposure to Lead: Overview and Integration of Neurobehavioral Consequences and Mediation • Thyroid-Disrupting Chemicals as Developmental Neurotoxicants • Environmental Factors in Neurodevelopmental Disorders: Summary and Perspectives • Overview of Neurodegenerative Disorders and Susceptibility Factors in Neurodegenerative Processes • Parkinson's Disease: Neuropathology, Mechanisms and Biological Plausibility • Genetic Models of Parkinson's Disease: Behavior, Signaling, and Pathological Features • Environmental Exposures and Risks for Parkinson's Disease • Alzheimer's Disease and the Search for Environmental Risk Factors • Environmental Factors and Amyotrophic Lateral Sclerosis: What Do We Know? • Gene–Environment Interactions in Huntington's Disease • Neuroinflammation in Neurological Dysfunction and Degeneration • Environmental Factors in Neurodegenerative Disorders: Summary and Perspectives
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