NS5004: MOLECULAR AND CELLULAR NEUROSCIENCE

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Molecular and Cellular Neuroscience

Subject Code
NS - Neuroscience
Course Number
5004

Academic Unit
Neuroscience (NS)

College/School
College of Biomedicine (BD)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
BMS8103 Cell and Molecular Biology Research

Part II Course Details

Abstract

Understanding the molecular and cellular mechanisms of neuronal function is not only crucial for gaining fundamental insights into how the brain works, but is also pivotal to identify new therapeutic targets for various brain disorders. This course aims to (1) equip students with the basic knowledge of molecular events, signal transduction pathways and cellular specializations within the brain; (2) introduce some of the latest frontiers on understanding how neurons function at the molecular and cellular levels; and (3) describe the latest technologies and tools in studying neuronal function. This interdisciplinary course provides detailed explanation on the molecular and cellular basis of various neuronal processes, with focus on intracellular transport, formation and plasticity of synapses, as well as molecular and cellular aberrations during neurodegeneration and neurodevelopmental disorders. Through wide range of teaching activities including tutorial discussions, paper presentations and essay writing, we aim to inspire students on the different fascinating aspects of molecular and cellular neuroscience.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the major molecular pathways and cellular compartments that control various neuronal functions			x	x
2	Develop critical thinking skills to evaluate the key concepts and new discoveries in molecular and cellular neuroscience		x	x	x
3	Apply the core knowledge in the molecular compositions of neuron to explain how their abnormalities affect normal brain function in specific disorders		x	x	x
4	Understand the principles behind key experimental approaches in molecular and cellular neuroscience research		x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Provide the essential knowledge about the molecular and cellular basis of neuronal functions	1, 2, 3, 4	

2	Laboratory sessions	Provide students to experience the techniques used in current molecular and cellular neuroscience research	2, 4	
3	Tutorial	Provide opportunities for discussion, further explanation of concepts and problem-solving	1, 2, 3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Laboratory Reports	1, 2, 3, 4	30	
2	Mid-term exam/Quizzes	1, 2, 3, 4	20	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Assessment Rubrics (AR)

Assessment Task

Mid-term and Final exam (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

To test students' application of material taught in class and evaluate their performance based on their performance on the exam

Excellent

(A+, A, A-) Excellent level of achievement. Students demonstrate mastery in their understanding of neuroscience concepts; express their ideas fluently; show clear evidence of strong critical thinking and integration of relevant materials.

Good

(B+, B, B-) Good level of achievement. Students show thorough understanding of neuroscience concepts; express their ideas well; demonstrate critical thinking and have suitable reading and integration of relevant materials.

Fair

(C+, C, C-) Satisfactory level of achievement. Students show some understanding of neuroscience concepts; express coherently; demonstrate some evidence of critical thinking and some reading and integration of relevant materials.

Marginal

(D) Barely satisfactory level of achievement. Students have a weak understanding of neuroscience concepts; show a minimally acceptable ability to communicate; barely able to demonstrate critical thinking with limited reading and integration of relevant materials.

Failure

(F) Unacceptable level of achievement. Students are unfamiliar with neuroscience concepts; cannot communicate effectively; do not show original thought and critical thinking, and have not read or integrated relevant materials.

Assessment Task

Laboratory Reports (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

To test students' application of materials taught in class into experimental design

Excellent

(A+, A, A-) Excellent level of understanding of practical aspects of some of the cellular experiments for neuroscience

Good

(B+, B, B-) Good level of understanding of practical aspects of some of the cellular experiments for neuroscience

Fair

(C+, C, C-) Satisfactory level of understanding of practical aspects of some of the cellular experiments for neuroscience

Marginal

(D) Barely satisfactory level of practical aspects of some of the cellular experiments for neuroscience

Failure

(F) Unacceptable level of understanding of practical aspects of some of the cellular experiments for neuroscience

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Assessment Task

Mid-term and Final exam (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

To test students' application of material taught in class and evaluate their performance based on their performance on the exam

Excellent

(A+, A, A-) Excellent level of achievement. Students demonstrate mastery in their understanding of neuroscience concepts; express their ideas fluently; show clear evidence of strong critical thinking and integration of relevant materials.

Good

(B+, B) Good level of achievement. Students show thorough understanding of neuroscience concepts; express their ideas well; demonstrate critical thinking and have suitable reading and integration of relevant materials.

Marginal

(B-, C+, C) Satisfactory level of achievement. Students show some understanding of neuroscience concepts; express coherently; demonstrate some evidence of critical thinking and some reading and integration of relevant materials.

Failure

(F) Unacceptable level of achievement. Students are unfamiliar with neuroscience concepts; cannot communicate effectively; do not show original thought and critical thinking, and have not read or integrated relevant materials.

Assessment Task

Laboratory Reports (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

To test students' application of materials taught in class into experimental design

Excellent

(A+, A, A-) Excellent level of understanding of practical aspects of some of the cellular experiments for neuroscience

Good

(B+, B) Good level of understanding of practical aspects of some of the cellular experiments for neuroscience

Marginal

(B-, C+, C) Satisfactory level of understanding of practical aspects of some of the cellular experiments for neuroscience

Failure

(F) Unacceptable level of understanding of practical aspects of some of the cellular experiments for neuroscience

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Part III Other Information

Keyword Syllabus

Cytoskeleton composition and dynamics, Dendritic spine development and remodelling, Gene transcription, Genome editing, Neurotrophic factors and their receptors, Human induced pluripotent stem cells and neural differentiation, Intracellular transport, Learning and memory, Microscopy in neurobiology, Post-translation modification of protein, Protein synthesis, RNA (mRNAs and non-coding RNAs), RNA interference, Signal transduction, Synaptic plasticity, Synapse

Reading List

Compulsory Readings

	Title
1	NIL

Additional Readings

	Title
1	The synapse: structure and function, Edited by: Virginia Pickel and Menahem Segal, 2014 Academic Press
2	Methods in cell biology. The neuronal cytoskeleton, motor proteins, and organelle trafficking in the axon. Volume 131, Edited by Kevin Pfister, 2016 Academic Press
3	Neuroscience: exploring the brain by Mark Bear, Barry Connors and Michael A. Paradiso. 4 th Edition