

NS2002: MOLECULAR AND CELLULAR NEUROBIOLOGY

Effective Term

Semester B 2024/25

Part I Course Overview

Course Title

Molecular and Cellular Neurobiology

Subject Code

NS - Neuroscience

Course Number

2002

Academic Unit

Neuroscience (NS)

College/School

College of Biomedicine (BD)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

Understanding how neurons function at the molecular and cellular levels is fundamental to unlock mystery of the brain. This course aims to provide students with the knowledge of basic molecular events and cellular specializations within the brain. Latest frontiers on the molecular mechanisms that underlie brain function and technological advance in studying neuronal function will also be described. This interdisciplinary course covers fundamental concepts on different neuronal processes including neuronal migration and axon guidance, formation and plasticity of synapses, learning and memory, as well as neurodegeneration and neurodevelopmental disorders. Exciting new technologies in microscopy, genome-editing and stem cell biology will be introduced to students via lectures and mini-project oriented practical sessions. Through experiential learning activities that involve conducting experiments and tutorial discussions, we aim to inspire students on the different fascinating aspects of molecular and cellular neuroscience.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 app.)		DEC-A2	DEC-A3
1	Explain the major molecular pathways and cellular compartments that control brain development and functioning			x	x
2	Develop scientific inquiry and 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 mechanisms of neuronal function to explain defects in different brain disorders			x	x
4	Gain the technical experience and 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 basic information about the molecular and cellular basis of neuronal functions	1, 2, 3, 4	

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

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term exam	1, 2, 3, 4	20	
2	Lab reports	1, 2, 3, 4	20	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

3

Assessment Rubrics (AR)**Assessment Task**

Mid-term and Final examination

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 in writing; 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 in writing; 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 in writing; 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 in writing; 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 in writing; do not show original thought and critical thinking, and have not read or integrated relevant materials.

Assessment Task

Lab reports and group presentation

Criterion

To test students' application of materials taught in class, and evaluate their skills for oral and written communications

Excellent (A+, A, A-)

Excellent level of achievement as described above

Good (B+, B, B-)

Good level of achievement as described above

Fair (C+, C, C-)

Satisfactory level of achievement as described above

Marginal (D)

Barely satisfactory level of achievement as described above

Failure (F)

Unacceptable level of achievement as described above

Part III Other Information

Keyword Syllabus

Axonal growth cone guidance
Brain fractionation
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
Ion channels
Learning and memory
Microscopy in neurobiology
Protein phosphorylation
Protein synthesis
RNA interference
Signal transduction
Synaptic plasticity
Synapse

Reading List**Compulsory Readings**

Title	
1	Neuroscience: exploring the brain 4th Edition by Mark F. Bear, Barry W. Connors, Michael A. Paradiso
2	Memory: from mind to molecules by Larry Squire, Eric Kandel

Additional Readings

Title	
1	Nil