NS6004: EPIGENETIC REGULATION AND BRAIN FUNCTION: HEALTH AND DISORDERS

Effective Term
Semester A 2026/27

Part I Course Overview

Course Title
Epigenetic Regulation and Brain Function: Health and Disorders

Subject Code
NS - Neuroscience
Course Number
6004

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
Nil

Additional Information
Nil

Part II Course Details

Abstract

This course explores how epigenetic and transcriptomic mechanisms regulate brain development, plasticity, and aging, and how their disruption contributes to neurological and psychiatric disorders. Topics include DNA methylation, histone modifications, chromatin remodeling, RNA editing, and the roles of non-coding RNAs in neural function. Students will examine cutting-edge research linking these processes to conditions such as Alzheimer’s disease, Parkinson’s disease, and Huntington's disease. It is designed for students seeking to understand and apply molecular insights to advance brain health research and clinical innovation.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand the fundamental principles of epigenetic and transcriptomic regulation in the brain, including DNA methylation, histone modifications, chromatin remodeling, RNA editing, and non-coding RNAs. Describe classical and modern approaches to studying these mechanisms in brain health and disease.		x	x	
2	Explain current theories on how epigenetic and transcriptomic mechanisms contribute to neural development, plasticity, aging, and cognitive function. Understand their roles in the pathology of disorders such as Alzheimer’s disease, Parkinson’s disease, Huntington's disease, and Amyotrophic lateral sclerosis (ALS).		x	x	x
3	Describe and apply experimental and computational approaches (e.g., single-cell transcriptomics, multi-omics integration, and epigenome editing) to investigate disrupted regulatory processes in brain disorders. Evaluate the translational potential of these approaches for biomarker discovery and therapeutic innovation		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	Teaching and learning through a combination of lectures and multimedia resources to explain the fundamental principles of epigenetic and transcriptomic regulation, including classical and modern research approaches.	1, 2, 3	2 hours/week
2	Tutorials and Group Discussions	Interactive sessions including case studies, and discussions to deepen understanding of epigenetic and transcriptomic mechanisms in brain health and disease.	1, 2, 3	1 hours/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Tutorial Quizzes/ Presentations/ Discussion	1, 2, 3	40	-	No

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Assessment Rubrics (AR)

Assessment Task

Tutorial Quizzes (for students admitted in Semester A 2026/27)

Criterion

Demonstrate understanding of epigenetic and transcriptomic principles, research methods, and their application to brain health and disease, as well as the ability to analyze and describe findings clearly in written form.

Excellent

(A+, A, A-) Demonstrates a high level of understanding of epigenetic and transcriptomic mechanisms and advanced research methods. Shows strong critical thinking by linking findings to brain health and disease, and communicates ideas clearly, coherently, and with originality.

Good

(B+, B) Demonstrates a well-developed understanding of key concepts in epigenetic and transcriptomic regulation and related methods. Able to link findings to brain health and disease with clear written communication.

Fair

(C+, C) Demonstrates a basic but incomplete understanding of epigenetic and transcriptomic mechanisms and research approaches. Written description shows some clarity but lacks depth and critical evaluation.

Marginal

(D) Demonstrates a rudimentary understanding of basic epigenetic and transcriptomic principles. Written communication is weak, with limited ability to connect findings to brain health and disease.

Failure

(F) Fails to demonstrate an understanding of basic epigenetic and transcriptomic concepts. Written work is unclear, incomplete, or irrelevant, showing little to no connection to brain health and disease.

Assessment Task

Final Examination (for students admitted in Semester A 2026/27)

Criterion

Ability to understand epigenetic and transcriptomic mechanisms and technologies, apply critical thinking skills, and demonstrate how molecular neuroscience knowledge can be used to explain brain health and propose solutions to real-life problems.

Excellent

(A+, A, A-) Demonstrates a comprehensive and in-depth understanding of epigenetic and transcriptomic regulation in the brain health and disease. Written answers are coherent, precise, and demonstrate originality in problem-solving.

Good

(B+, B) Demonstrates a well-developed understanding of epigenetic and transcriptomic concepts and their relevance to brain health and disease. Answers effectively link scientific principles to disease mechanisms and potential interventions, though with less originality or depth.

Fair

(C+, C) Demonstrates a basic understanding of epigenetic and transcriptomic principles with limited application to brain health and disease. Answers remain mostly descriptive without deeper problem-solving insights.

Marginal

(D) Demonstrates a rudimentary understanding of epigenetic and transcriptomic concepts. Written answers are superficial and lack coherence.

Failure

(F) Fails to demonstrate understanding of basic epigenetic and transcriptomic mechanisms. Responses are largely inaccurate, irrelevant, or incoherent, showing no ability to apply knowledge to brain health or disease-related problems.

Part III Other Information

Keyword Syllabus

DNA methylation, histone modifications, chromatin remodeling, RNA editing, non-coding RNAs, alternative splicing, RNA modifications, Alzheimer’ s disease, Parkinson’ s disease. Huntington’ s disease, Biomarker discovery, epigenetic drugs, RNA therapeutics

Reading List

Compulsory Readings

	Title
1	N/A

Additional Readings

	Title
1	"Neuroepigenetics Mechanisms in Health and Disease", by Brigitte van Zundert, Martin Montecino, 2025
2	"Epitranscriptomics", by Stefan Jurga, Jan Barciszewski, 2021