

JNL 203					
Neuroscience: Systems, Circuits, and Behaviour					
Course coordinator: Prof Sheeba Vasu					
Course co-coordinator: Dr Anupama Sathyamurthy					
Teaching Assistant: (Surajit Dawn, CBNL)					
DATE	DAY	TOPIC	TOPIC IN DETAIL	LECTURER	CLASS
6-Jan	Tuesday	BIOLOGICAL RHYTHMS	Biological Rhythms - Rhythms of different scales, clocks vs rhythms, adaptive significance	Prof Sheeba Vasu	1
8-Jan	Thursday		Biological Rhythms - molecular basis of circadian clocks		2
13-Jan	Tuesday		Biological Rhythms - neural circuits comprising circadian clock organisation across taxa		3
15-Jan	Thursday		Biological Rhythms - multi-oscillator organisation in complex organisms		4
20-Jan	Tuesday		Biological Rhythms -Sleep characterisation, variety, neuronal control, disorders		5
22-Jan	Thursday	WHY DO WE NEED A BRAIN?	In this class, we will explore the fundamental functions of the brain and ask the central question: Why do we need a brain at all? We will briefly touch upon how the brain supports sensation, movement, homeostasis, learning and memory, biological rhythms, and the complex domains of emotion and cognition—revealing how these systems together allow us to perceive, act, adapt, and thrive.	Dr Anupama Sathyamurthy	6
27-Jan	Tuesday	DISEASES RELATED TO BRAIN FUNCTION	In this class, students will each pick a neurological or psychiatric condition (for example, color blindness, ALS, Parkinson’s disease, foreign accent syndrome, pain insensitivity, dysautonomia, or acquired savant syndrome) and explore which of the major brain functions we’ve discussed is affected—and how. The goal isn’t to provide an exhaustive clinical overview, but to use real-world examples to illuminate the underlying principles of brain function.		7
29-Jan	Thursday	LANGUAGE OF THE BRAIN	We will explore the language of the brain through a historical journey into how scientists first uncovered neuronal communication. We begin with landmark experiments of Galvani and Volta on “animal electricity,” and move on to Helmholtz’s measurement of nerve conduction and the discovery of the action potential. We then examine how Golgi and Cajal’s competing views on neural structure shaped our understanding of synapses, before shifting to the chemical side: the colonial roots and clinical motivations behind early neurotransmitter discoveries and the classic “soups vs. sparks” debate that revealed the intertwined roles of electrical impulses and chemical messengers in neural signalling.		8
3-Feb	Tuesday				9
5-Feb	Thursday				10

10-Feb	Tuesday	INTRODUCTION TO SENSATION AND MOVEMENT	In this introductory class on sensation and movement, we will explore how the fundamental need to sense and respond to the world shaped the evolution and architecture of the nervous system. We'll briefly trace the history of how scientists came to understand movement—beginning with Swammerdam's early experiments on muscle contraction, moving through Marshall Hall's pioneering work on reflexes, and then to Sherrington's integrative view of motor control.		11
12-Feb	Thursday	HOMOEOSTASIS AND STRESS	We will explore how the nervous system maintains homeostasis and how the three major pillars of homeostatic control—the neuroendocrine system, and the sympathetic and parasympathetic branches of the autonomic nervous system—are activated during both physical and psychological stress. We will examine how these systems work together to regulate physiology, restore balance, and shape our emotional responses to the challenges we encounter.		12
17-Feb	Tuesday				13
19-Feb	Thursday	SENSATION	We will explore the fundamental principles of sensation and examine the neural substrates that allow different sensory modalities—vision, audition, gustation, olfaction, and somatosensation—to be transformed into perception.	Prof SP Arun	14
24-Feb	Tuesday				15
26-Feb	Thursday	VOLUNTARY CONTROL OF MOVEMENT	We will explore the neural substrates that give rise to two major forms of movement—rhythmic movements, such as walking or chewing, and voluntary movements, which are initiated and shaped by intention. We will examine how distinct neural circuits generate and coordinate these movement types, and how the brain integrates them into fluid, adaptive behaviour.	Prof Aditya Murthy	16
3-Mar	Tuesday	RHYTHMIC CONTROL OF MOVEMENT		Prof Vatsala Thirumalai	17
5-Mar	Thursday	Tutorial		TA	
10-Mar	Tuesday	Exam		TA	
12-Mar	Thursday	Learning and memory	In these classes, we will explore the fundamental principles of how the nervous system learns, and examine the circuits, cells, and genes that enable the formation and storage of memories.	Prof Balaji Jayaprakash	18
17-Mar	Tuesday				19
19-Mar	Thursday	Ugadi / उगादी			
24-Mar	Tuesday	Learning and memory			
26-Mar	Thursday			Prof Ravi Mudashetty	21

31-Mar	Tuesday				22
7-Apr	Thursday	Research approaches	In this class, we will discuss the major research approaches used to study the brain—from behavioural observations and recordings of neural activity in patients, to mechanistic studies in model systems using lesions, targeted manipulations, and high-resolution recordings. We will also cover genetic approaches for knocking out or modifying genes, single-cell methods for classifying cell types, and viral tools that allow us to map and probe neural circuits.	Dr Anupama Sathyamurthy	23
9-Apr	Tuesday	Neuroethics - case studies	In this class, we will discuss key cases in neuroethics, using real-world examples to explore how advances in neuroscience intersect with questions of privacy, agency, responsibility, and societal impact.		24
14-Apr	Thursday	Adult neurogenesis, neurodegeneration	In these classes, we will explore the phenomenon of adult neurogenesis—how new neurons are generated in the adult brain, the circuits and conditions that support this process, and its functional implications.	Dr Achira Roy	25
16-Apr	Tuesday				26
21-Apr	Thursday	Neurodegeneration & related disorders	In this class, we will discuss major neurodegenerative diseases and underlying molecular mechanisms, with a focus on how disruptions in cellular processes ultimately impair neural function.		27
23-Apr	Tuesday	Tutorial		TA	
28-Apr	Thursday	Exam		TA	