

# GE1352: HOW YOUR BRAIN WORKS

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**Effective Term**

Semester B 2024/25

## Part I Course Overview

**Course Title**

How Your Brain Works

**Subject Code**

GE - Gateway Education

**Course Number**

1352

**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

**GE Area (Primary)**

Area 3 - Science and Technology

**Medium of Instruction**

English

**Medium of Assessment**

English

**Prerequisites**

Nil

**Precursors**

Nil

**Equivalent Courses**

Nil

**Exclusive Courses**

Nil

## Part II Course Details

### Abstract

In this course, we will provide a highly accessible introduction to neuroscience for the general student population. For many neuroscientists it is a core belief that all of human experience, our sensory perception of our environment, our thoughts, memories, emotions and aspirations are ultimately manifestations of brain function and should at least in principle be explainable in terms of physiological mechanisms. The objective of this course is to enable students to understand the scientific insights and discoveries that this belief is based on. We will provide a broad overview of key topics in neuroscience, from electrical and chemical communication in nerve cells, explain how we see and hear, how our brains control the movements of our bodies, how memories are formed in our brains, and how so called neuromodulatory systems control our arousal and attention. A dedicated web-site with supplementary material and videos of some of the previous lectures accompanies the course (see <http://howyourbrainworks.net>)

### Course Intended Learning Outcomes (CILOs)

| CILOs |                                                                                                                                                                                                                                                                      | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------|--------|--------|
| 1     | Explain how fundamental physical and chemical processes that make it possible for nerve cells to become electrical signalling devices.                                                                                                                               |                     | x      | x      |        |
| 2     | Describe the basis of chemical synaptic transmission. Be able to infer the likely consequences of administering drugs which interfere with aspects of chemical neurotransmission.                                                                                    |                     |        |        |        |
| 3     | Understand the key stages in the acquisition of sensory information from our sense organs, particularly the eyes and ears, and be able to describe the main structures involved, as well as their function.                                                          |                     | x      | x      |        |
| 4     | Be able to explain how convergent synaptic excitation and inhibition can give rise to information processing networks in the brain.                                                                                                                                  |                     |        |        |        |
| 5     | Reflect on the various ways in which modification of synaptic connections allows neural networks to learn and to adapt to novel environments.                                                                                                                        |                     | x      | x      |        |
| 6     | Describe the basic neuroanatomy of the human brain, able to locate key structures involved in visual, auditory, motor, cognitive and memory functions. Use this knowledge to hypothesize appropriately about consequences of damage to particular brain areas.       |                     | x      |        | x      |
| 7     | Understand how our brain controls our actions. In particular, be able to describe of the interplay between cortical circuits and basal ganglia, and to theorize about the roles these structures play in regulating motor behaviour, action selection and addiction. |                     | 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 based on a combination of lectures and models to explain the fundamental principles in neurosciences | 1, 2, 3, 4, 5, 6, 7 | 2 hours per week           |
| 2    | Tutorials | Interactive sessions based on questions and answers                                                                        | 1, 2, 3, 4, 5, 6, 7 | 1 hour per week            |

**Additional Information for LTAs****Provisional / Representative Lesson Plan (may be subject to change)**

- Week 1: The Anatomy of the Brain
- Week 2: The Brain Electric
- Week 3: Neurotransmitters and Synapses
- Week 4: Taste, Smell and Touch
- Week 10: Moving
- Week 11: Motor Disorders
- Week 13: Attention, Memory and Summing up

**Tutorial Organization**

For five of the tutorials, we will prepare short mini-exams or quizzes of multiple-choice and short answer questions to be administered via canvas . These quiz will to test understanding / application of the content presented in the previous two lectures , provide continuous assessment of the students progress and feedback to the lecturers about how accessible the material is. In the remaining tutorials, the students will be given an opportunity to engage with the materials covered in the lectures through practical exercises or demonstrations. For example we will use devices such as the “human-to-human interface” to record electrical activity from the arm of one student to trigger electrical stimulation of the nerves in the arm of another student, so that voluntary hand movements of one student induce involuntary hand movements in the other. Or we will experience and explain a number of optical illusions. Or work through auditory demonstrations to gain a deeper appreciation of the brain mechanisms of auditory perception. Or we will run informal, competitive timed quizzes ( “kahoots” ) to revise material in a fun, interactive manner. The tutorials will take place in computer labs.

**Assessment Tasks / Activities (ATs)**

| ATs |                  | CILO No.      | Weighting (%) | Remarks (e.g. Parameter for GenAI use) |
|-----|------------------|---------------|---------------|----------------------------------------|
| 1   | Tutorial Quizzes | 1, 2, 3, 4, 5 | 50            |                                        |

**Continuous Assessment (%)**

50

**Examination (%)**

50

**Examination Duration (Hours)**

2

**Assessment Rubrics (AR)**

**Assessment Task**

1. Tutorial Work Sheets

**Criterion**

Understand the basics and fundamentals of neuronal systems.

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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**Assessment Task**

2. Final Examination

**Criterion**

Ability to explain the concepts, technologies and impact of neurosciences, and possess critical thinking skills and know how to use neuroscience knowledge to solve real-life problems.

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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## Part III Other Information

Keyword Syllabus

- Nerve impulse
- Synapse
- Neurotransmitter
- Neural network
- Plasticity
- Visual pathway
- Auditory pathway
- Motor cortex
- Neural coding

## Reading List

### Compulsory Readings

| Title |                                                                                                                                                                                       |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | We set no compulsory textbooks for the course. All materials the students need will be made available through <a href="http://howyourbrainworks.net">http://howyourbrainworks.net</a> |

### Additional Readings

| Title |                                                                                           |
|-------|-------------------------------------------------------------------------------------------|
| 1     | Carpenter and Reddi “Neurophysiology – a conceptual approach, CRC Press, 5th edition”     |
| 2     | Gazzaniga and Ivry “Cognitive Neuroscience – The Biology of Mind” , W.W. Norton & Company |

## Annex (for GE courses only)

**A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:**

Please indicate which CILO(s) is/are related to this PILO, if any (can be more than one CILOs in each PILO)

### PILO 1: Demonstrate the capacity for self-directed learning

1, 2, 3, 4, 5, 6, 7

### PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology

1, 2, 3, 4, 5, 6, 7

### PILO 3: Demonstrate critical thinking skills

1, 2, 3, 4, 5, 6, 7

### PILO 4: Interpret information and numerical data

1, 2, 3, 4, 5, 6, 7

### PILO 5: Produce structured, well-organised and fluent text

1, 2, 3, 4, 5, 6, 7

### PILO 6: Demonstrate effective oral communication skills

1, 2, 3, 4, 5, 6, 7

### PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation

1, 2, 3, 4, 5, 6, 7

**B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.**

### **Selected Assessment Task**

Final examinations