**Course Teaching Methodology (Please mention following details in plain text)**

- Teaching Methodology: synchronous or asynchronous or a blend of both
- Lecture details: Percentage of recorded and live interaction lectures

All teaching will be through live interaction lectures (synchronous)

### Course Basics

<table>
<thead>
<tr>
<th>Credit Hours</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture(s)</td>
<td>5</td>
</tr>
<tr>
<td>Recitation/Lab (per week)</td>
<td>110 minutes</td>
</tr>
<tr>
<td>Tutorial (per week)</td>
<td>70 minutes lecture+ 2x20 Breakout sessions</td>
</tr>
</tbody>
</table>

### Course Distribution

<table>
<thead>
<tr>
<th>Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective</td>
</tr>
<tr>
<td>Open for Student Category</td>
</tr>
<tr>
<td>Close for Student Category</td>
</tr>
</tbody>
</table>

### COURSE DESCRIPTION

Neuroscience is one of the most rapidly developing disciplines in Biological Sciences. This multi-pronged field carries the answers to all our fundamental questions of living, from how we learn the language, to how we behave in different situations, to why conditions like stress, aging, or disease impair brain functions. The purpose of this course is to equip the students with a 'Neuroscience tool-box', which not only contains a strong theoretical basis for different process related to human central nervous system, but also how to develop, study, and solve a neuroscience-based scientific question after gaining knowledge about the molecular mechanisms involved.
The main object of this course is to furnish the students with strong fundamentals of molecular neuroscience. The course is designed to encompass all the relevant neuroscience basics, such as neuroanatomy, cell biology, electrophysiology, and neuropharmacology. Furthermore, there is a strong emphasis on functional processes of the nervous system, such as learning and memory, behavioral regulation, sleep, circadian rhythm. Some of these concepts will additionally be revisited and applied with the study of neurodegenerative disorders, neuropsychiatric disorders, as well as addiction. A final aim is to introduce students to rapidly emerging research sub-fields in neuroscience to prepare them for interesting opportunities in future.

Learning Outcomes

After taking this course students should be able to:

1. Understand the different anatomical regions of the mammalian brain and their physiological functions
2. Develop a thorough understanding of cell biology of the nervous system, with an equal emphasis on neurons and glia
3. Know about different types of neurotransmitters and their modus operandi
4. Understand electrical properties of neurons, how signals are relayed across synapses and how the synaptic connections can be weakened or strengthened
5. Develop a theoretical basis of the fundamental functions of the brain, including learning & memory formation, regulation of sleep & consciousness, circadian rhythms, as well as the basis for pathological behaviors like depression and addiction
6. Develop some understanding of the relationship between genes, nerve cells and behavior
7. Acquire knowledge about neurodegenerative disorders, which are becoming epidemic globally due to an aging population
8. Get introduced to emerging topics in neuroscience, like iPSC-derived neuronal models, brain organoids, optogenetics, chemogenetics, functional MRIs and nanoparticles for delivering drugs to the brain.
### Midterm Exam

- **Yes/No:** No
- **Combine Separate:**
- **Duration:**
- **Preferred Date:**
- **Exam Specifications:**

### Final Exam

- **Yes/No:** Yes
- **Combine Separate:** Online
- **Duration:** 1 hour
- **Exam Specifications:** MCQs

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#### COURSE OVERVIEW

<table>
<thead>
<tr>
<th>Week/Lecture/Module</th>
<th>Topics</th>
<th>Recommended Readings</th>
<th>Objectives/Application</th>
</tr>
</thead>
</table>
| **Anatomy and Cell Biology of Human Nervous System** | - Neuroanatomy of the Human Brain I  
- Neuroanatomy of the Human Brain II  
- Cell Biology of the Nervous System-Neurons  
- Cell Biology of the Nervous System-Astrocytes and Oligodendrocytes  
- Cell Biology of the Nervous System-Microglia | [https://nba.uth.tmc.edu/neuroanatomy/introduction.html](https://nba.uth.tmc.edu/neuroanatomy/introduction.html)  
[https://www.youtube.com/watch?v=GRiecERWp34](https://www.youtube.com/watch?v=GRiecERWp34)  
[https://nba.uth.tmc.edu/neuroscience/s1/chapter08.html](https://nba.uth.tmc.edu/neuroscience/s1/chapter08.html) | |
| **Functions of the Nervous System** | - Week 1 Quiz / Excitability of Neurons  
- Synaptic Transmission and Neurotransmitters  
- Synaptic Plasticity  
- Neuromuscular Junction and Autonomic Nervous System  
- Cutting Edge Neuroscience: iPSC derived Neurons and Brain Organoids/ Recap | [https://nba.uth.tmc.edu/neuroscience/s1/introduction.html](https://nba.uth.tmc.edu/neuroscience/s1/introduction.html)  
[https://nba.uth.tmc.edu/neuroscience/s1/chapter01.html](https://nba.uth.tmc.edu/neuroscience/s1/chapter01.html)  
[https://nba.uth.tmc.edu/neuroscience/s1/chapter03.html](https://nba.uth.tmc.edu/neuroscience/s1/chapter03.html)  
[https://nba.uth.tmc.edu/neuroscience/s1/chapter04.html](https://nba.uth.tmc.edu/neuroscience/s1/chapter04.html)  
[https://nba.uth.tmc.edu/neuroscience/s1/chapter05.html](https://nba.uth.tmc.edu/neuroscience/s1/chapter05.html) | |
| **Neuroscience of Health and Disease (I)** | - Week 2 Quiz/ Mechanisms of Learning and Memory  
- Neuroscience of Sleep  
- Neuropsychiatric Disorders  
- Molecular Basis of Addiction I  
[https://iosh.com/media/4030/sleep-a-basic-introduction.pdf](https://iosh.com/media/4030/sleep-a-basic-introduction.pdf) | |
<table>
<thead>
<tr>
<th>and Disease (II)</th>
<th>Disease</th>
<th>Recap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parkinson Disease</td>
<td>Mechanisms of Neurodegeneration</td>
<td><a href="http://neuroscience.openetext.utoronto.ca/chapter/3-4-chemogenetic-methods-to-examine-the-brain-and-behaviour/">http://neuroscience.openetext.utoronto.ca/chapter/3-4-chemogenetic-methods-to-examine-the-brain-and-behaviour/</a></td>
</tr>
<tr>
<td>Motor neuron disease and frontotemporal dementia</td>
<td>CUTTING EDGE NEUROSCIENCE-Optogenetics, Chemogenetics, Functional MRIs, and Nanoparticle delivery</td>
<td></td>
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</tbody>
</table>

Textbook(s)/Supplementary Readings

https://www.academia.edu/43014289/Neuroscience_by_Dale_Purves_et_al_eds_z_lib_org_