



# Course on “Molecular insights of neurodegeneration pathways and its drug development strategies”

An event under

**GLOBAL INITIATIVE FOR ACADEMIC NETWORKS (GIAN)**

Professor Allen Kaasik is the Head of the Department of Pharmacology at the Institute of Biomedicine and Translational Medicine, University of Tartu, Estonia. His research focuses on how organelles function, especially in relation to neurodegenerative diseases like Parkinson's. Currently, he is studying the connections between endoplasmic reticulum stress, calcium signalling, mitochondrial dysfunction, and autophagy in neurons. Recently, his team identified compounds that improve endoplasmic reticulum calcium balance and neuronal health in cell models of Wolfram syndrome, offering potential new approaches for treating neurodegenerative diseases. His work relies heavily on advanced imaging techniques, and he also leads the Estonian Bioimaging Core Facility.



Professor Allen Kaasik

October 13 to 17, 2025

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## Course Details

Fees : Rs. 1000/-

Number of participants: 40

## Course Coordinators



Dr. Tanzeer Kaur  
Department of Biophysics  
Panjab University  
Chandigarh



Prof. Rajat Sandhir  
Department of Biochemistry  
Panjab University  
Chandigarh



Prof. Gurjaspreet Singh  
Local Coordinator  
GIAN  
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# Molecular insights of neurodegeneration pathways and its drug development strategies.

## Overview

Neurodegeneration leads to the progressive loss of neuronal function, affecting cognition and motor skills. This course explores the molecular and cellular mechanisms of neurodegenerative diseases like Alzheimer's, Parkinson's, and Huntington's.

Key processes such as endoplasmic reticulum stress, mitochondrial dysfunction, and autophagy will be covered, along with drug development strategies targeting these pathways. Advanced imaging techniques and proteomics will be introduced as tools for identifying therapeutic targets. The role of animal models in studying cognitive and behavioural processes will also be explored in tutorials.

This course is designed for graduate students and academic fellows, equipping them with the skills to assess research and contribute to therapeutic advancements in neurodegeneration.

## Objectives

Provide a comprehensive understanding of neurodegenerative diseases, focusing on the molecular and cellular events leading to neurodegeneration

Explore the role of cellular quality control mechanisms like autophagy in maintaining homeostasis and their impact on neurodegenerative diseases

Understand the relevance of endoplasmic reticulum and mitochondrial health in neurons and their implications for drug development strategies in neurodegenerative diseases

Review experimental techniques, including disease models and functional assays, for identifying therapeutic targets in neurodegenerative diseases

Apply imaging techniques to investigate neuronal dynamics, neuronal activity, and functional changes within neurons, utilizing advanced imaging software and analysis tools

Examine the drug development pipeline for neurodegenerative diseases, emphasizing the identification and validation of drug targets, including in-silico approaches

Assess the role of biomarkers in the early diagnosis of neurodegenerative diseases and methods for their quantification

Evaluate the use of animal models to study cognitive and behavioural processes, as well as the design of animal experiments for the study of neurodegeneration

Investigate emerging proteomic techniques and their application in identifying molecular pathways involved in neurodegeneration, with a focus on potential therapeutic targets

1. Prof. Allen Kaasik (AK): 8 hours lectures and 4 hours tutorials
2. Prof. Rajat Sandhir (RS): 2 hours lectures and 2 hours tutorials
3. Dr. Tanzeer Kaur (TK): 2 hours lectures and 2 hours tutorials

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- Course Duration : October 13 to 17, 2025 (5 days)
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- Number of participants: 40

#### Day 1 Understanding Neurodegenerative Diseases

Lecture (2 hrs): Neurodegenerative diseases: Unveiling mechanisms and symptoms (AK)  
Lecture (2 hrs): Exploring experimental techniques for studying neurodegenerative diseases: From disease models to functional assays (AK)

#### Day 2 Insights into Drug Development for Neurodegenerative Diseases

Lecture (1 hr): Drug development and its perspectives in neurodegenerative diseases (AK)  
Lecture (1 hr): Navigating drug development to target endoplasmic reticulum stress in neurodegenerative diseases (TK)  
Tutorial (2 hrs): An in-silico tutorial for computational approaches in drug discovery (TK)

#### Day 3 Unraveling Mitochondrial Involvement

Lecture (2 hrs): Role of mitochondria in neurodegenerative diseases: Mitochondrial health as a key factor in pathophysiology for drug development (AK)  
Tutorial (2 hrs): Imaging of mitochondrial function in neurodegenerative diseases (AK)

#### Day 4 Visualizing Neuronal Function

Lecture (1 hr): Unveiling neuronal dynamics through imaging techniques for deciphering activity and functional changes within neurons (RS)  
Lecture (1 hr): Quantitative assessment of cellular features using high-resolution imaging: Image analysis software and tools (AK)  
Tutorial (2 hrs): Comprehensive understanding and practical application of flow cytometry in neurobiology (RS)

#### Day 5 Investigating Cognitive and Behavioral Processes

Lecture (1 hr): Designing controlled experiments to investigate cognitive and behavioral processes using animal models (TK)  
Lecture (1 hr): Proteomic perspectives on neurodegeneration: Navigating molecular pathways in neurobiology (RS)  
Tutorial (2 hrs): Participant poster presentations and feedback session (AK)