



Direzione Ricerca,  
Innovazione e  
Internazionalizzazione

**UNIVERSITÀ  
DI TORINO**

**ID**

**VP\_004\_BIOS**

## **Visiting Professor Program Academic Year 2025/2026**

**TEACHING COMMITMENT:** 14 hours

### **COURSE TITLE**

**Exploring K2P Channels and Cutting-Edge Tools in Neurophysiology**

### **TEACHING PERIOD**

I semester

### **SCIENTIFIC AREA**

Physiology

### **LANGUAGE USED TO TEACH**

English

### **COURSE SUMMARY**

The Role of Two-Pore-Domain Potassium (K2P) Channels in the Nervous System

1. Introduction to K2P Channels (30min)
  - 1.1. Potassium Channels
  - 1.2. General Functions of K2P Channels
2. Molecular Characteristics and Diversity of K2P Channels (1h)
  - 2.1. Classification of K2P Channels
  - 2.2. Increasing functional diversity through heteromerization
  - 2.3. Regulation of K2P Channels
  - 2.4. Structure
3. Functional Roles in the Nervous System (1h)
  - 3.1. PNS : Sensory Systems
  - 3.2. CNS Regulation
  - 3.3. Neuroprotection and Pathophysiology

#### 4. K2P Channels in Pain and Analgesia

#### 5. Practical

Tools for Controlling Biological Systems in Neurophysiology: Photopharmacology, Optogenetics, and Chemogenetics

##### 1. Introduction to Light and Chemical Control in Biology

- Importance of spatiotemporal precision:

- Key differences: Photopharmacology; Optogenetics; Chemogenetics

##### 2. Photopharmacology: Principles and Applications

###### 2.1 Basics of Photopharmacology

###### 2.2 Molecular Design of Photoswitchable Compounds

###### 2.3 Applications in Neuroscience

###### 2.4 Improving Technologies in Photopharmacology

##### 3. Optogenetics

###### 3.1 Introduction to Optogenetics

###### 3.2 Optogenetic Applications

###### 3.3 Limitations and Challenges

##### 4. Chemogenetics: Chemical Control of Cellular Function

###### 4.1 Basics of Chemogenetics

###### 4.2 Applications

##### 5. Practical class

Remote Control of Pain Behavior in *C. elegans* Using Photopharmacology

Article to Analyze (30min article already introduced above)

Behavioral Assay with *C. elegans* (1h)

### LEARNING OBJECTIVES

This teaching contributes to the learning objectives included into the Neurobiological area of the Master in Cellular and Molecular Biology, providing knowledge and applicative abilities. In particular, the course is focused on the relevant issues of Neurophysiology and aims to foster basic knowledge of students on cellular neurophysiology and electrical signals transmission as well as integrated knowledge of neurophysiology. Additional objective points to a quantitative analysis of some conceptual and technical approaches to neurophysiological mechanisms including specific hands on in modern Neuroscience labs using cutting edge techniques in the field by means of specific group work and at home assignments.

For each item, students learn how to highlight the specific scientific question, to interpret data, to discuss the experimental approaches employed by the authors.

The course is organized in 1.5 ECST and aims to provide theoretical, technical and methodological background to critic.

### OTHER ACTIVITIES BESIDE THE COURSE

The VP will provide seminars in the context of both PhD in quantitative Biomedicine (UNITO) as well as Photoinduced systems (Dottorato di interesse nazionale)

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### **VISITING PROFESSOR PROFILE**

The Visiting Professor should have a solid teaching experience in Physiology, as well as a solid experience in English teaching. Due to the focused topic proposed for the Neurophysiology course the Visiting Professor should have both experience in the teaching K<sup>+</sup> channel involvement in Neurophysiology as well in photopharmacology. On the other hand, it would be necessary that the Visiting Professor has a international-recognized research experience related to ion channels regulation involvement in Physiopathology. The Visiting Professorship will be a great opportunity for the students to be able to meet and to have the possibility of training abroad.

### **CONTACT REFERENT**

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