

Latin American Training Program 2019

ENLIGHTENING THE BRAIN: THE USE OF LIGHT TO UNDERSTAND THE FUNCTION OF THE NERVOUS SYSTEM

Preliminary Program

ORGANIZERS

Francisco Fernández de Miguel, PhD

Director

*Neuroscience Division , Neuroscience Division
Institute for Cellular Physiology
National Autonomous University of Mexico*

Dilia Aguirre Olivas, PhD

Co-Director

*Institute for Cellular Physiology
National Autonomous University of Mexico*

LOCAL ORGANIZING COMMITTEE

Sorel A. Achounna, M. Sc.

*Neuroscience Division ,
Institute for Cellular Physiology, UNAM.*

Three-dimensional reconstruction of steps of vesicle fusion during somatic release of serotonin in the leech Retzius neuron, using Electron Tomography (ET) techniques.

Fernando García Hernández, PhD

*Chair of the Imaging and Electron microscopy Unit
Institute for Cellular Physiology
National Autonomous University of Mexico*

Optical confocal and multiphoton imaging. Electron microscopy.

Guillermo Hernández Mendoza, M. Eng.

*Center for Applied Sciences and Technological Development and Institute for
Cellular Physiology
National Autonomous University of Mexico*

Optical and mechanical instrumentation. Construction of an optical nanoscope to study serotonin release in neurons.

Bruno Méndez Ambrosio, M. Eng.
*Neuroscience Division, Neuroscience Division
Institute for Cellular Physiology, UNAM*

Naser Qureshi, PhD
*Center for Applied Sciences and Technological Development
National Autonomous University of Mexico*
Microwave and Terahertz Photonics
Optics. Near Field Microwave microscopy. Terahertz microscopy. Scanning probe microscopy and lithography. Spin wave devices. Focus and Alignment Tolerance in a Photoconductive Terahertz Source.

Yazmín Ramiro Cortés, PhD
*Institute for Cellular Physiology, Neuroscience Division
National Autonomous University of Mexico*
Dendrite dynamics in cortex of living animals using multiphoton technology

María Celeste Sánchez Sugía
*Neuroscience Division, Neuroscience Division
Institute for Cellular Physiology, UNAM*
Circuits and behavior studied with multiphoton microscopy.

Carlos Treviño Palacios, PhD
*National Institute of Astrophysics, Optics and Electronics
Department of Optics, Mexico*
Optics and photonics. New alternatives for the analysis and interpretation of the functional optical neuroimaging. Terahertz radiation for clinical applications.

FACULTY

Félix Aguilar Valdés, PhD
*National Institute of Astrophysics, Optics and Electronics
Department of Optics, Mexico*

Francisco J. Barrantes, PhD
Pontificia Universidad Católica de Argentina

Jesus Garduño
*National Autonomous University of Mexico
Center for Applied Sciences and Technological Development*
Design of lasers and their applications

Stefan W. Hell, PhD

*The Max Planck Institute for Biophysical Chemistry
NanoBiophotonics, Goettingen, Germany*

Arturo Hernández Cruz, PhD

*National Autonomous University of Mexico
Institute for Cellular Physiology, Neuroscience Division*

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*School of Medicine, Cellular and Molecular Biophysics
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*Montreal Polytechnic
Department of Electrical Engineering and Department of Engineering Physics*

William Bill Kristan, PhD

*Division of Biological Science
University of California San Diego, USA*

Pablo Loza-Alvarez, PhD

*The Institute of Photonics Sciences
Barcelona, Spain.*

Jerome Mertz, PhD

*Biomicroscopy Laboratory
Boston University, USA.*

Paras N. Prasad, PhD

*Institute for Lasers, Photonics and Biophotonics
University of Buffalo, USA*

Walter Stühmer, PhD

Max Planck Institute for Experimental Medicine, Göttingen

Bernardo Sabatini, PhD

Harvard University, USA

Fatuel Tecuapetla, PhD

*Institute for Cellular Physiology, Neuroscience Division
National Autonomous University of Mexico*

Luis Vaca Domínguez, PhD

*National Autonomous University of Mexico
Institute for Cellular Physiology, Basic Research Division*

Rafael Yuste, PhD
The NeuroTechnology Center
Columbia University, USA.

PROGRAM

WEEK 1: Introduction to Optics and Optical Systems

**Instructor: Dilia Aguirre Olivas, Naser Qureshi and Carlos Treviño Palacios,
Bruno Méndez Ambrosio and Guillermo Hernández Mendoza**

This week will be an introduction to basic concepts in optics, such as refraction, reflection, interference, diffraction and coherent light. Optical elements and optical systems as light manipulators will be discussed. Hands on training will allow students to experience the effects of the properties of light, and how to capture it and produce images. Students will have experimental devices, power supplies, lenses and computers coupled to their devices to experience generating and capturing images.

Monday

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|----------------------|---|
| 09:00 - 09:15 | Opening Introduction to the School
Francisco F. De-Miguel |
| 09:15 - 10:45 | Lecture: Light and its properties I
Speaker: Dilia Aguirre Olivas, PhD |
| 10:45 - 11:30 | Lecture: Introduction to Microscopy I
Speaker: Félix Aguilar Valdés, PhD |
| 11:30 - 13:00 | Lecture: Introduction to the laboratory work.
Speaker: Naser Qureshi |
| 13:00 - 15:00 | Lunch break |
| 15:00 - 18:00 | Hands on Lab |
| 18:00 - 19:00 | Lecture: How networks of nerve cells produce different behaviors
Speaker: William B. Kristan |

Tuesday

- 09:00 - 09:30** Daily work review.
- 09:30 - 10:15** **Lecture:** Light and its properties II
Speaker: Dilia Aguirre Olivas, PhD
- 10:15 - 12:15** Laboratory work
- 12:15 - 13:00** **Lecture:** Introduction to Microscopy II
Speaker: Félix Aguilar Valdés, PhD
- 13:00 - 15:00** Lunch break
- 15:00 - 18:00** Hands on
- 18:00 - 19:00** **Lecture:** What biologist need to know about LASERs.
Speaker: Jesús Garduño

Wednesday

- 09:00 - 10:00** Daily work review.
- 10:00 - 13:00** Laboratory work
- 13:00 - 15:00** Lunch break
- 15:00 - 18:00** Hands on
- 18:00 - 19:00** **Lecture:** Total internal reflection for visualizing cell dynamics and DNA microarrays
Speaker: Luis Vaca Domínguez

Thursday

- 09:00 - 10:00** Daily work review.
- 10:00 - 13:00** Laboratory work
- 13:00 - 15:00** Lunch break
- 15:00 - 18:00** Hands on
- 18:00 - 19:00** **Lecture:** Non-linear optics
Speaker: Raman Kashyap

Friday

- 09:00 - 10:00** Daily work review.
- 10:00 - 13:00** Laboratory work

13:00 - 15:00	Lunch break
15:00 - 18:00	Hands on
18:00 - 19:00	Lecture: Reverse-engineering of cortical microcircuits Speaker: Rafael Yuste

WEEK 2.

Instructors: Francisco F. De Miguel, Dilia Aguirre Olivas, Arturo Hernández Cruz, Luis Vaca Domínguez, León Islas, Fatuel Tecuapetla, Fernando García and Yazmín Ramiro

Practical work in this and the following week will consist of spending three days doing experiments in three different laboratories.

Monday

09:00 - 10:00	Daily work review.
10:00 - 13:00	Laboratory work
13:00 - 15:00	Lunch break
15:00 - 18:00	Hands on
18:00 - 19:00	Lecture: Fluorescence Energy Transfer (FRET) studies of structure and function of ion channels Speaker: León Islas Suárez

Tuesday

09:00 - 10:00	Daily work review.
10:00 - 13:00	Laboratory work
13:00 - 15:00	Lunch break
15:00 - 18:00	Hands on
18:00 - 19:00	Lecture: Multiphoton absorbing materials: molecular designs, characterizations, and applications. Biophotonics. Speaker: Paras N. Prasad

Wednesday

09:00 - 10:00	Daily work review.
10:00 - 13:00	Laboratory work
13:00 - 15:00	Lunch break
15:00 - 18:00	Hands on

18:00 - 19:00 **Lecture:** Development at the cutting-edge of several microscopy and super-resolution imaging techniques.
Speaker: Pablo Loza-Alvarez, PhD

Thursday

09:00 - 10:00 Daily work review.
10:00 - 13:00 Laboratory work
13:00 - 15:00 Lunch break
15:00 - 18:00 Hands on

18:00 - 19:00 **Lecture:** Visualizing neuronal activity in behaving animals
Speaker: Fatuel Tecuapetla, PhD

Friday

09:00 - 10:00 Daily work review.
10:00 - 13:00 Laboratory work
13:00 - 15:00 Lunch break
15:00 - 18:00 Hands on

18:00 - 19:00 **Lecture:** Clustering of acetylcholine receptors measured with STORM optics.
Speaker: Francisco J. Barrantes

WEEK 3:

Instructors: Francisco F. De Miguel, Dilia Aguirre Olivas, Arturo Hernández Cruz, Luis Vaca Domínguez, León Islas, Fatuel Tecuapetla, Fernando García and Yazmín Ramiro

Monday

09:00 - 10:00 Daily work review.
10:00 - 13:00 Laboratory work
13:00 - 15:00 Lunch break
15:00 - 18:00 Hands on

18:00 - 19:00 **Lecture:** Super Resolution Microscopy
Speaker: Stefan W. Hell

Tuesday

09:00 - 10:00 Daily work review.
10:00 - 13:00 Laboratory work
13:00 - 15:00 Lunch break
15:00 - 18:00 Hands on

18:00 - 19:00 **Lecture:** Optical sectioning microscopy with planar or structured illumination.
Speaker: Jerome Mertz, PhD

Wednesday

09:00 - 10:00 Daily work review.
10:00 - 13:00 Laboratory work
13:00 - 15:00 Lunch break
15:00 - 18:00 Hands on

18:00 - 19:00 **Lecture:** New insights in neural network function by use of photonics
Speaker: Walter Stühmer

Thursday

09:00 - 10:00 Daily work review.
10:00 - 13:00 Laboratory work
13:00 - 15:00 Lunch break
15:00 - 18:00 Hands on

18:00 - 19:00 **Lecture:** Somatic vesicle transport and serotonin exocytosis measured with multiphoton microscopy and second harmonic generation
Speaker: Francisco F. De-Miguel

Friday

09:00 - 10:00 Daily work review.
10:00 - 12:00 Laboratory work

12:00 - 13:00 **Lecture:** synaptic function and animal behavior.
Speaker: Bernardo Sabatini

13:00 - 15:00 Lunch break
15:00 - 18:00 General discussion and conclusions
18:00 - 19:00 Closing ceremony