

Latin American Training Program

Montevideo, September 26 - October 14, 2022

Latin American Training Program 2022

MOLECULES, CELLS AND CIRCUITS: UNDERSTANDING NERVOUS SYSTEM MECHANISMS

Montevideo, September 26 -October 14

Program

INTRODUCTION

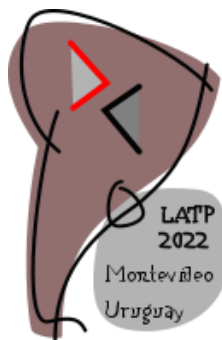
The aim of the Latin American Training Program (LATP) Course 2022 entitled “From Molecular and Cellular Neuroscience to Cognition: Clues to Understand Brain Diseases” is to provide the next generation of leading Latin American neuroscientists with intensive training on different aspects of neurobiology for three weeks. The selected students will be taught by leading neuroscientists from the region and overseas. A key feature of the LATP 2022 course is the strong hands-on lab activities that will give the students the opportunity to work side-by-side with expert neurobiologists and learn first-hand about state-of-the-art technologies (from electrophysiology, advanced imaging, microdialysis, and behavior analysis). In addition to lectures on fundamental topics of neuroscience, the students will actively engage in discussions about the development of professional skills. The overall goal of this course is to promote among Latin American students a broad knowledge of neuroscience within the context of critical thinking.

MODULE I. CELLULAR AND MOLECULAR NEUROBIOLOGY: NEURONS, GLIA, AND PLASTICITY

September 26-October 1, 2022

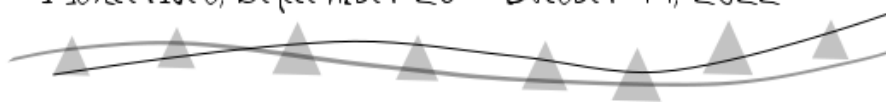
Coordination: Michel Borde and Raúl E. Russo

This module will focus on central aspects of cellular neurobiology such as the development of neural circuits, the biology of neural stem cells and neurogenesis, the biophysical basis of excitability and synaptic transmission together with the analysis of various forms of plasticity of neural circuits. Cutting edge experimental approaches will be discussed.



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Monday September 26

Chair: Raúl E. Russo

09:00-09:10 | Opening Introduction to the School

09:10-10:00 | Cellular aspects of early neural development in vertebrates. *Flavio Zolessi.*

10:00-10:50 | TRP channels and thermosensation. *Gonzalo Budelli.*

10:50-11:20 | **Coffee break**

11:20-12:00 | The integrative properties of neurons: intrinsic properties and neuronal compartments. *Michel Borde.*

12:00-14:30 | **Lunch break**

14:30-19:00 | **Introduction to** Hands-on lab activities |

Tuesday September 27

Chair: Michel Borde

09:00-09:50 | Presynaptic protein synthesis and synaptic function. *Pablo Castillo.*

09:50-10:40 | The axon: far more complex than a signal carrier. *Federico Trigo.*

10:40-11:10 | **Coffee break**

11:10-12:00 | Electrical synaptic transmission. *Alberto Pereda.*

12:00-14:30 | **Lunch break**

14:30-19:00 | Hands-on

Wednesday September 28

Chair: Federico Trigo

09:00-09:50 | Ca^{2+} voltage-dependent channels and the Ca^{2+} - and voltage-activated K^{+} (BK) channel. *Gonzalo Ferreira*

09:50-10:40 | Endocannabinoids as regulators of synaptic plasticity. *Pablo Castillo.*

10:40-11:10 | **Coffee break**

11:10-12:00 | Molecular complexity of electrical synapses. *Alberto Pereda.*

12:00-14:30 | **Lunch break**

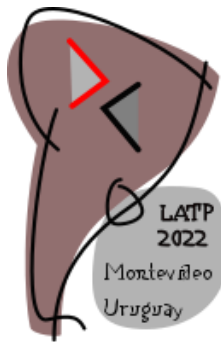
14:30-19:00 | Hands-on

20:00-21:00 | PROFESSIONAL SKILLS I "How to write a research proposal". *Benedikt Berninger & "A look into the process of scientific publishing". Pablo Castillo.*

Thursday September 29

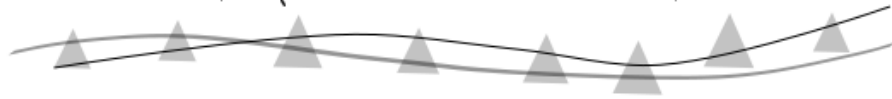
Chair: Raúl E. Russo

09:00-09:50 | Membrane properties and neural circuits: Focus on the role of striatal cholinergic interneurons in Parkinson's disease. *Cecilia Tubert*



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09:50-10:40 | Engineering new interneurons for grown-up brains. *Benedikt Berninger.*

10:40-11:10 | **Coffee break**

11:10-12:00 | How to mend the adult mammalian CNS: Neuronal repair and replacement.
Christian Göritz.

12:00-14:30 | **Lunch break**

14:30-19:00 | Hands-on

20:00-21:00 | Neuroscience by night: an informal open discussion. "*Synapse proposes, neuron disposes. Is that so?*". Active and passive intrinsic neuronal properties and synaptic integration and plasticity. *Sebastián Curti, Pablo Castillo and Cecilia Tubert.*

Friday September 30

Chair: Pablo Castillo

09:00-09:50 | Cerebral organoids as a model system to study human brain development.
Benedikt Berninger.

09:50-10:40 | What is wrong with the striatal cholinergic interneurons in Parkinson's disease and dyskinesia? Focus on intrinsic excitability. *Cecilia Tubert*

10:40-11:10 | **Coffee break**

11:10-12:00 | Neurogenesis in the adult hippocampus. *Alejandro Schinder.*

12:00-14:30 | **Lunch break**

14:30-19:00 | Hands-on

20:00-21:00 | Meet the PIs (Optional) In this activity students will have the chance, by their request, to meet principal investigators that participate in the course in an informal environment to discuss their science, future training possibilities and other aspects of interest for the young researchers.

Saturday October 1 - Location Palladium Business Hotel

Chair: Benedikt Berninger

Mini-Symposium I: Neural Stem Cells and Adult Neurogenesis

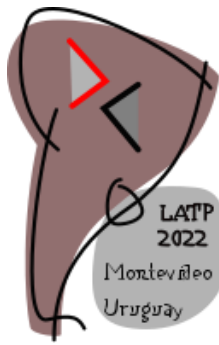
09:00-09:50 | Functional integration of newborn neurons in the hippocampal circuits of the adult and aging brain. *Alejandro Schinder.*

09:50-10:40 | Connexin signaling and the awakening of the ependymal stem cell niche. *Raúl E. Russo.*

10:40-11:10 | **Coffee break**

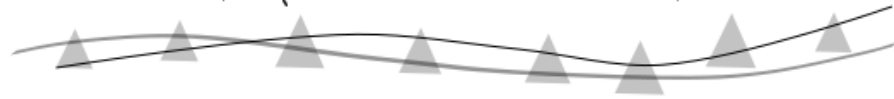
11:10-12:00 | Scarring and repair in the central nervous system. *Christian Göritz.*

12:00-14:30 | **Lunch break**



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Chairs: Michel Borde and Raúl E. Russo

15:00-16:00 | Presentations of Hands-on Lab activities I

MODULE II. NEURODEGENERATIVE AND NEUROPSYCHIATRIC DISORDERS: NEW EXPERIMENTAL APPROACHES AND THERAPEUTIC STRATEGIES

October 3-8, 2022

Coordination: Patricia Cassina and Cecilia Scorza

This module will focus on the neural mechanisms involved in the physiopathology of neurodegenerative (Parkinson's Disease, Amyotrophic Lateral Sclerosis), and metabolic and neuropsychiatric diseases (schizophrenia-psychosis, depression, and drug addiction). Additionally, students will have the opportunity to learn new approaches to study these pathologies, from neuronal and astrocyte cultures to behavior, using techniques such as immunohistochemistry, confocal microscopy, flow cytometry, and intracerebral *in vivo* microdialysis.

Monday October 3

Chair: Patricia Cassina

09:00-09:10 | Welcome and Opening Module II

09:10-10:00 | A role for glial cells in brain pathologies. *Luis Barbeito*.

10:00-10:50 | Microglia in health and disease. *Cintia Roodvelt*.

10:50-11:20 | **Coffee break**

11:20-12:00 | Oligodendrocytes in neurometabolic diseases. *Silvia Olivera*.

12:00-14:30 | **Lunch break**

14:30-19:00 | Introduction to hands-on activities II

Tuesday October 4

Chair: Silvia Olivera

09:00-09:50 | Neuroinflammation. *Cintia Roodvelt*.

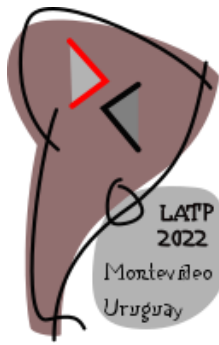
09:50-10:40 | Glial reactivity and metabolic modulation. *Patricia Cassina*.

10:40-11:10 | **Coffee break**

11:10-12:00 | Neuronal death mechanisms in Parkinson Disease. *Giselle Prunell*.

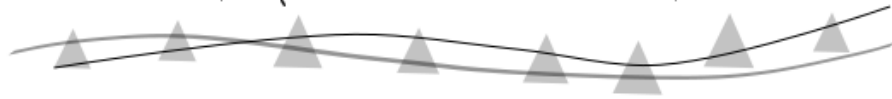
12:00-14:30 | **Lunch break**

14:30-19:00 | Hands-on



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Wednesday October 5

Chair: *Patricia Cassina*

09:00-09:50 | Brain energy metabolism: astrocytes-neurons coupling. *Juan Pedro Bolaños.*

09:50-10:40 | Molecular mechanisms of neuronal death and survival. *Angeles Almeida.*

10:40-11:10 | **Coffee break**

11:10-12:00 | Molecular imagenology in neurodegenerative diseases. *Andrés Damian.*

12:30-14:30 | **Lunch break**

14:30-19:00 | Hands-on

Thursday October 6

Chair: *Cecilia Scorza*

09:00-09:50 | Neurotoxic effect of ethanol exposition. *Alicia Brusco.*

09:50-10:40 | Ketamine: a polypharmacological drug with rapid antidepressant effects. *Miguel Reyes Parada.*

10:40-11:10 | **Coffee break**

11:10-12:00 | Vasopressin and oxytocin: role in drug addiction and therapeutic potential.

Georgina Renard.

12:00-14:30 | **Lunch break**

14:30-19:00 | Hands-on

20:00-21:00 | PROFESSIONALSKILLS II "Collaborative Neuroscience". *Juan Pedro Bolaños y Angeles Almeida.*

In this activity students will have the chance to discuss with prestigious scientists their experience in establishing collaborative networks.

Friday October 7

Chair: *Giselle Prunell*

09:00-09:50 | Psychotic-like effects induced by NMDA-R antagonists: role of GluNR2C. *Cecilia Scorza.*

09:50-10:40 | High frequency oscillations of the EEG in animal models of psychosis. *Pablo Torterolo.*

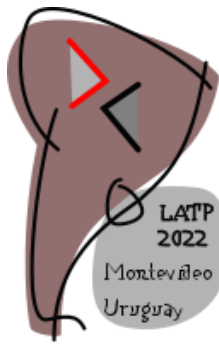
10:40-11:10 | **Coffee break**

11:10-12:00 | Psychedelic drugs. *Ignacio Carrera.*

12:00-14:30 | **Lunch break**

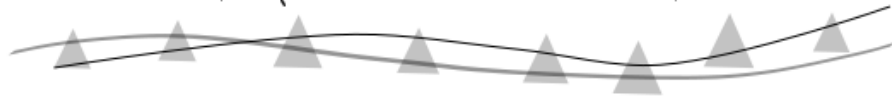
14:30-19:00 | Hands-on

20:00-21:00 | Meet the PIs (Optional)



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Saturday October 8 - Location IIBCE

Chairs: Patricia Cassina and Cecilia Scorza

11:00-12:00 | Presentations of Hands-on Lab activities II

12:00-13:30 | **Lunch break**

14:00-15:30 | Poster blitz (3 min)

15:30-16:00 | **Coffee break**

16:00-18:00 | Poster session

MODULE III: NEURAL SYSTEMS, COGNITION, GENOMICS & BEHAVIOR.

October 10-14, 2022

Coordination: Leonel Gómez and Ana Silva

This module will focus on neural circuits solving problems integrating computational and behavioral perspectives. The neural and molecular mechanisms underlying behavior, perception, and cognition will be explored in iconic vertebrate model systems. We will combine multi-level experimental approaches with theoretical modeling and bioinformatics processing to highlight general strategies of neural computing across evolution.

Monday October 10

Chairs: Leonel Gómez and Ana Silva

09:00-09:10 | Welcome and Opening Module III

09:10-09:50 | Neural Circuits. *Leonel Gómez - Ana Silva*

09:50-10:40 | Neuronal Networks. *Ruben Coen-Cagli*

10:40-11:10 | **Coffee break**

11:10-12:00 | Genomics of Behavior. *José Sotelo Silveira*

12:00-14:30 | **Lunch break**

14:30-19:00 | Introduction to hands-on lab activities III

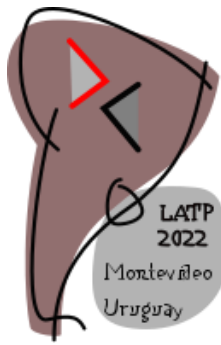
Tuesday October 11

Chair: Leonel Gómez

09:00-09:50 | *Cognitive and computational approaches to perception. Nature and challenges of perception. Leonel Gómez*

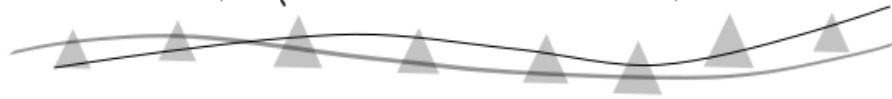
09:50-10:40 | *Cognitive and computational approaches to perception. Neural basis of early visual processing. Ruben Coen-Cagli*

10:40-11:10 | **Coffee break**



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11:10-12:00 | *Cognitive and computational approaches to perception. Computing with auditory circuits.* José Luis Peña

12:00-14:30 | **Lunch break**

14:30-19:00 | Hands-on

Wednesday October 12

Chair: José Luis Peña

09:00-09:50 | *Neural bases of perception. Auditory computation in the frog brain.* Kim Hoke

09:50-10:40 | *Neural bases of perception. The electromotor-electrosensory loop of pulse gymnotiformes.* Angel Caputi

10:40-11:10 | **Coffee break**

11:10-12:00 | *Neural bases of perception. Adaptive command for orienting behavior in premotor brainstem neurons of barn owls.* José Luis Peña

12:00-14:30 | **Lunch break**

14:30-19:00 | Hands-on

20:00-21:00 | PROFESSIONALSKILLS III "Women in Latin American Neuroscience". Verónica Amarante, ECLAC-IBROLARC.

Thursday October 13

Chair: Laura Quintana

09:00-09:50 | *Neural and molecular bases of social behavior. Neuroendocrinological modulation of communication signals.* Vielka Salazar

09:50-10:40 | *Neural and molecular bases of social behavior. Seasonal plasticity and sex differences.* Laura Quintana

10:40-11:10 | **Coffee break**

11:10-12:00 | *Neural circuits and molecular bases of social behavior.* Anita Autry

12:00-14:30 | **Lunch break**

14:30-19:00 | Hands-on

20:00-21:00 | Meet the PIs (Optional)

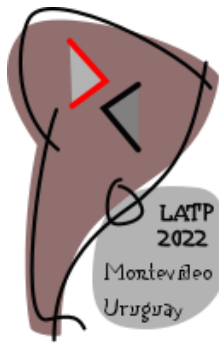
Friday October 14

Chair: Ana Silva

09:00-09:50 | *Neural and molecular bases of social behavior. Agonistic behavior.* Ana Silva

09:50-10:40 | *Neural and molecular bases of social behavior. Neuroendocrinological bases of maternal care in mammals.* Natalia Uriarte

10:40-11:10 | **Coffee break**



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11:10-12:00 | Neural and molecular bases of social behavior. Functional circuits shaping parental behavior. *Anita Autry*

12:00-14:30 | **Lunch break**

15:30-17:30 | Lab work student presentations III

17:30-18:00 | **BREAK**

18:00-19:00 | Closure Ceremony

Hands-on activities I (September 26-30)

1. Short- and long-term synaptic plasticity in rat hippocampal slices

Professors: Pablo Castillo & Michel Borde.

Location: Depto. de Fisiología, Fac. de Medicina, UdelaR.

Classical and novel forms of synaptic plasticity in the mammalian hippocampus will be analyzed *in vitro* with field potential recordings, current source density analysis (CSDA) and current and voltage-clamp intracellular recording techniques in the whole cell patch (WCP) configuration.

2. Membrane properties and electrical coupling in CNS neurons of the rat

Professors: Alberto Pereda & Sebastián Curti.

Location: Depto. de Fisiología, Fac. de Medicina, UdelaR.

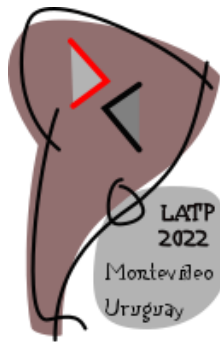
In an *in vitro* preparation, students will have the opportunity to gain insights in patch clamp whole cell recordings (voltage and current clamp configurations) from single cells and from electrically coupled pairs of neurons. Electrical transmission between neurons will be characterized through the evaluation of the coupling strength, its bi-directionality, and the junctional conductance. The interaction of electric coupling with passive and active membrane properties of coupled neurons will also be analyzed.

3. Mapping Glutamate and GABA ionotropic receptors with laser photolysis

Professor: Federico Trigo

Location: Depto. de Neurofisiología Celular y Molecular, IIBCE.

In this hands-on section, we will learn how to use a laser in order to photo-trigger the release of GABA and Glutamate in central nervous system neurons. We will learn the advantages and



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disadvantages of the technique as well as calibration methods. We will analyze the laser-evoked currents and compare those with spontaneous EPSCs and IPSCs.

4. The intrinsic dynamics of neuronal firing: patch clamp recordings in slices

Professors: Raúl Russo & Nicolás Marichal

Location: Depto. de Neurofisiología Celular y Molecular, IIBCE.

The students will learn the basics of patch clamp recordings of neurons in slices of the central nervous system. During the hands-on activity, we will discuss the advantages and limitations of in vitro preparations as well as the fundamentals of current and voltage-clamp. We will focus the activity on the intrinsic membrane properties of neurons: how they arise and their impact on neural integration.

Hands-on activities II (October 3-7)

5. Analysis of mitochondrial morphology and function in live glial cells.

Professors: Laura Martínez, Ernesto Miquel, Juan P. Bolaños, Adriana Cassina.

Location: Depto. de Histología & Embriología. Fac. de Medicina, UdeLaR.

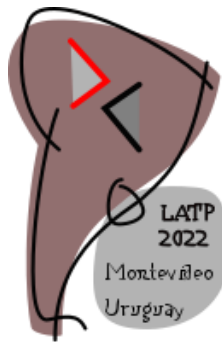
Mitochondria are organelles that have been primarily known as the “power house of the cell”. However, recent advances in the field have revealed that mitochondria are also involved in many other cellular activities like lipid modifications, redox balance, calcium balance, and even control cell death. These multifunctional organelles are motile and highly dynamic in shapes and forms; the dynamism is brought about by the mitochondria's ability to undergo fission and fusion with each other. Therefore, it is very important to be able to image mitochondrial shape changes to relate to the variety of cellular functions these organelles have to accomplish.

6. Determination of inflammatory cytokines in neurodegeneration models.

Professors: Eugenia Isasi, Silvia Olivera, Soledad Marton, Cintia Roodvelt.

Location: IIBCE

The inflammatory response that occurs associated with many neurological diseases contributes to spread tissue damage to healthy regions, and consequently, to increase neurological deficits. Certain cytokines/chemokines are involved in not only the initiation but also the persistence of inflammation. The students will have the opportunity to identify several key pro-inflammatory and anti-inflammatory cytokines and their relationship with pathology in animal models of human disease.



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7. Neuroprotection and neuroplasticity in cellular models

Professors: Giselle Prunell, Carolina Echeverry, Mariana Pazos

Location: Laboratorio de Mecanismos de Neurodegeneración y Neuroprotección, IIBCE.

Cellular models of neurodegeneration and neurite outgrowth will be used during the laboratory module and the beneficial effects of natural products will be taken as an example of new potential therapies. The students will have the opportunity to work with primary neuronal cultures and a cell line to assess the neuroprotective activity and neurite outgrowth capacity of different natural products using biochemical and morphological approaches.

8. *In vivo* microdialysis technique to study the effect of cannabinoids on GABA/GLU release

Professors: Georgina Renard (USACH), Miguel Reyes Parada (USACH), Ximena López Hill, Jessika Urbanavicius (DNFE-IIBCE)

Location: Depto. de Neurofarmacología Experimental, IIBCE and Plataforma de Química Analítica, IIBCE

Cannabidiol (CBD), a major non-psychotomimetic constituent of *Cannabis sativa*, has therapeutic potential for certain psychiatric and neurodegenerative disorders. Studies in laboratory animals show that CBD has a broad therapeutic potential throughout multiple sites of actions. Its actions on GABA or glutamate release have remained unclear. The students will have the opportunity to analyze the effect of CBD on GABA or GLU release in the prefrontal cortex using the *in vivo* intracerebral microdialysis technique in awake rats.

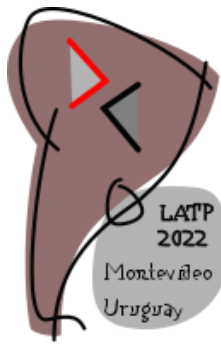
Hands-on activities III (October 10-14)

9. Close loop behavior with bonsai.

Professors: Leonel Gómez, Cecilia Herbert, Marcos Colleti, Juan Ignacio Sanguinetti

Location: Lab. Neurociencias, Fac. de Ciencias, Udelar.

Currently, despite the success of the reductionist approaches in neuroscience, many authors maintain that it is necessary to complement those strategies with studies that allow a careful theoretical and experimental decomposition of behavior to discover the component processes and their underlying algorithms. These studies provide a solid base for addressing the neural implementation of a behavior. Bonsai is a high-performance programming environment, fast to learn and easy to extend which allows the development of behavioral analysis projects based on the acquisition and processing of signals of different types: video, sound, neurophysiological



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records, etc. Using these tools, the students will be able to track, quantify and analyze different kinds of behavior guided by experimented instructors.

10. Structural plasticity in the rat's nervous system during motherhood

Professors: Natalia Uriarte & Javier Nogueira

Location: Sec. Fisiología, Fac. de Ciencias-Depto. Histología y Embriología, Fac. de Medicina, Udelar.

A remarkable reorganization of the extracellular matrix (ECM) occurs in the medial preoptic area (mPOA) of female rats during motherhood. Highly organized aggregations of ECM, perineuronal nets (PNNs) are expressed in mPOA and dynamically change during this period in response to gonadal hormones. As PNNs are proposed to play key roles in neural plasticity, and pregnancy and lactation are characterized by a significant increase in neuroplasticity, we proposed that these structures are involved in the expression of the behavioral flexibility during motherhood. Students will participate in experiments designed to assess the role of PNNs in the maternal behavior of lactating rats, which will include stereotaxic surgeries, behavioral recording, and cytochemical detection of PNNs.

11. Gene expression associated to social behavior

Professors: Laura Quintana, José Sotelo Silveira, Vielka Salazar

Location: Unid. Bases Neurales de la Conducta- Depto. De Genómica, IIBCE

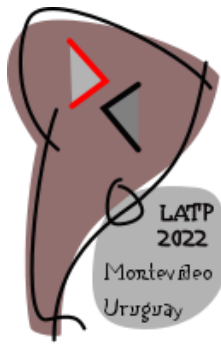
The advent of genomics has revolutionized the field of behavioral genetics by providing tools to quantify the dynamic nature of brain gene expression in relation to behavioral output. Students will be involved in behavioral experiments of the non-breeding aggression using the native weakly electric fish, *Gymnotus omarorum*. Further, students will analyze transcriptomic profiling of the brain and will link gene expression with behavioral traits.

12. Circadian modulation of social behavior

Professors: Ana Silva, Adriana Migliaro, Federico Pedraja

Location: Lab. Neurociencias, Fac. de Ciencias, Udelar.

The electric behavior, the outcome of the electrogenic system of weakly electric fish, is a behavioral display with well-known circadian, social, and seasonal modulations. It is also an advantageous model to explore neuroendocrine mechanisms controlling the interplay of circadian (melatonin) and social (hypothalamic neuropeptides) modulators. Students will record the electric behavior in the wild using a remote system that allows the tracking of freely

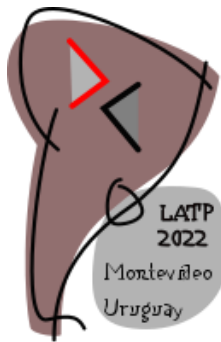


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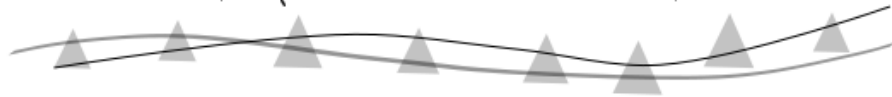
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moving fish during day and night. Students will be trained to do data processing of the electric behavior, to induce pharmacological modulations in in vivo and in vitro preparations, and to explore the changes of the melatonergic and vasotocinergic systems between day and night.



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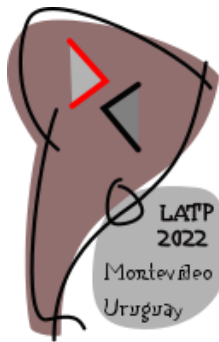
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Ana Silva

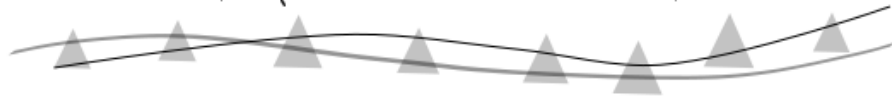
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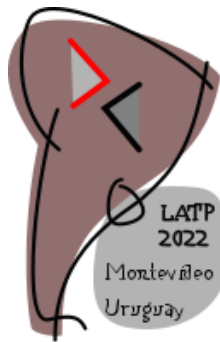
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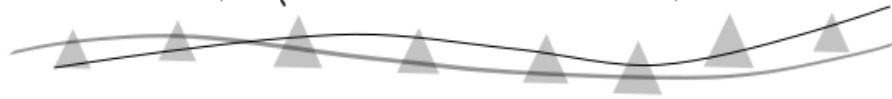
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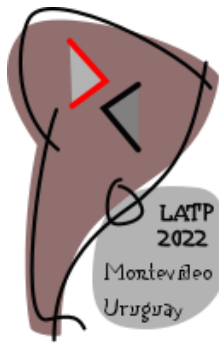
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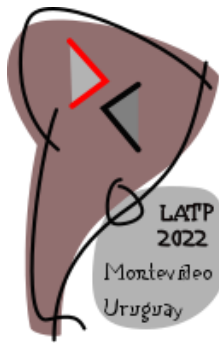
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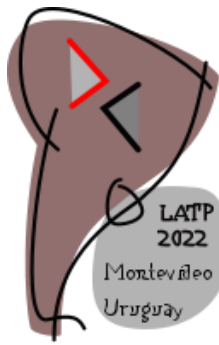
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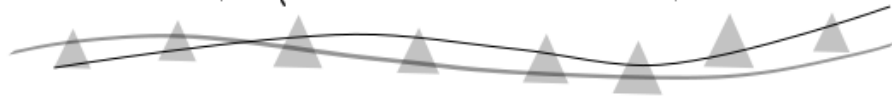
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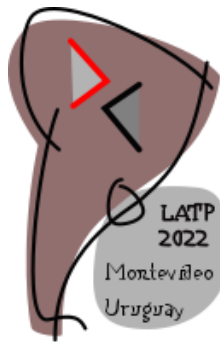
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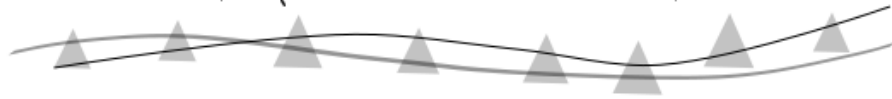
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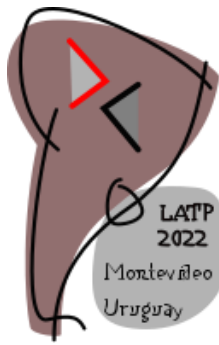
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