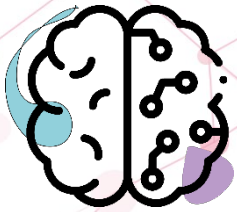
Integrative Neurosciences & Omics (INO)



Explore this IDIL Master's track in detail, including its academic objectives, curriculum, research opportunities, admission requirements and career prospects.

TRACK OVERVIEW & LEARNING OBJECTIVES

The Integrative Neuroscience and Omics (INO) track of the Life-Health Master's degree, integrated into the IDIL graduate program, addresses one of the major challenges of modern neuroscience: collecting, analyzing, and integrating biological data acquired at different scales, from genes and proteins to neuronal circuits, the whole brain, and behavior.

At the interface of neurosciences, omics technologies, and complex biological data analysis, INO offers an interdisciplinary training program allowing students to approach the functioning of the nervous system at all scales, in both physiological and pathological contexts. The track stands out for its strong methodological and analytical orientation, with a focus on genomics, transcriptomics, proteomics, high-throughput omics technologies, and integrative approaches stemming notably from systems biology.

The pedagogical objective is to train students capable of tackling complex questions in neuroscience by jointly mobilizing knowledge in neurobiology, omics approaches, and methods for analyzing and integrating biological data. The training develops the capacity to understand the principles and applications of high-throughput technologies, analyze and interpret the data they generate, and integrate different levels of biological information into a global vision of nervous system function.

Upon completion of the training, students will have acquired in-depth knowledge in neurosciences as well as a mastery of omics technologies. They will know how to acquire, analyze, and integrate complex biological data to identify the mechanisms involved in the physiological and pathological functioning of the nervous system. They will be able to mobilize this knowledge within the framework of a research project and will be prepared for doctoral studies or integration into academic or private research structures.

KNOWLEDGE, SKILLS & COMPETENCIES

Knowledge

- General knowledge in biology and neurosciences, from the molecular and cellular scale to the scale of a tissue or an organism.
- Principles of genomics, transcriptomics, and proteomics.
- Principles of technological approaches allowing the performance of omics experiments.
- Principles of analysis, processing, and integration of complex biological data.
- Integrative approaches and systems biology applied to the study of the nervous system.

Skills (Savoir-faire)

- Analyze and interpret complex biological data.
- Integrate data from different levels of biological organization.
- Relate molecular and cellular data to the integrated functions of the nervous system.
- Use and interpret data from high-throughput approaches.
- Search for and exploit information from biological databases and literature.
- Analyze experimental results, formulate hypotheses, and propose strategies to test them.
- Participate in the design and realization of an interdisciplinary research project.
- Synthesize and present scientific results in writing and orally, notably in English.

Soft Skills and Transversal Competencies

- Accomplish work while respecting deadlines and deliver regular output.
- Develop an integrated and multidisciplinary perspective.
- Work independently, adapt to a new context, and take relevant initiatives.
- Self-evaluate and question oneself in order to learn.
- Communicate, listen, and exchange constructively.
- Respect legal, ethical, and deontological rules relating to scientific production, the use of sources, data, and the handling of living organisms.

Disciplinary Competencies in Neurosciences

- Understand the relationships between genes and behaviors and molecular adaptations to environmental constraints.
- Know the neurobiological foundations of emotions, mechanisms of synaptic plasticity, and major processes of nervous system development.
- Know the pharmacology of major neurotransmission systems and principal pathologies of the nervous system.
- Understand cellular interactions, notably neuron-glia, networks involved in sensory functions, the neurobiological bases of cognitive functions, and relationships between neurosciences and endocrinology.
- Know the practices applied in research laboratories.

DETAILED CURRICULUM

Semester 1 (S7)

- HBV706V: Practical Genomic Data Analysis using R (5 ECTS)
- HBV713V: Neurogenetics (4 ECTS)
- HBV714V: Artificial intelligence and applications in biology and health (5 ECTS)
- QAM1PPRJ: Personal project: research project + English (10 ECTS)
- QAM1TTRA: IDIL Transversal training units (4 ECTS)

Semester 2 (S8)

- HBV807V: IDIL M1 Internship (30 ECTS)

Semester 3 (S9)

- HBV910V: Molecular and Cellular Signaling in Neuroscience (5 ECTS)
- HBV911V: Biology and modeling of Neural circuits (5 ECTS)
- HBV912V: Fundamental and clinical neuropathologies (5 ECTS)
- QAM2MUTP: Multidisciplinary team project (10 ECTS)
- QAM2TTRA: IDIL Transversal units 2B (4 ECTS)

Semester 4 (S10)

- HBV001V: IDIL M2 Internship (30 ECTS)

IDIL Non-Core Training Units (one choice in M1 and one in M2):

- DAPCNCM1: Why democracy is hard (2 ECTS)
- HA1I01B: Mediterranean Terrestrial Ecosystems (2 ECTS)
- HA1I01H: Defusing quantitative bullshit (2 ECTS)
- HA1I01T: Scientific openness to earth and water issues under global change (2 ECTS)
- HA1I01V: Plant health 2.0: a global war (2 ECTS)
- HA1I03B: One health and eco-epidemiology (2 ECTS)
- HA1I12E: The Bionic Man (2 ECTS)

- HA1I22B: Explore understand learn (2 ECTS)
- HA1I22V: Biology by the numbers (2 ECTS)
- HA1I23V: Who's afraid of AI? (2 ECTS)
- KAPMS790: Sustainable management basics (2 ECTS)
- MAM1IDIN: Innovations in clinical biomarkers; biotechnologies for personalized medicine (2 ECTS)
- PAM1IDCH: Challenges in chemistry for health and environment (2 ECTS)
- PAMCBWCA: The Chemistry of Beer, Wine, and Culinary Arts (2 ECTS)
- SAMIDNC1: How the way we move reveals how we are (2 ECTS)

In-Labs:

- PPM-FPP proteomics platform
- MGX transcriptomics platform

ADMISSION REQUIREMENTS & STUDENT PROFILE

Student Profile

The INO track is intended for students wishing to acquire interdisciplinary training in neurosciences, with a particular interest in omics approaches, complex biological data analysis, and systems biology. It targets in particular students from backgrounds in biology, neurosciences, or related disciplines wishing to pursue academic or private research.

Necessary Prerequisites

- Bachelor's degree (Licence) level in biology essential.
- For students coming from other fields, notably chemistry or engineering schools, prior contact with the track coordinators is necessary.

Recommended Prerequisites

- General knowledge in molecular and cellular biology.
- Notions of physiology and neurosciences.
- Interest in quantitative analysis and the exploitation of biological data.
- Good command of scientific English.

CAREER OPPORTUNITIES

The INO track primarily prepares students for doctoral studies and academic research careers. Its interdisciplinary training also enables graduates to evolve in environments combining neurosciences, omics technologies, data analysis, and biomedical research.

Further Studies

- Doctorate in neurosciences, life-health, systems biology, omics, or related disciplines, in France or abroad.
- Specialized training in biomedical data analysis and exploitation.
- Other studies abroad, notably MBA-type programs.

Activity Sectors and Employers

- Academic research.
- Pharmaceutical industry.
- Biotechnology companies.
- Structures and sectors exploiting biological and biomedical data on a large scale.

RESEARCH LABORATORIES & ACADEMIC PARTNERS

The INO track is offered within the Life-Health Master's degree of the University of Montpellier and integrated into the IDIL graduate program.

The research dimension is reinforced by a 6-month internship each year, which can be carried out in local, national, or international neuroscience research teams.

Contact

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For more information: https://idil.edu.umontpellier.fr/en/master-idil/les-parcours/