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UNIVERSITÉ DE FRIBOURG
UNIVERSITÄT FREIBURG

Master in Molecular Life and Health Sciences

Department of Biology

FACULTY OF SCIENCE AND MEDICINE
DEPARTMENT OF BIOLOGY
CH. DU MUSÉE 10, CH-1700 FRIBOURG

“Combining biomolecules and cell function”

The Department of Biology of the Faculty of Science and Medicine offers this multidisciplinary master programme with five different options that address **molecular aspects** in organisms ranging from **yeast to mammals**. **The Master of Science in Molecular Life and Health** Sciences provides a **solid background** including aspects on understanding **human disease** and **animal development**. This programme gives to the student the opportunity to acquire **advanced theoretical background** on molecular topics, **hands-on experience** in the laboratory, and the ability to **communicate science**. Master’s students are integrated in research teams and thus gain extensive experience in fundamental academic research.

Why a Master in Molecular Life and Health Sciences?

- **State of the art technologies and research**
- **at the cutting edge between biomedical sciences and biology**
- **personalized supervision and teaching**

Overview of the 5 options

Developmental Biology and Regeneration

Neurobiology

Biochemistry and Cell Biology

Marine Biology

120 ECTS
4 semesters

Master Thesis
60 ECTS
Courses
49 ECTS
Seminars
11 ECTS

Teaching

90 ECTS; 3 semesters
Master Thesis 45 ECTS; Courses 36.5 ECTS; Seminars 8.5 ECTS

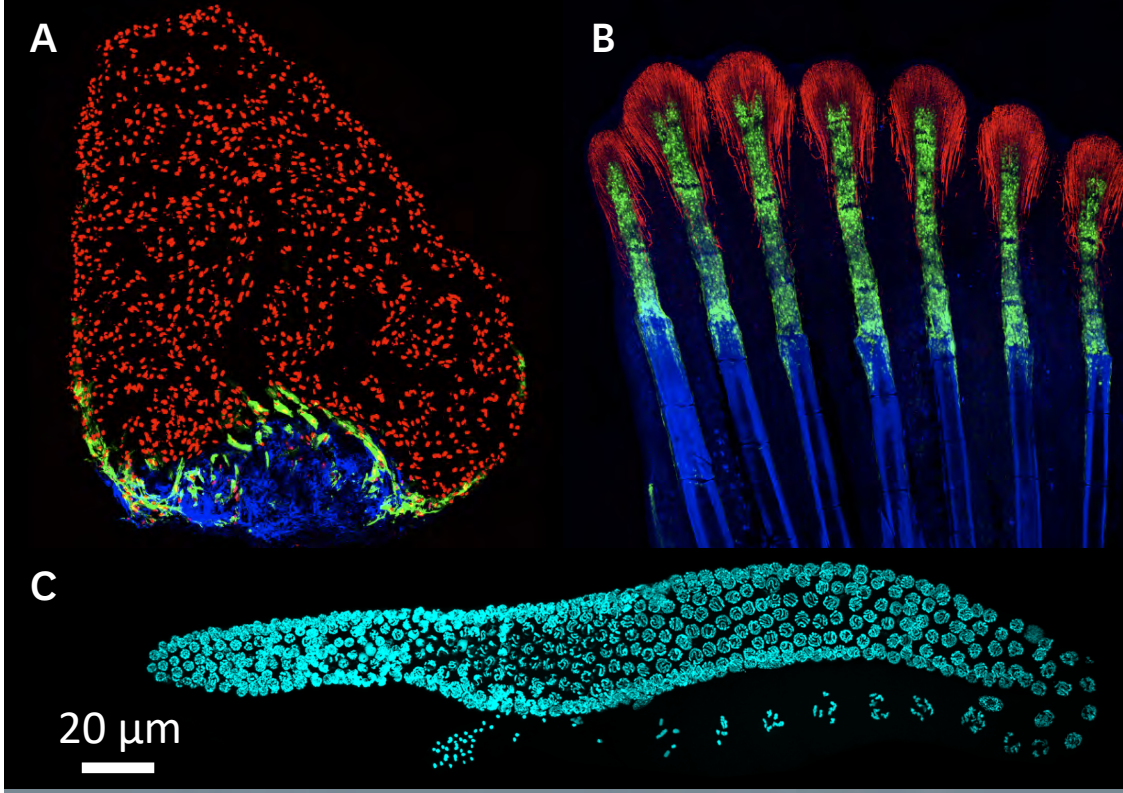
Developmental Biology and Regeneration

Main research questions

- How do organisms develop from a zygote to a complex multicellular adult? What are the genes responsible?
- How do genes exert their molecular functions?
- How do germ cells decide whether to divide or differentiate?
- How do epigenetic mechanisms affect gene activity ?
- How do zebrafish regenerate their complex organs after injuries?

Organisms and techniques used

Caenorhabditis elegans (Nematode); *Danio rerio* (Zebrafish).
Molecular genetics; classical and confocal microscopy; micromanipulation; histology; image processing.



Legends to figures :

A. Zebrafish heart forms a new myocardium after injury.

B. Zebrafish fin regrows its skeleton after amputation.

C. Germline nuclei stained for chromatin (*C. elegans*).

D. The free-living model organism *Caenorhabditis elegans*.

Neurobiology

Main research questions

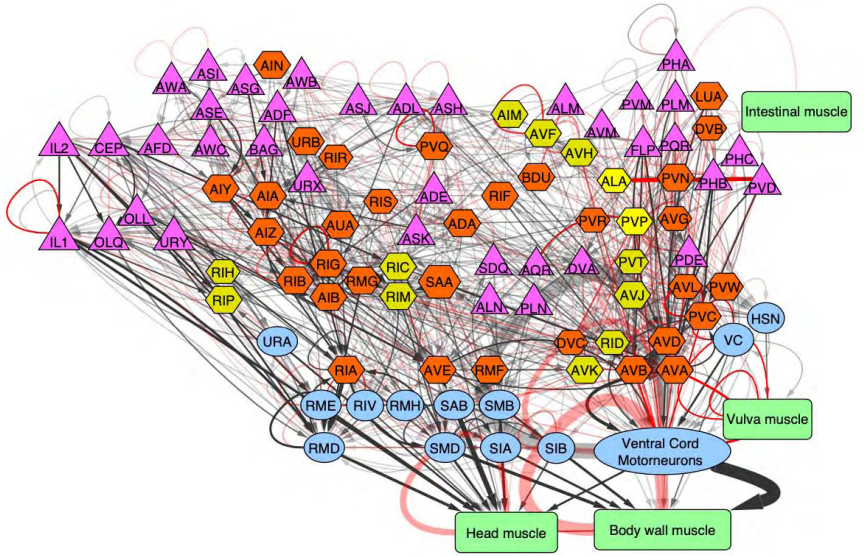
- Drosophila neurogenetics : building the brain of a fly.
- Modelling neurodegenerative diseases.
- Worms sense their environment: mechanisms of nociception at the molecular, cellular and neural circuit levels.
- Differentiation of the neural ectoderm in flies.
- How do biological rhythms regulate brain function?

Organisms and techniques used

Drosophila melanogaster; *Caenorhabditis elegans*; mouse; marine species. Behavioral tests; optogenetics; confocal microscopy; transcriptomics and phospho-proteomics; genome editing; classical and molecular genetics.

Legends to figures :
A. The 'simple' *C. elegans* nervous system wiring diagram at a glance. Sensory neurons (pink), interneurons (red), motor neurons (blue).
B. The developing *Drosophila* visual system: imaginal disk on top of the optic lobe. Cell membranes are shown in green.
C. *C. elegans* head with the AFD thermosensory neuron and its extensions shown in red. Other cell nuclei are in blue.

A



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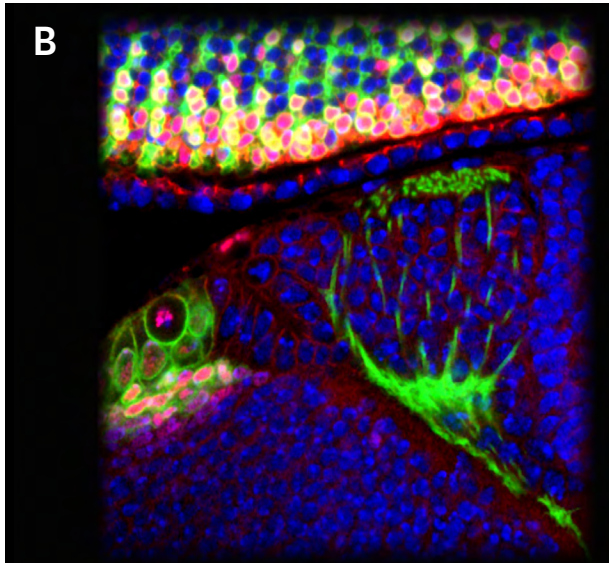
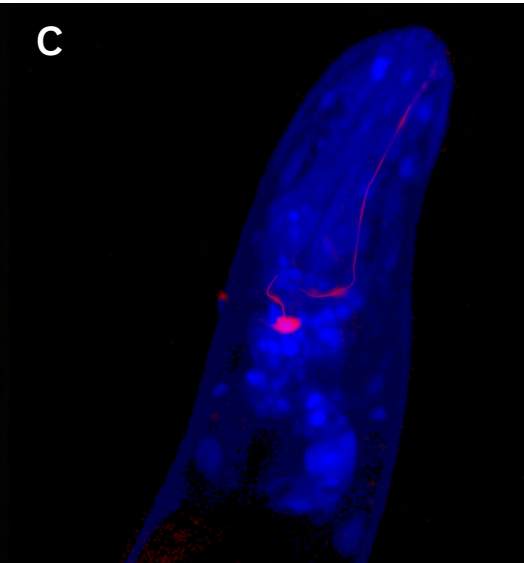


C



Biochemistry and Cell Biology

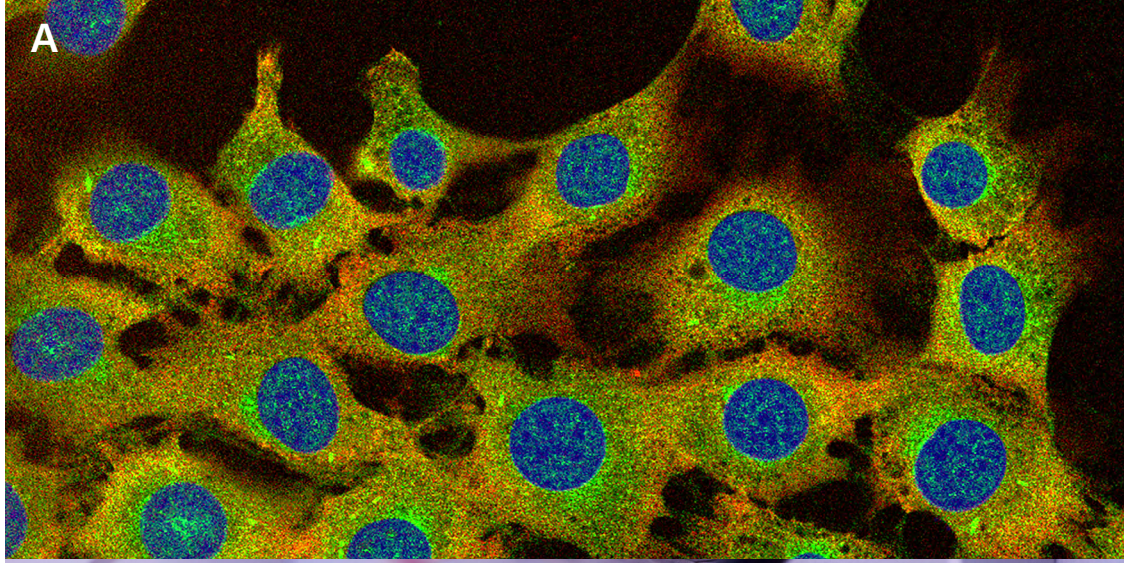
Main research questions

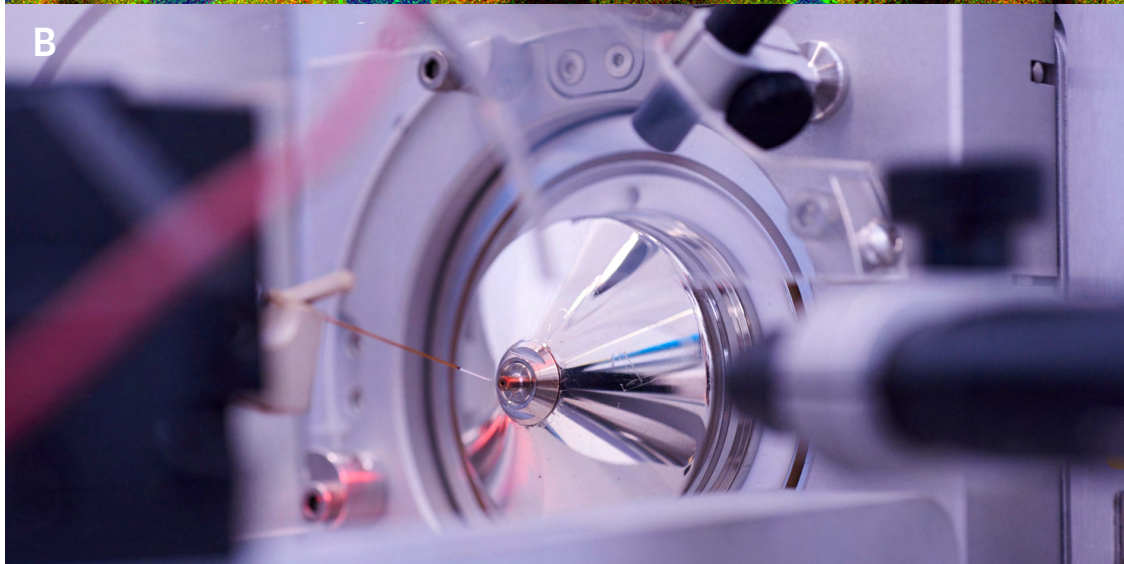
- Biological rhythms: how is life influencing sleep and health?
- Autophagy : how does a cell decide what to degrade when and where?
- Cell cycle control: rest or divide
- Lipid transport and biogenesis of lipid droplets
- Ribosome biogenesis: escorting ribosomal proteins from birth to assembly

Organisms, systems, and techniques used

Mouse; *Saccharomyces cerevisiae* (Baker's yeast); Mammalian cells in culture. Transcriptomics and phospho-proteomics; genome editing; classical and molecular genetics.

Legends to figures :
A. Mouse fibroblasts stained for DNA (blue), PER2 protein (green) and cytoplasmic phosphorylated PER2 (red).
B. Electrospray ionization source of a tandem mass spectrometer.





Marine Biology

Main research questions

- Evolution on the nervous system: from a neuronal network to a complex brain
- Learning and memory: what is common and what changes between different phylogenetic groups?
- Molecular role of Dopamine in memory processing

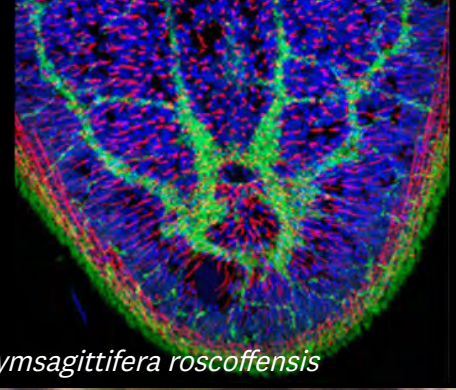
Organisms used

Nematostella vectensis (cnidarian); *Symsagittifera roscoffensis* (acoel); *Euprymna scolopes* ; *Sepia bandensis* (cephalopods)

Legends to figures :

- *Nematostella vectensis* features a neuronal network, but no central brain. Is it capable of learning?
- *Symsagittifera roscoffensis* is an acoel with remarkable regeneration possibilities. Actin is shown in red, DNA in blue and the neuronal network with a primitive “brain” in green.
- “Pepita”, our first *Sepia bandensis* bred in Fribourg. Squids have a complex nervous system, including one central brain and eight small brains, one per foot.

Nematostella vectensis



Symsagittifera roscoffensis

Sepia bandensis

Teaching

- Core courses from the 4 research options.
- Wide range of elective courses.
- For students aiming at becoming teachers at secondary level II (DEEM, LDM).
- Students taking this option must complete the 90 ECTS with 30 ECTS of another program, corresponding to the second teaching domain.
- The 120 ECTS options are also eligible for future teachers at secondary level II, with or without a second teaching domain.

Perspectives with this Master degree

- Academic research in molecular life and health sciences.
- Fundamental education to pursue with a PhD thesis.
- Teacher at secondary level II.
- Work in pharmaceutical companies.
- Laboratory manager.
- Work as a salesperson in biotech companies or for laboratory equipment.
- Work in patent offices.
- Work in regulatory affairs.
- Get trained as a medical analyst (FAMH)

Visit our webpage:

- https://www.unifr.ch/bio/en
- https://www.unifr.ch/bio/en/studies/master/

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