Master in Medical Biology
Program

1615-1630  Welcome, General Information (Prof. Olivier Staub)
1630-1645  Track in Metabolism  (Prof. Christian Widmann)
1645-1700  Track in Pharmacology & Toxicology (Dr. Marie-Christine Broillet)
1700-1715  Track in Immunology and Cancer (Prof. Sanjiv Luther)
1715-1730  Track in Neurosciences (Prof. Andrea Volterra)
1730-1830  Questions, Apéro (Cafeteria of the CIIL: Center of Immunity and Infection Lausanne-Epalinges)
Three types of master in biology at UNIL

http://www.unil.ch/eb-mb/home.html
(school of biology website)
Responsibles of Master in medical biology (MB)

Olivier Staub

Marie-Christine Broillet
Pharmacology & Toxicology

Sanjiv Luther
Immunology & Cancer

Christian Widmann
Metabolism

Andrea Volterra
Neurosciences
WHAT WE OFFER

- Studies of the **molecular mechanisms** involved in **physiology and human pathophysiology**

- Initiation to **translational research** (Interface between basic research and clinical applications)

- Development of **new diagnostic and therapeutic tools**
OUR COMPETENCES

- Immunology and Cancer
- Metabolism, obesity, diabetes, and cardiovascular pathologies
- Pharmacology & Toxicology
- Medical Microbiology
- Neurosciences

Master in Medical Biology
Who are we?

Pharmacology

Biochemistry, Ludwig, Oncology
Or Immunology and Cancer

Physiology

Fundamental Neurosciences

EPFL

CHUV/Cery

LAD

Debiopharm

UNIGE

Almost 100 laboratories provide First step or Master projects
Our sites

Dept. of fundamental Neurosciences

Dept. Of Physiology

Dept. of Pharmacology and Toxicology

CHUV

CIG

Infection and immunity center (CIIL)

Cery
Organization of the studies: 3 semesters (90 ECTS)

- **Module 1**: Compulsory and optional courses (15 credits ECTS)
  - Semester 1: Sept-Dec 2017
- **Module 2**: First step research project (15 credits ECTS)
  - Feb – April 2018
- **Module 3**: Filières / Commun course (15 credits ECTS)
  - Semester 2: Feb-May 2018
- **Module 4**: Master Research Project: A personal project (45 credits ECTS)
  - May 2018 – Jan 2019

Exams

Defense of the Master project
Semester 1

Module 1

- Courses:
  - Cell Biology & Signalling
  - Medical Microbiology
  - Cardiovascular diseases
  - From memory to memory loss: Alzheimer Disease
  - Immunology & Cancer
  - Metabolic Diseases
  - Publish or Perish: How to increase the impact of your research by a patent
  - Scientific Method & Communication

- Optional modules:
  - Training in animal experimentation
  - Introduction to clinical research

Module 2

- First step project (initiation work)
Semesters 2 and 3

Module 3
- Specializations (Tracks / «Filières»)
  - Immunology & Cancer
  - Metabolism
  - Neurosciences
  - Pharmacology & Toxicology

- Common practical classes
  - Introduction to clinical medicine
  - Bioinformatics & Biostatistics
  - E-learning in «Bio-Informatics»

Module 4
- Master Project
  - In many laboratories of the affiliated research departments of UNIL, the CHUV or outside laboratories of the Master's degree (LAD, UNIGE, EPFL, NIHS)
  - Mobility
  - Medical Biology Poster Day
Medical Biology Poster Day
28.10.2016 (CHUV)
Introductory Course in Laboratory Animal Science

Aims

- To acquire the practical and theoretical skills with laboratory animals as requested by legislation (20h theory + 20h practical)

- To get the federal accreditation to perform animal experimentation (Swiss federal veterinary office)
Who is concerned by this module?

- This training module is relevant to all students working with animals during their master project.

- Conditions for registration to this module:
  
  • The host laboratory must have permission to work with animals
  
  • Students must be announced to the cantonal veterinary office
Introduction to Clinical Research
(1st semester: 1 week course)

Prof. Luc Tappy, Department of Physiology
021 692 55 41, Luc.Tappy@unil.ch
Aims of the clinical research course

- Get acquainted with the **fundamentals in Clinical Research**
  - Study design
  - Statistics
  - Ethics
  - Regulations and legal requirements, safety, quality controls

- Learn **specific skills** for human research
  - Insert iv lines, collect blood samples
  - Know how to react in case of an emergency
  - Ressuscitation

- **Examples of biological research** integrated to clinical care
  - High Blood Pressure
  - Metabolic diseases
Introduction to clinical medicine (2\textsuperscript{nd} semester)

Coordinator: Prof. Olivier Bonny  
Department of Pharmacology & Toxicology  
Olivier.Bonny@unil.ch  
Tel. 021 692 54 17

- 7 Monday afternoons, Feb – April 2018
- Four modules:
  - Lectures by clinical doctors, MD-PhDs or PhDs involved in biomedical research
  - Clinical exercises (ECG, blood pressure measurement)
  - Clinical demonstrations (dermatology, neuropsychology, bedside approach of a patient,...)
  - Presentation of career possibilities in a clinical environment
Aims of this course in clinical medicine (2nd semester)

- Bring a flavor of clinical medicine and clinical research to the Master students.
- Introduce the master students to the way of thinking and the specific vocabulary of the MDs.
- Show opportunities for fruitful interactions with the world of clinical medicine (translational research).
Biostatistics: 2nd and 3rd semester

Coordinator: Dario Diviani
Département de Pharmacologie et de Toxicologie
email: ddiviani@unil.ch

Objectifs:

Put into practice the theoretical concepts of bioinformatics and biostatistics taught in the Bachelor thanks to the practical problems encountered during the Master work.
Course E-learning in Biostatistics

• Introduction to the basic concepts of probability, common distributions, statistical methods, and data analysis, via online material

• Small quiz in the beginning in order to assess your basic biostatics skills.

• Using the webpage you will learn basic statistics following two strategies:

  - **Strategy A**, problem-based approach

    The web page is designed in such a way that the students can work their way through a Master experiment consisting of three “sub-experiments”. This master experiment consists of a representative collection of typical experiments done in the wet lab and are designed in such a way that commonly used statistical tests will be addressed.

  - **Strategy B**, theory-based approach

    In parallel, the students may also study statistical theory going from the most basic to more complex statistical concepts and tests.

• The two main strategies are connected and the students can easily change between the two approaches.
Programme objectives

- Acquire **advanced knowledge** in medical biology. Both the fundamental and clinical aspects are explored in depth, with the aim of achieving an integrated understanding.

- Learn important **lab techniques**

- Acquire **key research skills**

- **Apply acquired knowledge and skills** to cutting edge research projects

- Provide you with **soft skills** (analysis, capacity of rapid learning, oral and written communication, development and defense of projects in front of experts or other actors (economists, politician,….)

- Prepare you for the **professional** world (academic, industrial,…..)
PERSPECTIVES

- **Multidisciplinary training** in various domains of biomedical sciences (neurosciences, metabolism, cancer, immunology, cardiovascular, pharmacology)

- Acquisition of **advanced skills in basic and translational research** (genomics, imaging, electrophysiology, transgenesis, ...)

- **Perspectives, careers**
  - academic research
  - medical laboratories
  - pharmaceutical / biotech
  - hospital setting
  - toxicological evaluations
  - teaching
  - ...

**Master in Medical Biology**
Want to know more?

http://www.unil.ch/eb-mb/home.html

For further questions: please contact School of biology (Laura Junod) or Prof. O. Staub (Olivier Staub@unil.ch)
Next: Presentation of the four specializations

- Immunology & Cancer
- Pharmacology & Toxicology
- Neuroscience
- Metabolism

http://www.unil.ch/eb-mb/home.html
Metabolism study track

METABOLISM the sum of the chemical reactions in an organism
Research and teaching

Department of Physiology
Research and teaching

Cancer Cachexia

Lipid and proliferation of neurons

[Image of person pointing to graph]

[Image of brain with gears and light bulb]

[Image of clock with time periods marked]

[Image of person flexing arm]

[Image of person giving presentation]
Research and teaching
### 8th semester (2017)

<table>
<thead>
<tr>
<th>Morning</th>
<th>7 weeks</th>
<th>Afternoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courses in the morning</td>
<td>2 weeks</td>
<td>Exam preparation</td>
</tr>
<tr>
<td>Work at home for the courses (e.g. paper preparation)</td>
<td>Exam</td>
<td>Master project</td>
</tr>
<tr>
<td>February 20 to April 10</td>
<td>April 11 to April 23</td>
<td>April 24 to April 28</td>
</tr>
<tr>
<td><strong>Visit in the clinic</strong>&lt;br&gt;(2 students at a time during one morning)</td>
<td>May 1st to June 1st</td>
<td></td>
</tr>
</tbody>
</table>
Exams and evaluation (8th semesters)

Two final grades
Theory and practical

Written exams  April 24, 2017
Four questions, 4 hours

Oral exams  April 27, 2017
Two randomly chosen questions; 30 minute preparation; 2x15 minute exam

Evaluation
Mean of the written and oral exams; pass with 4 and above

Theory

Practical

Paper presentation (evaluated by teachers) ½
Exercises and workshops (evaluated by me) ¼
Grant proposal (evaluated by tutors) ¼
Master project presentation (evaluated by a panel of scientists) ¼

Evaluation
Pass with 4 and above
Metabolism study track

METABOLISM IS LIFE
FILIÈRE
PHARMACOLOGY
AND TOXICOLOGY

AGE 0-4
AMOCELIN

4-12
RITALIN

12-18
APPETITE
SUPPRESSANTS

18-24
NO-DOZ

24-38
PROZAC

38-65
VIAGRA

65——EVERYTHING
ELSE

Master in Medical Biology
The majority of drugs act on receptors, pumps or ion channels

Chemical or physical message

Drug target

ions
neurotransmitters
hormones
odors
light
...

Pharmacology studies how drugs interact within biological systems to affect function
1. Fundamental Principles
   Pharmacokinetics–Pharmacodynamics
   Pharmacogenetics—genomic (personalized medicine)

2. Practical Aspects
   Drug design and discovery
   Drug development
   Optimization of drug treatment
   Regulations and Regulatory agencies

2. System Pharmacology
   Neuropharmacology
   Cardiovascular pharmacology
   Endocrine pharmacology
   ...

3. Principles of chemotherapy
   Cancer
   Infectious diseases

4. Toxicology
   Pharmacotoxicology
   Food toxicology
   Ecotoxicology
   (e-learning, visit)
E-learning activities

"It is ironic to think that man might determine is own future by something so seemingly trivial as the choice of an insect spray."

Rachel Carson, Silent Spring, p.8
A whistleblower: Rachel Carson

Rachel Carson

Rachel Carson was born on May 27, 1907, in Pennsylvania and died on April 14, 1964, in Maryland, as a consequence of a heart attack occurred after several years of illness (she was diagnosed with breast cancer). As a professional marine biologist, she worked for the Bureau of Fisheries and the Fish and Wildlife Service, before dedicating herself almost exclusively to writing in the fifties, mostly as a result of her passion for environmentalism and popularization. She has been ranked by Time magazine as one of the most influential women of the twentieth century. See GRAHAM, Frank Jr., November-December 1978: Rachel Carson.

Silent Spring

Silent Spring is the fourth book written by Rachel Carson and it was first published in The New Yorker magazine in the June 16, June 23 and June 30, 1962 issues, and subsequently published in its entirety by the publisher Houghton Mifflin (Boston) on September 27, 1962. Considered one of the most important books in the history of the U.S. environmental movement, Silent Spring systematically analyzes and documents for the first time the possible negative effects of massive and indiscriminate use of pesticides.

Throughout the 17 chapters of Silent Spring, Carson gives us a careful and rich in testimonies analysis of pesticide use in the U.S., their impacts on different natural environments and their inhabitants, and the
Visit of a water purification plant
(STEP, Vidy, Lausanne)
Visit of TRIDEL a waste recycling plant
Visit of TRIDEL a waste recycling plant
Program

- Seminar Series on «Drug discovery & development» with speakers performing research in industry

- Optional PD courses: Inflammation and cancer
  Poisonous and hallucinogenic plants
Visit of an INDUSTRY research center
...Problem-based learning activities will provide critical thinking about the Pharma industry... with precise examples of drug development from the finding of an interesting active principle to a commercialized drug to... (regulatory affairs, pharmacovigilance,...ecopharmacovigilance)
Involved teachers
Department of Pharmacology and Toxicology

Bugnon 27
1005 Lausanne
What we offer

- Entry in the world of pharmaceutical drugs with theoretical and practical knowledges

- Active awareness of the different toxicology issues

- Multidisciplinary approaches: neurosciences, cardiovascular, cancer, metabolism, etc.

- General Basis for future careers in biomedical and pharmaceutical research
Job Openings

Academic Research
Pharma
Biomedical Industries
Biotechs
Lab Med
Hospitals (FAMH)
Tox Labs
Patent Offices
Regulatory affairs
Governmental Agencies
Teaching
What we offer:

- Finish classes and evaluations in April 2018
- The filière pharmacology and toxicology offers >20 projects
- Learn and apply advanced techniques
- Work in a caring and collegial atmosphere
Learn and apply advanced techniques
- Cell cultures
- Imaging
- Electrophysiology
- Transgenesis
- Different animal models
WANTED

…students who are motivated, curious and involved…

Questions & Infos
M.-C. Broillet
DPT, Bugnon 27, bureau 315
021/692.53.69
mbroille@unil.ch
Filière Immunology and Cancer

Courses cover basic physiology, diseases and treatments

Sanjiv Luther, Department of Biochemistry

Master in Medical Biology
Why should you study Immunology and Cancer at UNIL?
Immunology and Cancer (IC)

Dangers from outside

- Infections (viruses, fungi, bacteria, parasites)

Dangers from inside

- Autoimmunity

Subject: highly disease-relevant
Cause of death

Infections

Subject: concerns everybody and all age ranges.
And: need for new vaccines and therapies!

Cancer

Lung: 1.4 mio
Stomach: 0.8 mio
Liver: 0.7 mio
Colon: 0.6 mio
Breast: 0.5 mio
Genital: 0.3 mio
Lausanne: lot of expertise in immunology and cancer

Biochemistry Department

Ludwig Center /Oncology

CHUV Departments

EPFL (selected)

HSeT

More than 35 group leaders provide Master projects and give lectures

Master in Medical Biology
CIIL: Center of Immunity and Infection Lausanne-Epalinges

Newly renovated UNIL research campus (since 2014).
One of Europe’s biggest centers dedicated to **immunology and oncology research!**

- Several institutions under one roof
- > 350 scientists
- > 50 research groups
- Basic and translational research
- International atmosphere, many students
- Many seminars and courses
- Modern animal facilities, technology platforms, restaurants etc.
Two new cancer research centers

January 2013

2018: Agora Cancer Center (Bugnon)

Space for 400 scientists and clinicians

May 2015: Ludwig Cancer Research invests 100mio sFr. in Epalinges over the next 10 years, including a new research building
What is the course program?
Master in Immunology and Cancer

1st semester
Fall semester
Christmas

- Lectures, seminars
- 1st step project
- Pre-master

2nd semester
Spring semester
Mid-may

- Lectures
- PW
- Lectures
- PW
- Eval.
- Master thesis

3rd semester
Fall semester
Christmas

- Master thesis

Review the basic knowledge and major concepts

To understand the diseases, means of prevention and therapies

PW: practical work
Eval.: Evaluation (exam)

To be able to study them by yourself
Website: Immunology and Cancer

Welcome to the Immunology and Cancer course

This website is designed for students attending the Immunology and Cancer course for the second semester of the Master (MSc) in Medical Biology.

The left hand pane lists all materials that are available for your use:

- Program: the detailed program of the course.
- Lecture handouts: the downloadable courses of the teachers (posted 24h before each course).
- Lecture prerequisites: This is content that you are required to read before the lecture starts. The immunity will be held on Wednesday, March 28.
- Online teaching: eLearning activities including:
  - One article-based learning (ABL) in Proteomics & Cancer
  - One article-based learning (ABL) in Immunology
  - One case-based-learning (CBL) in Immunology & Cancer
  - Two web-assisted histology practical sessions: one on immunology and another one on.
- Journal club: the list of articles to be presented by students individually.
- Practicals: the manuals for the TP of Proteomics and Immunology.
- Online resources: This additional material is intended to support the Immunology lectures with material to help you visualize how the immune system works. This material has been developed by the HiSiF Group.
- Went to learn more: more web pages on immunology and statistics for those who want to deep.

All the material offered in the portal will remain accessible during the entire training course of the student each year by sending an email to Nathalie Delaroche.

Enjoy the website!

Tests of knowledge (QCM)

Training site: ‘Basics in Immunology and Cancer’

Encyclopedia, animations

Documents: courses and practicals, annotated publications, exercises etc.

http://unil.bio-med.ch

(restricted access)
1st semester: Immunology and Cancer

Immunology (12h):
Prof. W.Held: *Innate immunity*
Prof. S.Luther: *Adaptive immunity*

Biology of Cancer (12h):
Prof. D. Speiser: *Clinical aspects*
Prof. F. Martinon: *Molecular aspects*

Course: Overview of basic concepts as well as in depth lectures
Pre-master project: A wide and diverse choice of laboratories
2nd semester: Immunology and Cancer

In-depth lectures: From basic science to clinical cases and therapies

Courses by more than 30 specialists in:

- key aspects of immunology and cancer
- autoimmune diseases, infections, types of cancer
- prevention of infections (vaccines)
- therapies (cancer)
- development of drugs

8 weeks of courses
### 2nd semester: Immunology and Cancer

#### Immunology

<table>
<thead>
<tr>
<th>C Immunology II</th>
<th>S. Luther (SL)</th>
<th>Introduction, Lymphoid organs</th>
<th>6h</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. Thome (MT)</td>
<td>S. Luther (SL)</td>
<td>Signaling in lymphocytes</td>
<td>6h</td>
</tr>
<tr>
<td>W. Held (WH)</td>
<td>W. Held (WH)</td>
<td>NK-cells, Innate lymphoid cells</td>
<td>4h</td>
</tr>
<tr>
<td>F. Tacchini (FTC)</td>
<td>F. Tacchini (FTC)</td>
<td>Macrophages, neutrophils, T cell differentiation</td>
<td>6h</td>
</tr>
<tr>
<td>G. Guarda (GG)</td>
<td>G. Guarda (GG)</td>
<td>Signalling in innate immunity</td>
<td>2h</td>
</tr>
<tr>
<td>P. C. Ho (PCH)</td>
<td>P. C. Ho (PCH)</td>
<td>Metabolism of T cells</td>
<td>3h</td>
</tr>
</tbody>
</table>

#### Immunology III

<table>
<thead>
<tr>
<th>C Immunology III</th>
<th>S. Luther (SL)</th>
<th>Autoimmunity and allergy</th>
<th>6h</th>
</tr>
</thead>
<tbody>
<tr>
<td>H. Acha (HAO)</td>
<td>M. Perreau (MP)</td>
<td>Acute and chronic infections</td>
<td>5h</td>
</tr>
<tr>
<td>D. Valin (DV)</td>
<td>D. Valin (DV)</td>
<td>Mucosal immunity</td>
<td>4h</td>
</tr>
<tr>
<td>B. Marsland (BM)</td>
<td>B. Marsland (BM)</td>
<td>Microbiome of gut and lung</td>
<td>4h</td>
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</tbody>
</table>

**Total: 46h**

#### Cancer

<table>
<thead>
<tr>
<th>C Cancer II</th>
<th>P. Romero (PR)</th>
<th>Epigenetics of cancer</th>
<th>3h</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Raggi (NR)</td>
<td>D. Gfeller (DG)</td>
<td>Genetics of antitumor immunity, omics</td>
<td>2h</td>
</tr>
<tr>
<td>E. Missiaglia (EM)</td>
<td>E. Missiaglia (EM)</td>
<td>Cancer genetics and heterogeneity</td>
<td>4h</td>
</tr>
<tr>
<td>T. Petrova (TP)</td>
<td>J. Joyce (JJ)</td>
<td>Tumor invasion and metastasis</td>
<td>4h</td>
</tr>
<tr>
<td>L. Fajas (LF)</td>
<td>L. Fajas (LF)</td>
<td>Metabolism of cancer cells</td>
<td>2h</td>
</tr>
<tr>
<td>D. Hanahan (DH)</td>
<td>D. Hanahan (DH)</td>
<td>Cancer: a summary</td>
<td>2h</td>
</tr>
</tbody>
</table>

**Total: 31h**

#### Cancer III

<table>
<thead>
<tr>
<th>C Cancer III</th>
<th>P. Romero (PR)</th>
<th>HPV cancers, vaccine (tumor example)</th>
<th>4h</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Nardelli (DN)</td>
<td>O. Hantschel (OH)</td>
<td>Leukemias (tumor example)</td>
<td>2h</td>
</tr>
<tr>
<td>A. Wolfer (AWo)</td>
<td>A. Wolfer (AWo)</td>
<td>Breast cancer (tumor example)</td>
<td>3h</td>
</tr>
</tbody>
</table>

**Total: 18h**

#### Treatments

<table>
<thead>
<tr>
<th>C Treatments</th>
<th>P. Romero (PR)</th>
<th>Antitumor immunity/immunotherapy</th>
<th>5h</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Collin (NC)</td>
<td>N. Collin (NC)</td>
<td>Vaccines</td>
<td>4h</td>
</tr>
<tr>
<td>S. Peters (SP)</td>
<td>S. Peters (SP)</td>
<td>Drug development</td>
<td>4h</td>
</tr>
<tr>
<td>M. C. Vozenin (MV)</td>
<td>M. C. Vozenin (MV)</td>
<td>Radio- and Chemo-therapy</td>
<td>2h</td>
</tr>
</tbody>
</table>

**Total: 11h**

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Learn from the specialists (biologists and medical doctors)

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**Master in Medical Biology**
2nd semester: Immunology and Cancer

Interactive teaching, group work, at the bench / computer

‘high tech’ practical work (PW): T lymphocyte responses, cancer

‘Proteomics’ (mass spectrometry)

5 color flow cytometry

Histology

Interactive teaching, group work, at the bench / computer
Practical work / Exercises

**Immunology**
- Proteomics
- E-learning/bioinformatics
- Molecular/cellular assays
- Histology
- Flow cytometry
- E-learning

**Cancer**
- Mass spectrometry (T cells)
- ‘Big data’ analysis in cancer
- CD8 T cell killing, MHC binding assay, 3D modelling, ELISA/ELISPOT
- Lymphoid organs
- Human tissues and tumors
- Lymphoma
2nd and 3rd semester: Immunology and Cancer

Master Thesis
Master Thesis

7-8 months (100%)

Learn the work at the bench and within a team. Discover the fascinating world of « research ».
Research groups participating in this master

http://www.unil.ch/ib
http://www.chuv.ch/chuv_home/recherche

http://www.unil.ch/licr
http://www.cancer-chuv.ch/
We look for:
Highly motivated students with strong interests in the subject

We offer:
a modern training,
top labs to do research,
....all you need to get an exciting job!
International PhD program in ‘Immunology and Cancer’

40 research laboratories
A wide choice of theoretical and practical courses
http://www.unil.ch/cancer-immunology
Epalinges campus: a vibrant biotech hub

2009
Biopôle I + II

2011
Biopôle III

2014, 2018 + ...
Biopôle VI, V...

www.biopole.ch
Immunology and Cancer: need more information?

CIIL, Department of Biochemistry, PhD program:
www.unil.ch/ib
http://www.unil.ch/fbm
www.unil.ch/cancer-immunology

School of Biology: Master in medical biology
www.unil.ch/ecoledebiologie

Master in immunology and cancer:
unil.bio-med.ch (restricted access)

Francoise.Flejszman@unil.ch (secretary)
Sanjiv.Luther@unil.ch

Come and join us in the Immunology and cancer branch!
Biomedical Master: « Filière » Neurosciences
Projects in neuroscience

Responsables: Andrea Volterra et Jean-René Cardinaux

http://www.unil.ch/eb-mb/home/menuinst/tracks/neuroscience.html
Curriculum en Neurosciences à l’EB

• 1ère année: tissu nerveux  
  (module: biologie cellulaire des tissus)
• 2ème année: introduction aux neurosciences
• 3ème année: neurobiologie  
  (module: physiologie des systèmes complexes)
• + Courses optionnels
• Master biomédical: filière Neurosciences
• ….Doctorat en Neurosciences UNIL-UNIGE
Why a course on Alzheimer’s disease (AD)?

- Is the **most diffuse form of senile dementia**, 60-80% of cases among aged people
- Strucks **5-10%** of people **older than 65** and up to **45%** of people **older than 85**.
- In **2040** it is predicted to struck **3-fold more** subjets than today, which makes this disease one of the main public health problems for our society

We are in a **biomedical master**, so we are interested in showing you **aspects of neuroscience related to human pathologies**

**AD is among the most diffuse and challanging human brain diseases**

**It poses questions at many levels**: clinical (diagnosis, prognosis, therapy), experimental (pathogenesis, mechanisms), therapeutic (approaches), and also social and ethical.

In the end, we hope it will give you an idea of the **challanges** Neuroscientists are faced and of the **strategies** they are developing to understand and fight against brains diseases

In 1906, Aloïs Alzheimer described for the first time the anatomical alterations he observed in the brain of a 51 years-old patient, Auguste D, struck by dementia.
Neurosciences course (18h C + 4h S) / Biomedical Master, 1st semester / fall 2016

From memory to memory loss: Alzheimer’s disease

Coordination:
Andrea Volterra, DNF, UNIL & Jean-René Cardinaux, CNP, CHUV

<table>
<thead>
<tr>
<th>Date</th>
<th>Teacher</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tue. Sept 27th 2016, 13h00-14h00</td>
<td>A.Volterra</td>
<td>Introduction to the module – remind about neurobiology of memory</td>
</tr>
<tr>
<td>Tue. Sept 27th 2016, 14h00-15h00</td>
<td>J. Popp</td>
<td>Epidemiology and clinical aspects of Alzheimer’s disease</td>
</tr>
<tr>
<td>Wed. Sept. 28th 2016, 10h00-11h00</td>
<td>J.F. Démonet</td>
<td>Alzheimer's disease and related disorders: a neurocognitive account</td>
</tr>
<tr>
<td>Wed. Sept. 28th 2016, 11h00-12h00</td>
<td>J.F. Démonet</td>
<td>Diagnostic aspects of Alzheimer’s and other dementing diseases.</td>
</tr>
<tr>
<td>Mon. Oct. 3rd 2016, 10h00-12h00</td>
<td>P. Steullet</td>
<td>Ethiopathological cascades and risk factors: focus on the β-amyloid protein</td>
</tr>
<tr>
<td>Tue. Oct. 4th 2016, 13h00-15h00</td>
<td>B. Riederer</td>
<td>Proteopathies (Tau protein, neuronal cytoskeleton) and « aggresome » (ubiquitin) : key pathological components?</td>
</tr>
<tr>
<td>Tue. Oct. 11th 2016, 10h00-12h00</td>
<td>A. Volterra</td>
<td>Transgenic models : Alzheimer’s disease as synaptic function pathology</td>
</tr>
<tr>
<td>Tue Oct 18th 2016 10h00-12h00</td>
<td>JR. Cardinaux</td>
<td>Genetic and epigenetic aspects of memory at synapses: functions and dysfunctions</td>
</tr>
<tr>
<td>Mon Oct. 24th 2016 8h00-10h00</td>
<td>B. Riederer</td>
<td>Students’ papers presentations</td>
</tr>
<tr>
<td>Tue Oct. 25st 2016 10h00-12h00</td>
<td>F. Tschudi-Monnet</td>
<td>The role of glial cell : neuroinflammation in Alzheimer’s disease</td>
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<tr>
<td>Mon Oct. 31st 2016 10h00-12h00</td>
<td>P. Steullet</td>
<td>Present pharmacological therapy of Alzheimer’s disease</td>
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<tr>
<td>Tue Nov. 1st 2016 15h00-17h00</td>
<td>A. Pfeifer</td>
<td>Therapeutic hopes : vaccines etc. – the strategy of a pharmaceutical company</td>
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<tr>
<td>Mon Nov. 7st 2016 10h00-12h00</td>
<td>F. Tschudi-Monnet</td>
<td>Students’ papers presentations</td>
</tr>
</tbody>
</table>
Filière Neurosciences

Teachers from both basic and clinical departments UNIL-CHUV, including the departments of Basic Neurosciences, Physiology, Pharmacology, Medical Genetics, the Clinical Neuroscience Department (Neurology, Neurosurgery and Neuropsychology Services), Anesthesiology and Ophthalmology Services, the Center of Psychiatric Neuroscience, as well as from the Brain & Mind Institute, EPFL)

For information: Andrea.Volterra@unil.ch, DNF

6 Modules
Biomedical Master

Filière Neurosciences

6 Modules

Brain Development

Sensory Functions

Neuron-Glia Biology

Neuronal Death and Repair

Modulation of Synaptic Transmission

Introduction to Psychiatric Neuroscience
<table>
<thead>
<tr>
<th>Module</th>
<th>Responsible</th>
<th>Room</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain Development (Module 1)</td>
<td>J.-P. Hornung (DNF)</td>
<td>Bugnon 9, niv. entrée, salle APP (DNF)</td>
<td>15C+3S+2TP</td>
</tr>
<tr>
<td>Sensory Functions (Module 2)</td>
<td>J.P: Hornung (DNF)</td>
<td>Bugnon 9, niv. entrée, salle APP (DNF)</td>
<td>24C</td>
</tr>
<tr>
<td>Neuron-glia biology (Module 3)</td>
<td>A. Volterra (DNF)</td>
<td>Bugnon 9, niv. entrée, salle APP (DNF)</td>
<td>18C + 2S</td>
</tr>
<tr>
<td>Modulation of Synaptic Transmission (Module 4)</td>
<td>D. Fasshauer (DNF)</td>
<td>Bugnon 9, niv. entrée, salle APP (DNF)</td>
<td>14C + 2S</td>
</tr>
<tr>
<td>Neuronal Death and Repair in the CNS (Module 5)</td>
<td>N. Toni (DNF)</td>
<td>Bugnon 9, niv. entrée, salle APP (DNF)</td>
<td>16C</td>
</tr>
<tr>
<td>Introduction to Psychiatric Neuroscience (Module 6)</td>
<td>K. Do (CNP)</td>
<td>Bugnon 9, niv. Entrée, salle APP (DNF)</td>
<td>20C</td>
</tr>
</tbody>
</table>

Courses: mid February – end of March

Exams:
- written: on modules 1-3
- oral: on modules 4-6
- practical: on master project + data presentation
Module 1 – Brain Development
*JP Hornung, JR Cardinaux, Y Arsenijevic*

- Cerebral cortex development
- Patterning and cell lineage in the vertebrate nervous system
- Neurogenesis
- Epigenetic control
- Journal Club
  - NEW – Neuroanatomy practical

Module 2 – Sensory Functions
*JP Hornung, I Décosterd, M. Murray, MC Broillet, A Croquelois,*

- Pain
- Olfaction
- Audition
- Gustation
- Vision
- Cortical plasticity
- Multisensorial integration
Module 3 – Neuron-glia Biology
A Volterra, L. Pellerin, P. Bezzi, F Tschudi-Monnet,

- Glial cells: introduction and historical perspective
- Multimodal control of the territory by astrocytes
- Neurometabolic, neurovascular coupling and brain imaging
- Gliotransmission
- The blood brain barrier
- Neuroinflammation and brain diseases: Multiple Sclerosis
- Journal club

Module 4 – Modulation of Synaptic Transmission
D. Fasshauer, A Lüthi, R Stoop, JL Martin, E Pralong, Varoqueaux F

- Molecular mechanisms of neurotransmitter secretion
- Post-synaptic receptors
- Synaptic plasticity: LTP and LTD
- Role of the neurotrophic factors NGF and BDNF
- Pharmacological modulation of synaptic transmission
- Journal club
Module 5 – Neuronal Death and Repair in the CNS
N. Toni, J Pujal, C Widmann, L Hirt, D Moore, JF Brunet, N Deglon

- Cell death: introduction; physiological neuronal death in development
- Excitotoxicity and neuroprotection against excitotoxicity
- Apoptosis
- Cerebral ischemia: strategies for treatment
- Parkinson’s Disease
- Adult Neurogenesis and Neuronal Stem Cells
- Cell replacement and gene therapies

Module 6 – Introduction to psychiatric neuroscience
K. Do, P Steullet, F Magara, A Rougemont-Buecking, JR Cardinaux, P Marquet, JL Martin, P Baumann, D. Preissmann

- Genes-environment interactions in neurodevelopment and stress-associated disorders
- Environmental risk and epigenetic mechanisms in psychiatry
- Experimental models of psychiatric disorders: cognitive and emotional behaviours
- Addiction: psychopathology and neurobiological mechanisms
- Mood disorders: psychopathology and neurobiology of depression
- Schizophrenia: psychopathology, neurobiological mechanisms and therapy
The Neuroscience network UNIL-CHUV

>30 Labs for Master Projects

Department of Basic Neurosciences (DNF)

Department of Physiology (DP)

Center for Integrative Genomics (CIG) in Dorigny

Department of Clinical Neuroscience (DNC)

- Neurology
- Neuropsychology and neurorehab.
- Neurosurgery

Center of Psychiatric Neurosciences (CNP) in Céry

Radiology and Center for Biomedical Imaging (CIBM) at CHUV

Anesthesiology
CHUV
(at Bugnon)
Department of Clinical Neuroscience (DNC)
Bogdan.Draganski@chuv.ch
Ferah.Kherif@chuv.ch
Neuropsychology and neuro-rehabilitation Service
http://www.chuv.ch/neuropsy/nps_home.htm
Micah.Murray@chuv.ch (double affiliation: Center of Biomedical Imaging)
Alexandre.Croquelois@unil.ch
Marzia.De-Lucia@chuv.ch (affiliation: Center of Biomedical Imaging)
Neurology Service
http://www.chuv.ch/dsi/dsi_home/dsi_dep_med/dsi_dep_med_neuro.htm
Lorenz.Hirt@chuv.ch
Neurosurgery Service
http://www.chuv.ch/dsi/dsi_home/dsi_dep_chir/dsi_dep_chir_neuro.htm
Marc.levivier@chuv.ch
Nicole.deglon@chuv.ch
Liliane.Tenenbaum@chuv.ch
epralong@chuv.ch

Center of Psychiatric Neuroscience (CNP)
(Site de Céry)
http://www.chuv.ch/psychiatrie/dpc_home/dpc_recherche/dpc_cnp.htm
Benjamin.Boutrel@chuv.ch
jean-rene.cardinaux@chuv.ch
Kim.Do@chuv.ch
Chin.Eap@chuv.ch
Genevieve.Leuba@chuv.ch
Fulvio.Magara@unil.ch
Jean-Luc.Martin@unil.ch
Beat.Riederer@unil.ch (double affiliation: DNF)
Ron.Stoop@unil.ch

Responsible of neurosciences for the Master curriculum at FBM:
Prof. Andrea Volterra (andrea.volterra@unil.ch)
# Approaches and techniques available in the labs

<table>
<thead>
<tr>
<th>Cell cultures</th>
<th>Acute brain slices, organotypic slice cultures</th>
<th>Living animals</th>
<th>Humans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunoprecipitation, cell fractionation</td>
<td>ELISA, FACS</td>
<td>Immunohistochemistry, cytochemistry and western blotting, 2D gel electrophoresis, autoradiography</td>
<td>HPLC-MS</td>
</tr>
<tr>
<td>In situ hybridization</td>
<td>Real-time RT-PCR</td>
<td>RNA interference</td>
<td>Gene array</td>
</tr>
<tr>
<td>Viral vectors and in utero injection</td>
<td>Optical microscopy (epifluorescence, confocal, TIRF, time-lapse, Ca2+ and Na+ imaging, AFM, image analysis, morphometry)</td>
<td>Electron microscopy</td>
<td>fMRI</td>
</tr>
<tr>
<td>Patch-clamp electrophysiology, extracellular field potentials</td>
<td>Electroencephalography, telemetry</td>
<td>Behavioural tests (self-administration, operant conditioning, conditioned place preference, working memory, social interaction and other tests)</td>
<td></td>
</tr>
</tbody>
</table>

## Biochemistry
- Immunoprecipitation, cell fractionation
- ELISA, FACS
- Immunohistochemistry, cytochemistry and western blotting, 2D gel electrophoresis, autoradiography
- HPLC-MS

## Molecular Biology and Genetics
- In situ hybridization
- Real-time RT-PCR
- RNA interference
- Gene array
- Viral vectors and in utero injection
- Optical microscopy (epifluorescence, confocal, TIRF, time-lapse, Ca2+ and Na+ imaging, AFM, image analysis, morphometry)
- Electron microscopy
- fMRI

## Imaging: Electron/Optical/Brain Imaging
- Optical microscopy (epifluorescence, confocal, TIRF, time-lapse, Ca2+ and Na+ imaging, AFM, image analysis, morphometry)
- Electron microscopy
- fMRI

## Electrophysiology, EEG
- Patch-clamp electrophysiology, extracellular field potentials
- Electroencephalography, telemetry

## Behavioural tests
- Behavioural tests (self-administration, operant conditioning, conditioned place preference, working memory, social interaction and other tests)
Lemanic Neuroscience Doctoral School

The Lemanic Neuroscience Doctoral School (LNDS) organizes student training both in theoretical and experimental aspects of neuroscience. Research projects take place at affiliated laboratories in Geneva and Lausanne. Students receive their training through comprehensive coursework within the LN Program and by attending seminars, journal clubs and workshops. They are also encouraged, and often sponsored, to present their research at national and international neuroscience conferences. Facilitating interaction between students and senior researchers helps the students build a network for future collaboration and employment. Our graduates have successful careers in a variety of areas including academia, teaching, research foundations, industry and scientific editing.

LN students are welcome to play an active role in the workings of the program and other outreach events. Every year LN students get involved in organizing the LN Annual Meeting and the Brain Awareness Week. At the last FENS meeting (Geneva, July 12-16 2008), they organized and hosted the successful Jump-the-FENS’08 evenings for their European and world-wide colleagues. In the last three years many students have also supervised international PhD students and postdocs on lab projects at the PENS Imaging Training Center.

Lemanic strenght...

According to the American journal Science, the Lake Geneva region is considered to be the third most important study centre in Europe for neuroscience behind Oxford and Cambridge in Britain.
The National Centre of Competence in Research (NCCR) “SYNAPSY – Synaptic Bases of Mental Diseases” aims to discover the neurobiological mechanisms of mental and cognitive disorders, since one of the major challenges in psychiatry is to achieve a better understanding of how these illnesses originate. It is hoped that this research will lead to the development of improved diagnostic tools and therapeutic approaches. The NCCR Mental Disease focuses on the interface between preclinical research and clinical development, combining neuroscience with psychiatry. This research focus will help train a new generation of psychiatrists, who will possess both high clinical expertise and a sound knowledge of the basic neurobiological aspects of mental functions and dysfunctions.

**Home institutions:** EPF Lausanne, Université de Genève, Université de Lausanne

**Finances**
2010 – 2018: > CHF 30'000'000

**Directors**
Prof. Pierre Magistretti (EPF Lausanne, UNIL, CHUV)
Prof. Alexandre Dayer (UNIGE)