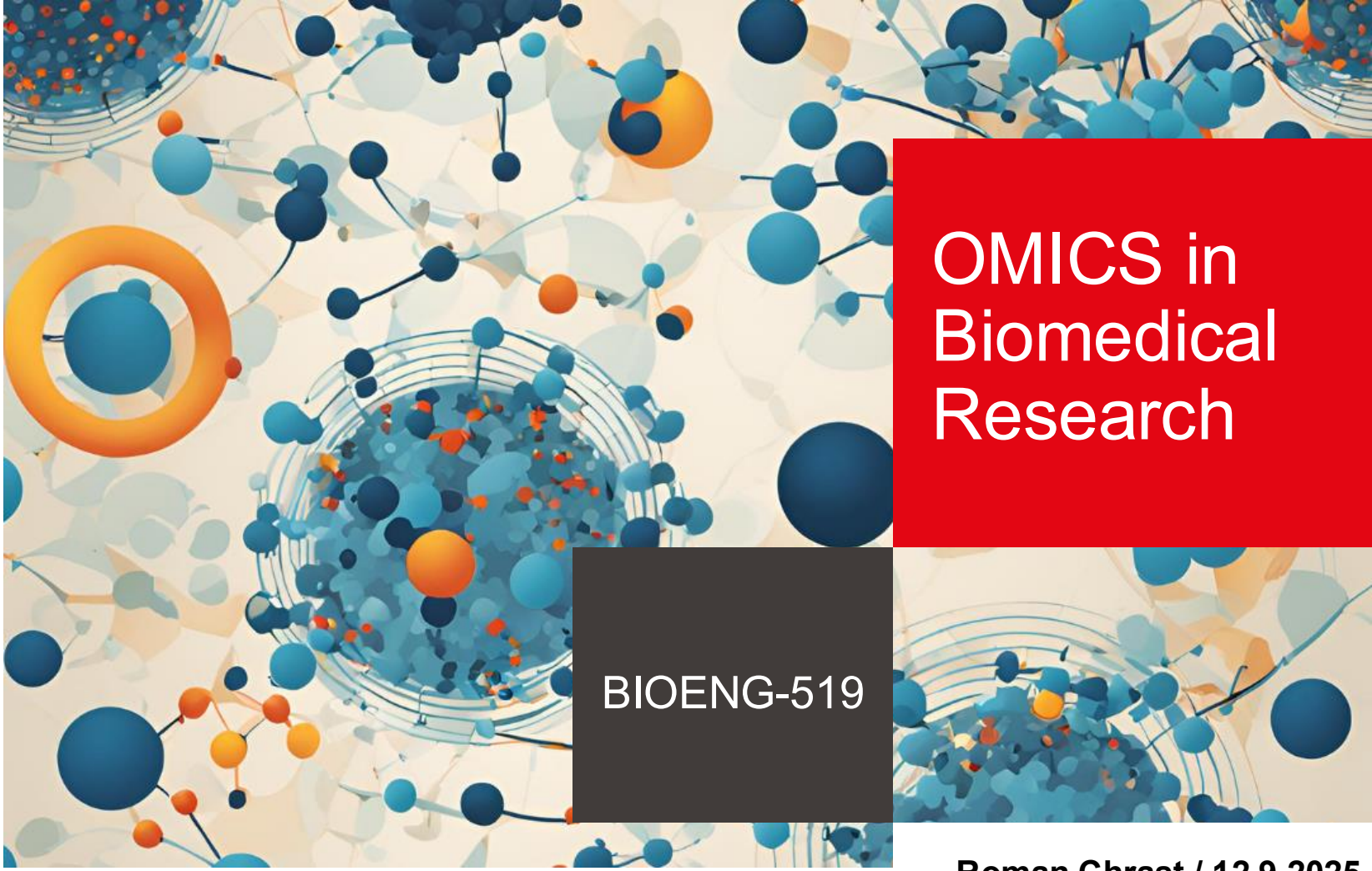


OMICS in Biomedical Research

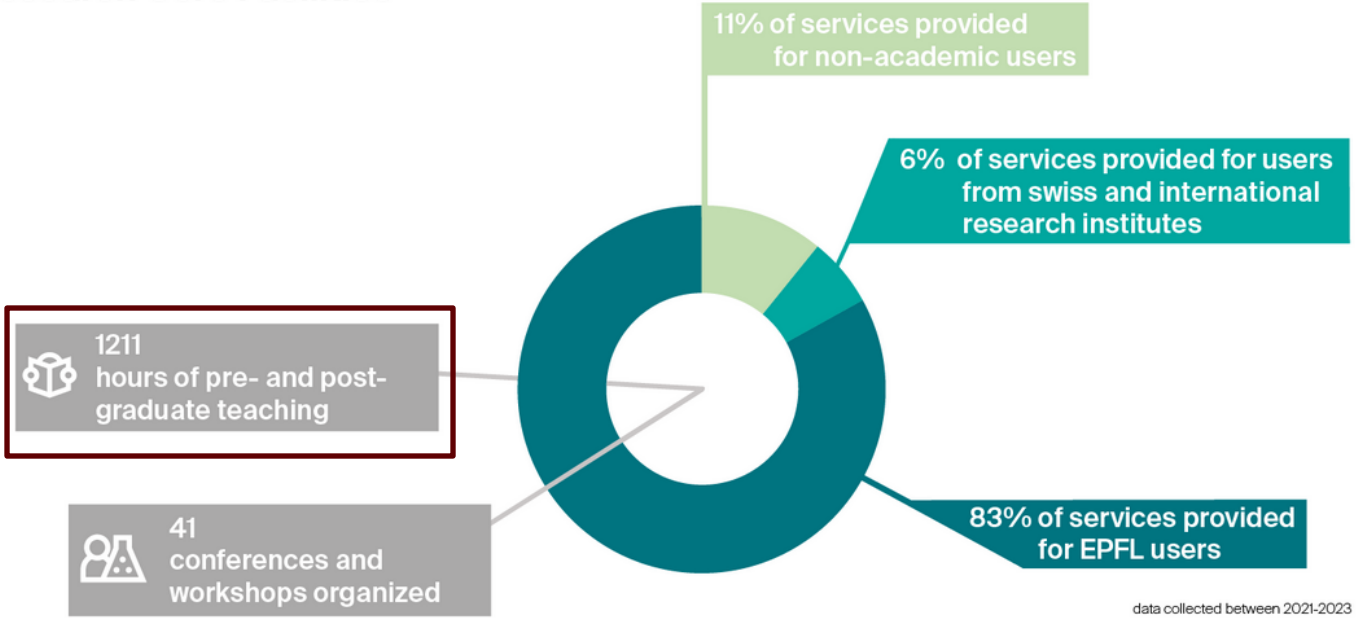
BIOENG-519

École polytechnique fédérale de Lausanne

Roman Chrast / 12.9.2025

SV Research Core Facilities (RCF)

11
Research Core Facilities



SV Research Core Facilities (RCF)












Head of RCFs **Roman Chrast**

Gene Expression Core Facility	Proteomics Core Facility	Flow Cytometry Core Facility	Bioinformatics Competence Center	Protein Production and Structure Core Facility	Bioimaging and Optics Facility	Biological Electron Microscopy Facility	Histology Core Facility	Biomolecular Screening Facility	Bertarelli Foundation Gene Therapy Facility	Bio-engineering and Organoids Facility
Head **Bastien Mangeat**	*Head* **Maria Pavlou**	*Head* **Miguel Garcia**	*Head* **Christian Iseli**	*Head* **Florence Pojer**	*Head* **Arne Seitz**	*Head* **Graham Knott**	*Head* **Jessica Sordet**	*Head* **Gerardo Turcatti**	*Head* **Bernard Schneider**	*Head* **Gaspard Pardon**

EPFL- Ecublens

CB Geneva

Agora Lausanne

Participating RCFs

Head of RCFs
Roman Chrast

Gene Expression Core Facility

Head
Bastien Mangeat

Proteomics Core Facility

Head
Maria Pavlou

Flow Cytometry Core Facility

Head
Miguel Garcia

Bioinformatics Competence Center

Head
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Protein Production and Structure Core Facility

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Biomolecular Screening Facility

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Gerardo Turcatti

Bertarelli Foundation Gene Therapy Facility

Head
Bernard Schneider

Bio-engineering and Organoids Facility

Head
Gaspard Pardon

Course organization

- ✓ Course will be held in person (no Zoom - no recordings)
- ✓ Practicals are mandatory
- ✓ Course material will be available via Moodle
- ✓ Exam

40% - 4 platform rotations
Genes to proteins (PTPSP) - Evaluation: Participation during platform rotation, student presentations
Proteomics (PCF) - Evaluation: Participation during platform rotation, quiz
Flow cytometry (FCCF) - Evaluation: Participation during platform rotation, quiz
Gene expression (PTEG) - Evaluation: Participation during platform rotation, report

60% - written exam during official exam session (for the written exam, each of the covered topics will count 1/5)

- ✓ Contact for general course organization related questions: roman.chrast@epfl.ch

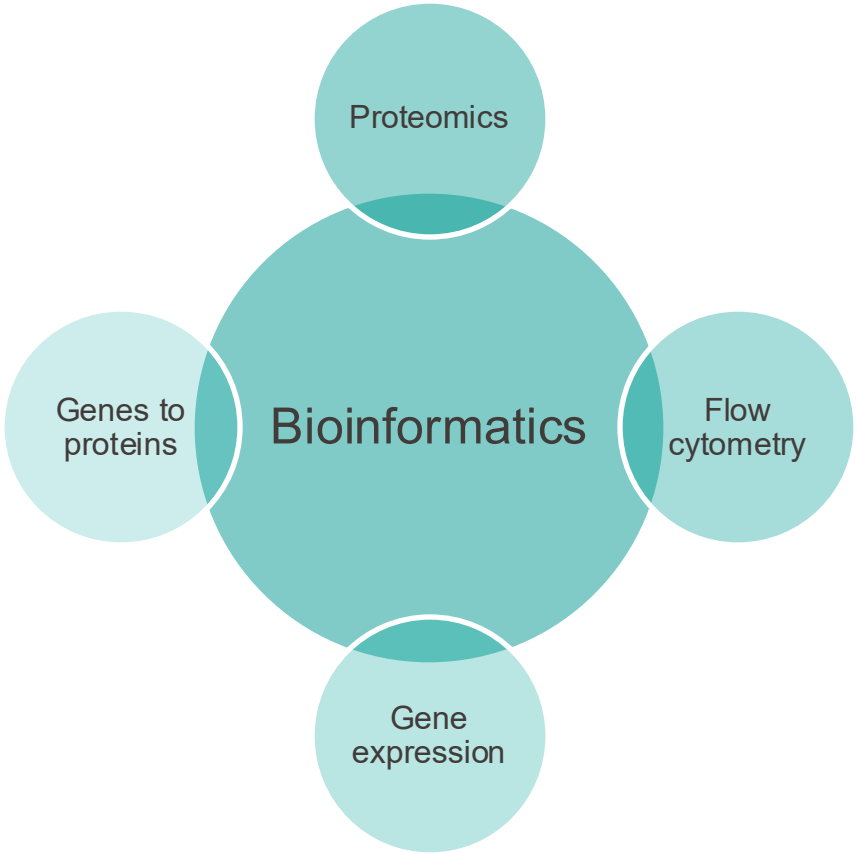
Course time-table

Date/Time	Sept 12	Sept 19	Sept 26	Oct 3	Oct 10	Oct 17	Oct 24	Oct 31	Nov 7	Nov 14	Nov 21	Nov 28	Dec 5	Dec 12	Dec 19
Week	*W1*	*W2*	*W3*	*W4*	*W5*	*W6*		*W7*	*W8*	*W9*	*W10*	*W11*	*W12*	*W13*	*W14*
8:15 - 9:00 9:15 - 10:00 10:15 - 11:00 11:15 - 12:00	Intro	Genes to proteins Proteomics	Flow cytometry Gene expression	Hands-on at platforms		Hands-on at platforms	FREE	Hands-on at platforms	Hands-on at platforms		Hands-on at platforms		Bioinformatics		

CM1106

CM1106

Course description



From genes to proteins - Florence Pojer

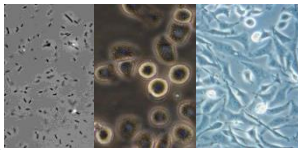
Genes to proteins (PTPSP)

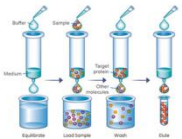
Lecture

Why are recombinant proteins important in science?

Strategies for production of recombinant proteins in different hosts

- Purification of proteins by affinity tags and other chromatography techniques
- State-of-the-art biophysical methods to ensure quality of purified proteins





Week 1: Purification of recombinant proteins by affinity

Week 2: Protein Quality control (QC) using biophysical techniques such as 2MP and DLS

Covered topics:

- Hands-on experience and expertise in the most advanced techniques used in the production and purification of recombinant proteins.
- Strategies to optimize protein production and ensure high-quality outputs.

Practicals

Proteomics - Maria Pavlou

Proteomics (PCF)

Lecture

Introduction in Proteomics

Mass Spectrometry-based Proteomics Workflows

Week 1: In-gel digestion and basic mass spectrometry principles

Week 2: Database search and protein annotation principles

Covered topics:

- Bottom-up mass spectrometry-based proteomics (from sample preparation to data analysis)
- Mass spectrometer hands-on experience

Practicals

Flow cytometry - Miguel Garcia

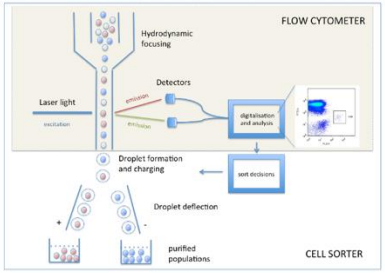
Flow cytometry (FCCF)

Lecture

Introduction to Flow Cytometry & Cell Sorting

How it works

Examples & applications



Schematic representation of a flow cytometer and a cell sorter

Week 1: Acquisition of stained cells on instruments

Week 2: Sorting demo & analysis + Wrap up and discussion/conclusion

Covered topics:

- Instrument set up & QC
- Acquisition settings
- Data analysis and QC
- Standardization
- Cell Sorting

Practicals

Gene expression - Bastien Mangeat

Gene expression (PTEG)

Lecture

The NGS toolbox

Gene expression analysis (single cell and bulk)

Week 1: quantification and quality control of nucleic acids

Week 2: single cell transcriptomics

Covered topics:

- Methods for quantification of RNA/DNA
- Methods for QC of RNA/DNA
- 10X Genomics single cell transcriptomics experiment and downstream data QC

Practicals

Bioinformatics - Christian Iseli (EPFL) and Nicolas Guex (UNIL)

BICC

Lecture & Practicals

Week 1: Analysis of flow cytometry data
Week 2: Analysis of RNAseq data
Week 3: Analysis of proteomics data

Covered topics:

- Mission of a bioinformatic facility
- Experimental design and sample nomenclature
- Protein, transcript and genome reference databases, nomenclature
- Biological function knowledge, protein and gene annotations
- Data QC, mapping, analysis and visualization
- Data clustering and its applications: theory and practice
- Data formats and handling
- Variant calling, peak calling, quantification, GSEA
- Evaluation of genetic mutation impact

What about you?

Session ID:
bio519polling

Group exercise

- ✓ Your group is working on a new blood disease that affects one type of white blood cell: the eosinophils. All other white blood cell types (neutrophils, basophils, monocytes, T cells, and B cells) are unaffected. A mouse model that mimics the human pathology is available, and your initial characterization of this model showed that eosinophils in adult mutant mice (2 months old) exhibit an increased accumulation of eosinophil granules.

- ✓ To develop a therapy for the disease, your goal is to characterize and correct the observed phenotype (increased accumulation of eosinophil granules).

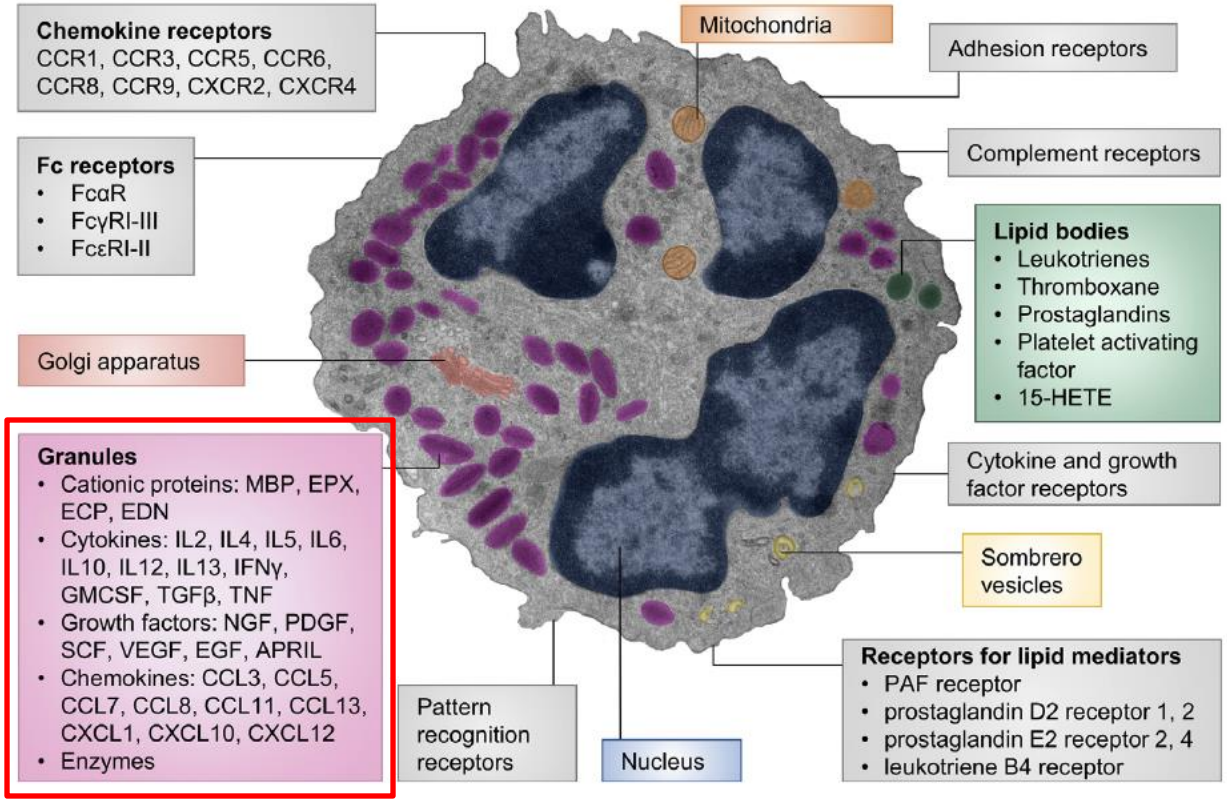
- ✓ Think about (45–60 min):
  - Your strategy (since your company has limited resources, consider factors like project cost, duration and risk mitigation)
  - The model / samples you will need
  - The methods you will use to analyse the collected samples (preferably omics approaches)
  - How you will analyse the generated data (data integration, bioinformatics etc)

- ✓ Prepare a 10-15 minute presentation to pitch your project to a panel of investors who will decide whether to fund it.

Ground rules:

- No internet research allowed
- When working on your strategy, you can ask questions to anyone in the room
- You can use PowerPoint and/or white-board to present your approach
- You can decide who will be presenting your project (it can be 1 person or a group of persons)

Cellular structure, receptors and mediators of wild-type eosinophils



Diny et al., 2017, Front. Immunol. 8:484