




University  
of Basel

Faculty of  
Medicine



# Certificate of Advanced Studies in Personalized Molecular Oncology



 Universitätsspital  
Basel



ADVANCED STUDIES

# Certificate of Advanced Studies (CAS) in Personalized Molecular Oncology

## Overview

Cutting-edge technologies, like next-generation-sequencing (NGS), combined with the development of targeted therapies are now revolutionizing clinical practice, thereby bringing new complexity to the field of oncology. The Certificate of Advanced Studies (CAS) in Personalized Molecular Oncology aims at providing a comprehensive and integrative view of the field, by covering all the aspects involved along the pipeline: (i) tumor biology and genetics, (ii) molecular pathology, (iii) clinical bioinformatics, and (iv) clinical oncology.

First of its kind in Switzerland, it focuses on the methodologies used to generate, analyze and interpret patients' molecular profiles, also touching upon the associated

technical, regulatory and ethical challenges. As an important outcome, it establishes a common language between the wide range of professionals involved in the personalized oncology process, from biologists, bio-informaticians, pathologists to clinicians, enabling an efficient and better-informed use of e.g. genomic data for both routine clinical practice and clinical research. Moreover, it empowers professionals to develop a vision in their own institution, by critically evaluating the potential benefits and limitations of current and future developments in personalized oncology.

The CAS is organized jointly by the University Hospital of Basel, the University Hospital of Lausanne, and the SIB Swiss Institute of Bioinformatics.

CAS Personalized Molecular Oncology   10 ECTS   Duration: approx. 10 months		
	Module title	Module coordination
<b>Module 1</b>	Tumor biology and genetics	CHUV Cancer Genetic
<b>Module 2</b>	Molecular pathology	USB Pathology
<b>Module 3</b>	Clinical bioinformatics	SIB Clinical Bioinformatics
<b>Module 4</b>	Clinical oncology	USB Oncology
<b>Mini-thesis</b>	Planned in small groups	Program Board

## Target audience

The CAS targets a multidisciplinary audience of professionals involved in personalized molecular oncology, including laboratory managers, biologists, bioinformaticians, pathologists, geneticists, clinicians and pharmaceutical company employees. Applicants are selected on the basis of their CV and demonstrated interest and experience in personalized oncology, and are expected to hold a university degree (MSc or MD).

## Needs

Medical practice is undergoing a revolution around personalized medicine, driven by the development of high throughput technologies. These technologies produce huge quantities of data, providing an unprecedented level of molecular information, but also raising new challenges for clinicians and clinical laboratory professionals.

In oncology and hemato-oncology, genomic profiles are now increasingly being used, notably for clinicians to prescribe the right drug for the right patient. The process to generate, analyze and interpret genomic data is however complex and calls upon a plurality of skills. There is therefore a need for continuing education in this rapidly evolving field, to ensure that professionals with various backgrounds can communicate and collaborate efficiently to optimize the personalized oncology process, for the benefit of patient care.

In Switzerland, existing continuing education for MDs and clinical laboratory professionals do not cover the multidisciplinary needs for personalized molecular oncology. Thus, we also ask credits to Swiss professional societies, to encourage MDs and clinical biologists to attend the CAS as part of their FMH / FAMH continuing education (SSMO, SPath, SRO, SSMG).

Existing bioinformatics curricula also lack the clinical emphasis on diagnosis and do not offer students the possibility to understand the experimental and clinical constraints of the medical realm.

The CAS in Personalized Molecular Oncology is unique in Switzerland, addressing currently unmet needs and bringing together a multidisciplinary audience.

## Partners

The CAS is hosted by the Faculty of Medicine of the University of Basel.

It is organized jointly by (i) the University Hospital of Basel, which is the Swiss hospital sequencing the largest number of samples in oncology, (ii) the University Hospital of Lausanne, a major onco-hematology sequencing center in Switzerland, and (iii) the SIB Swiss Institute of Bioinformatics, an internationally recognized leader in bioinformatics.

# Course program

The whole CAS consists of four modules.

## Tumor biology and genetics

### Module content

1. Basic cytogenetics and molecular genetics
2. Hereditary vs. acquired genetics
3. Genetic recombination, DNA damage and repair
4. Solid tumors and hematological malignancies
5. Genetic predisposition to cancer
6. Diagnostic genetic testing
7. Tumor cell proliferation
8. Clonal evolution & tumor heterogeneity

### Learning objectives for participants

- Describe the mechanisms yielding to genetic variation, and be familiar with the various types of genetic variants.
- Distinguish hereditary genetic anomalies from acquired genetic anomalies.
- Discuss the advantages and limitations of different genetic laboratory methodologies for diagnostic testing.
- Demonstrate how to interpret non-hotspot mutations using public databases and taking into account overall genomic aberrations and clonal evolution.
- Be aware of ethical implications of incidental genetic findings.

## Molecular pathology

### Module content

1. Sample classification and preparation
2. Principles of nucleic acids extraction
3. Sequencing platforms and setup
4. Understanding gene panels
5. Internal / external Quality controls
6. Laboratory accreditation
7. Reporting genomic variants
8. Interpreting a molecular profile

### Learning objectives for participants

- Understand the basics (procedures and rules) of an accredited clinical laboratory.
- Gain knowledge about the different types of specimens (e.g. tissue biopsy, cytology, resections).
- Get familiar with all the steps that lead from samples collection to final molecular report generation along with all possible bottlenecks.
- Have an overview about the currently used technological platforms in molecular diagnostics (comparison with the research setting).
- Get familiar with the most common clinically relevant variants along with their interpretation and classification system.

## Clinical bioinformatics

### Module content

1. Data pre-processing
2. Read mapping
3. Variant calling
4. Quality control
5. Variant annotation
6. Hardware, security, privacy
7. Artificial intelligence (AI) basics
8. AI current and future applications

### Learning objectives for participants

- Communicate efficiently with bioinformaticians.
- Describe a bioinformatics analysis pipeline to call mutations from NGS data.
- Perform quality control at the run, read and variant levels.
- Use off-the-shelf bioinformatics tools to annotate and support the interpretation of variants.
- Consider hardware, security and privacy issues when managing omics data.
- Understand how artificial intelligence contributes to and will further impact personalized oncology.

## Clinical oncology

### Module content

1. Tumor Physiology
2. Tumor Immunology
3. Cancer Statistics and Epidemiology
4. Prognostic and Predictive Markers
5. Targeted Therapies in Clinical Oncology
6. Risks / probabilities for the interpretation of genetic results and counseling
7. Clinical Trials in Molecular Oncology
8. Molecular Tumor Board

### Learning objectives for participants

- Describe main intracellular signaling pathways in solid tumors and molecular aberrations hampering this signaling.
- Get detailed knowledge of immunological mechanisms and how these may be used to optimize therapeutic approaches.
- Get a basic understanding of the principles underlying the design and analysis of clinical trials in oncology.
- Understand the importance of predictive markers in molecular oncology.
- Get familiar with the most frequent molecular aberrations in solid tumors and routinely used targeted therapies.
- Learn about genetic counseling and its implications for patients and families.

## Program structure

The program consists of 4 modules of 4 days each. Each module is interactive, with lectures alternating with hands-on sessions, group discussions, on-site lab visits, in addition to home assignments.

Acquired competencies are evaluated with an exam at the end of each module. In addition, students complete a mini-thesis on a study case in small multi-disciplinary groups. Altogether, completion of the program is awarded 10 ECTS. Previous experience may also be recognized.

Participants attending only one module receive a short course certificate with 2 ECTS, provided they pass the exam of the module.

## Quality assurance

Quality is assured on the student's side with an anonymous online questionnaire of about 20 questions, covering content, organization, teaching & interaction, relevance and satisfaction. This questionnaire is sent after the end of each module. Participants are also asked if they agree to answer a long-term feedback form, to assess the impact of the program on their career.

An online questionnaire is also sent to teachers after their respective module, covering organization, level and participation of the students.

The results of the questionnaires are communicated to the module coordinators and discussed with the Program Board before the start of every new session, thereby ensuring that content and format can be adjusted in due time as needed.

## Course fee

Fee for attending the whole CAS: CHF 6'000  
Fee for attending a single module: CHF 2'000  
These fees include course materials, lab visits, and exams.

## Program Board

### Tumor biology and genetics

**Prof. Dr. Jacqueline Schoumans Pouw**  
FAMH specialist in medical genetics  
Director of the Oncogenomics Laboratory  
Clinical Hematology Service/  
Laboratory Department  
University Hospital Lausanne

### Molecular pathology

**Dr. Salvatore Piscuoglio**  
Research group leader, Co-Director of  
Research Institute of Medical Genetics and  
Pathology  
Research group leader, Department of  
Biomedicine  
University of Basel

### Prof. Dr. Christian Ruiz

Head of Diagnostic Laboratory Department  
Co-Director Research Department Pathology  
Institute of Medical Genetics and Pathology  
University Hospital Basel

**PD Dr. Matthias Matter**

Head of Molecular Pathology Unit  
Institute of Medical Genetics and Pathology  
University Hospital Basel

**Clinical bioinformatics**

**Dr. Aitana Lebrand**

*CAS Program Coordinator*  
Team Lead Data Science  
Clinical Bioinformatics  
SIB Swiss Institute of Bioinformatics

**Dr. Grégoire Rossier**

Project Manager in Training  
SIB Swiss Institute of Bioinformatics

**Clinical oncology**

**PD Dr. Andreas Wicki**

Vice Chairman, Department for Medical  
Oncology and Hematology (MOH)  
Director, Comprehensive Cancer Center  
Zurich (C3Z), Clinical Program  
University Hospital Zurich

**PD Dr. Sacha Rothschild**

*CAS Director of Studies*  
Assistant Professor  
Chair Clinical Trial Unit  
Chair Lung Tumor Center  
Co-Chair of Network for Molecular Oncology  
Comprehensive Cancer Center (DKG)  
Medical Oncology  
University Hospital Basel

## Dates & Venue

Each session of the CAS begins in the fall and lasts approximately 10 months. Each module consists of 4 days of presential teaching, over two Friday-Saturday sessions. Exact dates are communicated on the website in March for the following year.

Modules take place in Lausanne (modules 1, 3) and Basel (modules 2, 4).

Registrations open in March. Selected applications are confirmed in the summer before the start of the CAS.

## CAS Website

[pmo.unibas.ch](http://pmo.unibas.ch)

## Sponsors

We are grateful to our sponsors for their unrestricted educational grants:





**Educating  
Talents**  
since 1460.

University of Basel  
Department of Biomedicine  
Hebelstrasse 20  
CH-4031 Basel

[pmo.unibas.ch](http://pmo.unibas.ch)

SIB Swiss Institute of Bioinformatics  
Clinical Bioinformatics  
Ch. des Mines 9  
CH-1202 Geneva

[clinical@sib.swiss](mailto:clinical@sib.swiss)