Master – Biology and Health

Track – Biomarkers and Artificial Intelligence

Program Overview

The Master's Program in Biomarkers and Artificial Intelligence (BIA) is a training course that combines biology, biotechnology, and digital sciences. It is designed to meet the current needs of modern healthcare, particularly in the fields of personalized medicine and artificial intelligence applied to health.

This master's program trains students to use the most advanced digital tools to enhance diagnosis, treatment, and biomedical research. Through an interdisciplinary and hands-on approach, students gain both strong theoretical knowledge and practical experience in research laboratories.

The main covered areas include:

- Human biology
- Mechanisms involved in major human diseases
- Understanding and analysis of scientific articles
- Computer programming
- Processing and analysis of complex biological data
- Artificial intelligence applied to healthcare

Program Objectives

The Master's program aims to:

- Understand how AI is used in biomedical and health research.
- Identify, develop, and validate biomarkers useful for disease prevention, diagnosis, or monitoring.
- Use computational tools and data analysis methods to explore large biological datasets.
- Apply artificial intelligence techniques (such as machine learning and deep learning) to develop innovative solutions in personalized medicine.
- Design, plan, and conduct health research projects with strong potential impact.

- Contribute to an interdisciplinary research project involving expertise in biology, artificial intelligence, and bioinformatics, by identifying the specific contributions of each field to design innovative solutions in healthcare.

Career Opportunities

Graduates of the program have access to a wide range of career opportunities in rapidly growing sectors such as academic research, biotechnology companies, pharmaceutical industries, as well as public and private healthcare organizations. They can pursue various roles, including:

- Health and biotechnology data scientist
- Bioinformatician specialized in health data analysis
- Biomedical research officer
- R&D engineer in AI applied to healthcare
- AI consultant for biotechnology and the pharmaceutical industry

Skills Acquired

Over the two years of the Master's program, students develop the following skills:

Biology and Medicine

- Pathophysiological mechanisms of human diseases
    - Analyze the pathophysiological mechanisms of human diseases to determine their impact on biological functions.
- Diagnostic, prognostic, and therapeutic biomarkers
    - Assess the relevance of diagnostic, prognostic, and therapeutic biomarkers in various clinical contexts.

Programming and Data Processing

- Programming languages
    - Develop scripts in appropriate languages (Python, R, etc.) to automate the analysis of biological and medical data.
- Biological and medical databases
    - Query and use biological and medical databases to extract relevant information for research purposes.
- Bioinformatics tools and statistical analysis
    - Apply bioinformatics tools and statistical methods to process, visualize, and interpret experimental data.

Artificial Intelligence Applied to Healthcare

- Machine Learning and Deep Learning
    - Design and train machine learning and deep learning models to address biomedical problems.
- Medical image analysis and omics data
    - Use AI algorithms to analyze medical images or omics data and extract decision-support information.
- Predictive modeling and treatment personalization
    - Develop predictive models to optimize treatment personalization based on patient data

Research and Innovation

- Design and management of scientific projects
    - Plan and carry out a scientific health-related project, from hypothesis formulation to experimental validation.
- Scientific report and article writing
    - Write structured scientific reports and academic articles according to publication standards.
- Scientific monitoring, ethics, and health regulations
    - Conduct scientific, ethical, and regulatory monitoring to ensure project compliance and foster innovation.

Covered Topics:

- Identification and validation of biomarkers
- Analysis of omics data (genomics, transcriptomics, proteomics)
- Artificial intelligence for medical imaging
- Predictive models in personalized medicine
- Bioinformatics and data visualization
- Methodology of clinical and translational research

Program

M1: Fundamentals of Programming and Machine Learning
Analysis and evaluation of the relevance of diagnostic, prognostic, and therapeutic biomarkers

- Acquisition of foundational knowledge in computer science, programming, and artificial intelligence
- Introduction to machine learning algorithms

M2: Specialization in One of Three Tracks
In the second year, students specialize in one of the following tracks:

- **Biomarkers**: Identification, validation, and use of biomarkers in a medical context.
- **Biotechnologies**: Application of advanced technologies for the discovery of innovative treatments.
- **Programming**: Development and implementation of IT solutions for health data analysis.

Part of the program takes place internationally, at partner universities:

- **Marseille (France)**: Biomarkers track
- **Pisa (Italy)**: Biotechnologies track
- **Stockholm (Sweden)**: Programming track

Our Partners

Thanks to partnerships with leading companies and prestigious research centers, you will have direct access to the latest innovations in healthcare and biotechnology. The program is supported by European partners such as the University of Pisa and Stockholm University, as well as renowned research institutions including:

- **C2VN** (Research Center in Cardiovascular and Nutrition)
- **CRCM** (Marseille Cancer Research Center)
- **IPC** (Paoli-Calmettes Institute)
- **IHU – Méditerranée Infection**
- **INRIA** (French National Institute for Research in Digital Science and Technology)
- **Private partners**: Genome-UP, Kode, IngeniArs, Halio DX

Why Choose This Master's Program?

Choosing this Master's program means joining a program of excellence that offers:

- **Comprehensive training**: An interdisciplinary approach combining biology, computer science, and artificial intelligence
- **A prestigious research network**: Collaborations with renowned research centers such as **IHU Méditerranée Infection, INRIA, and CRCM**
- **A unique international experience**: The opportunity to study at the **University of Pisa** or **Stockholm University**
- **Diverse and promising career prospects**: A dynamic and rapidly growing sector with a wide range of career opportunities

Application et Contact

Applications are submitted via the **e-candidats platform** (outside the "Études en France" procedure).
For more details on the application process, please visit:smpm.univ-amu.fr > Applications

For any questions, feel free to contact the program coordinators:

Professor **Christophe DUBOIS** : christophe.dubois@univ-amu.fr

Professor **Kathia CHAUMOITRE** : kathia.chaumoitre@univ-amu.fr

Professor **Matthieu GILSON** : matthieu.gilson@univ-amu.fr