live International Vaccinology

Co-funded by the European Union

UAB Universitat Autònoma de Barcelona | Universitat de Barcelona | University of Antwerp | Université Jean Monnet Saint-Étienne | Université Claude Bernard Lyon 1

EMJM – ERASMUS MUNDUS JOINT MASTER

PROGRAMME

LIVE_Innov - Leading International Vaccinology Education for Innovation

LIVE_Innov TEACHING UNIT SHEETS

PREAMBLE

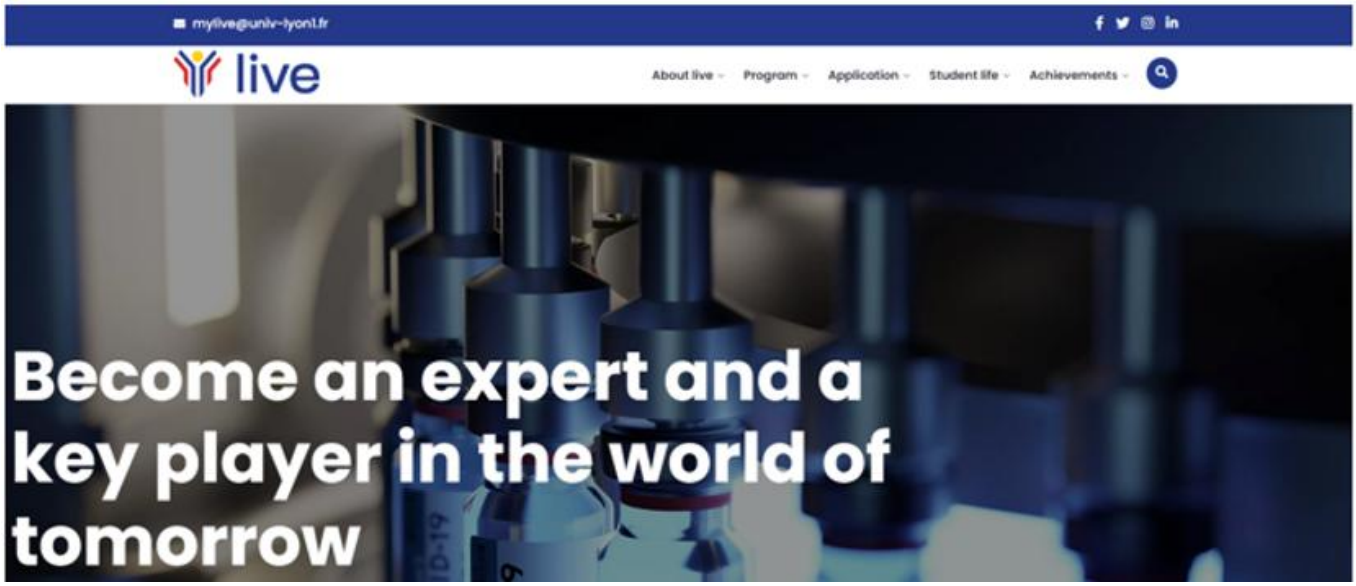
This file is the Appendix 2 of the Partnership Agreement for the project of the Erasmus Mundus Joint Master “Leading International Vaccinology Education for Innovation” (LIVE_Innov).

This document contains:

- Figures and tables explaining the general organisation of the LIVE_INNOV programme
- All the teaching unit sheets describing Title, ECTS, hours, Heads, programme, learning outcomes and assessment methods for the LIVE_Innov programme
- Example of schedule and all the evaluation forms required to assess the Master thesis
- The teaching unit sheets describing Title, ECTS, hours, Heads, programme, learning outcomes and assessment methods for the HDIS programme that welcome LIVE student on mobility at EMLYON during their M2-S3

Note: Next page, the **Table of Contents** is interactive and

hyperlinks refer to the paragraph



Programme website: https://masterlive-vaccinology.eu/

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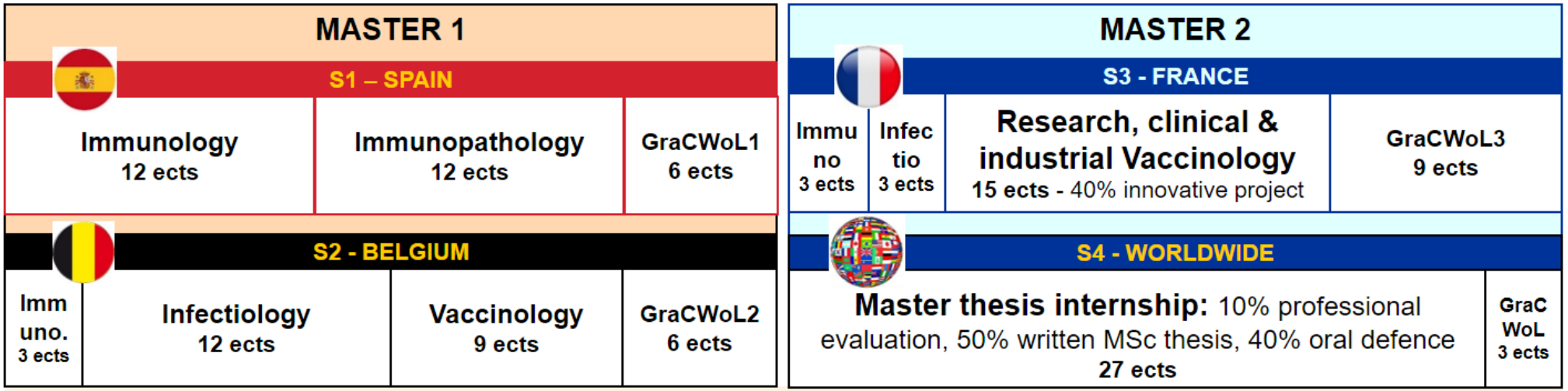
1. LIVE_Innov General organisation

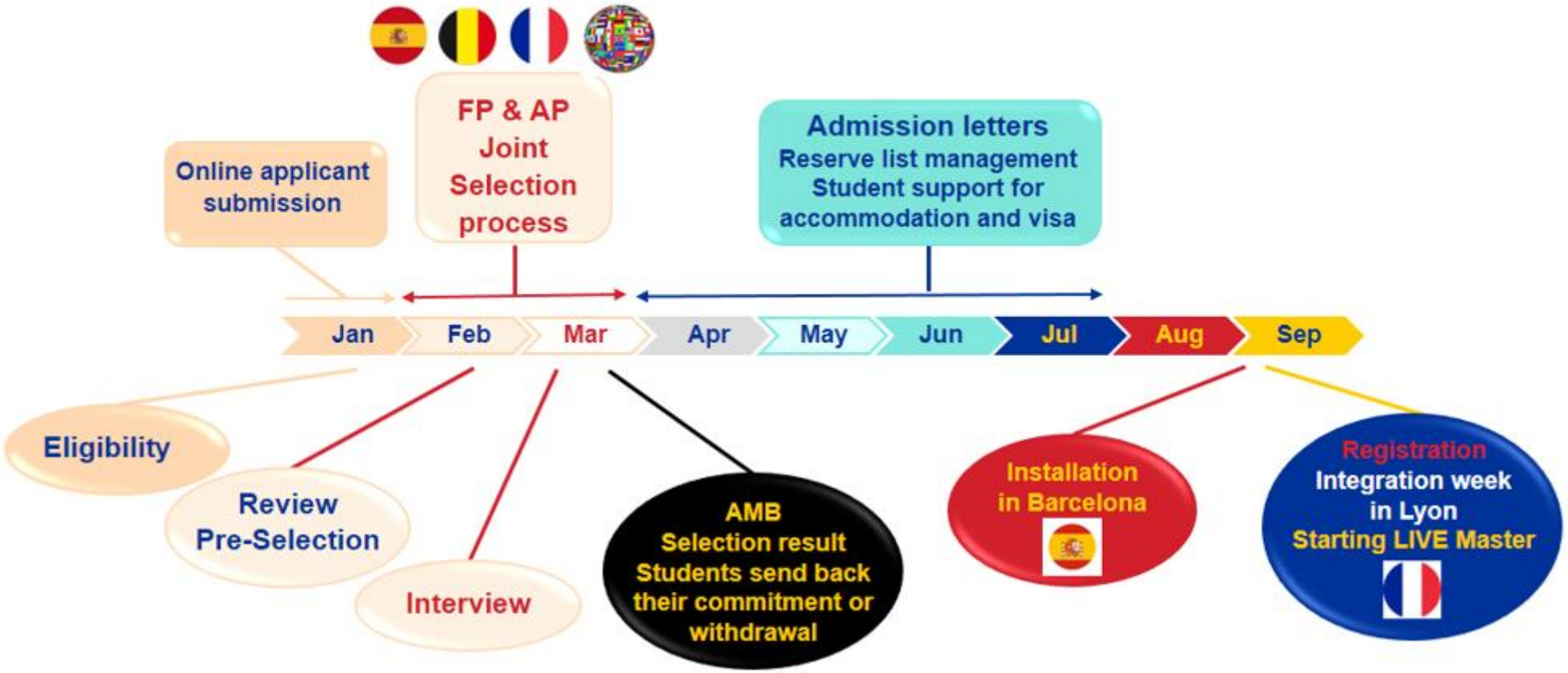
The students will study at higher level a **first specialisation** in immunology and immunopathology in Barcelona, then a **second specialisation** in infectiology including microbiology, virology and host-pathogen interactions in Antwerp, and a **third specialisation** in vaccinology in Lyon & Saint-Etienne, to reach the level for doing a master thesis.

1.1 General organisation and mobility during the LIVE Master

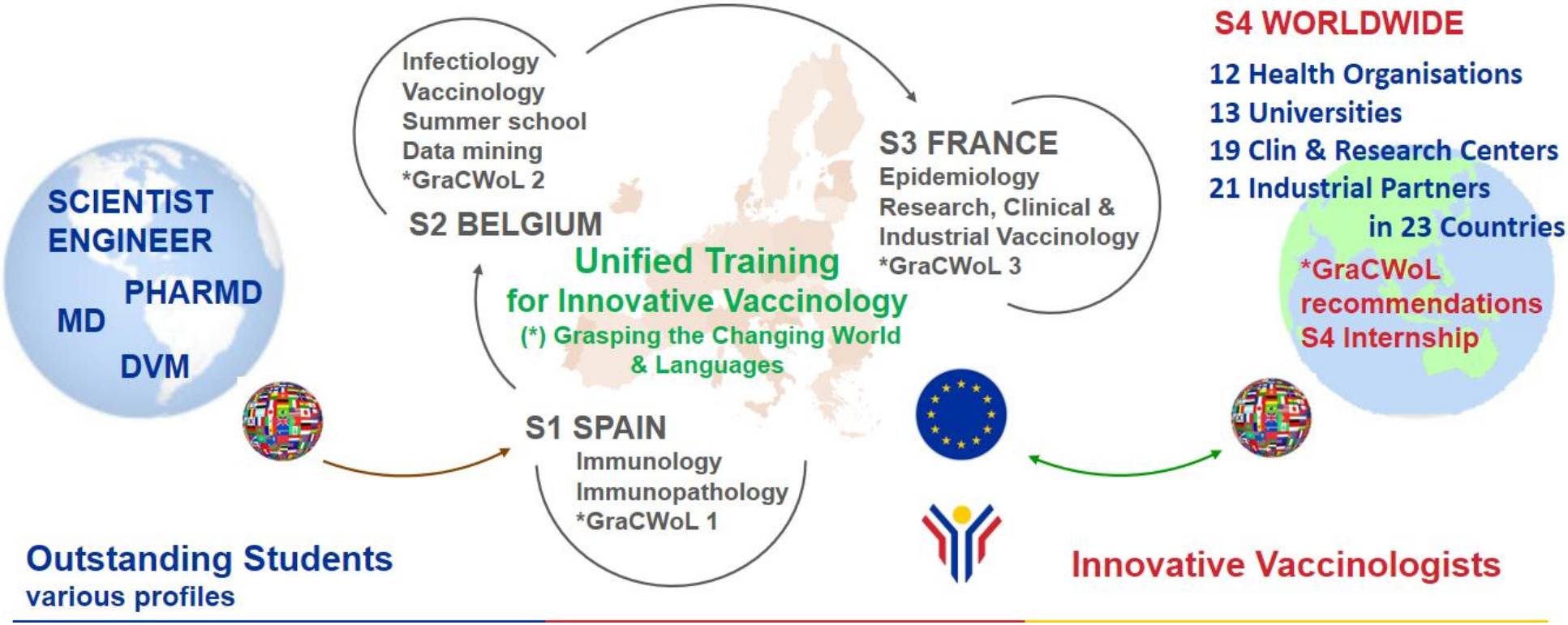


GraCWoL competency: **Gra**sping the **C**hanging **Wo**rld & **L**anguages, promoting green and digital transformation, challenging interdisciplinary interface of vaccinology with data mining, machine learning, artificial intelligence and communicating in different languages; **ects**: European credits transfer system.

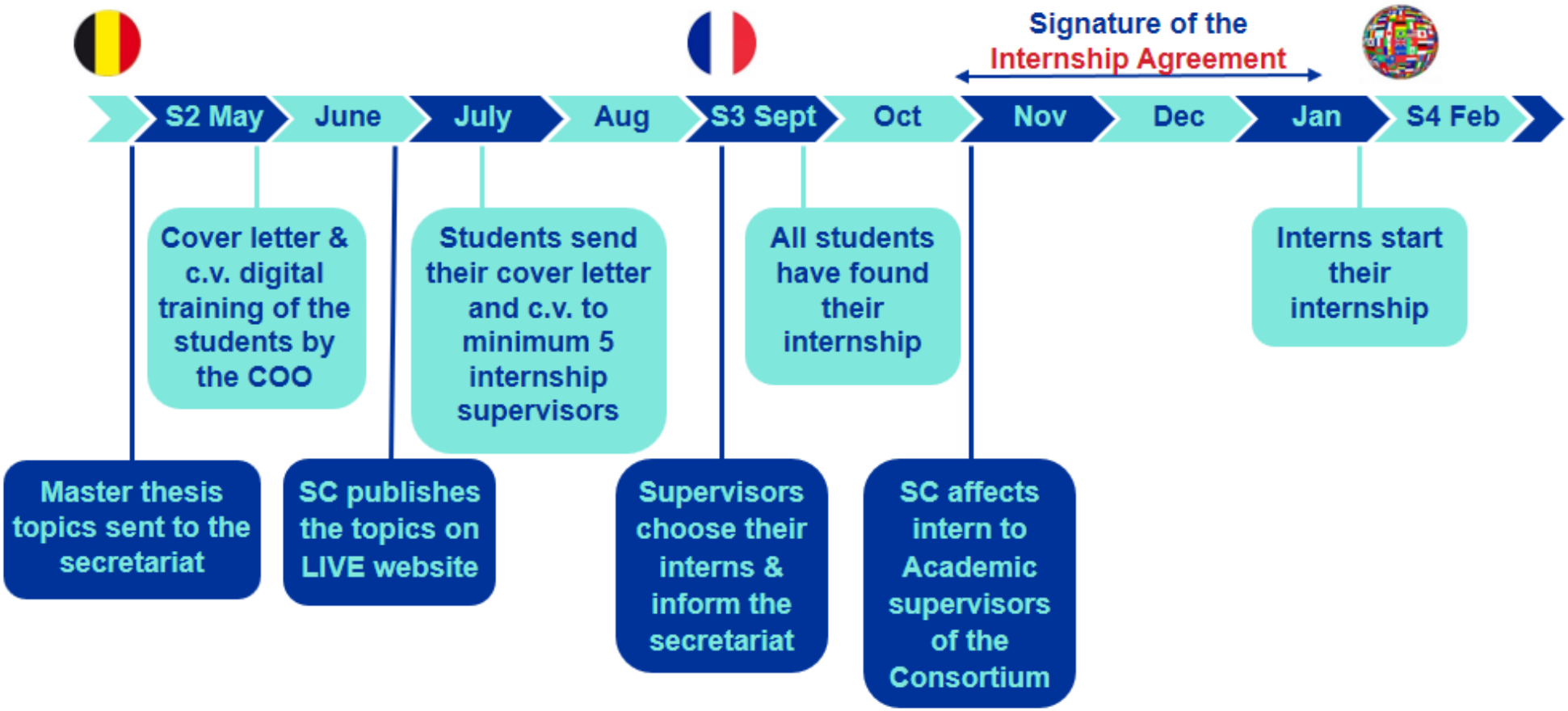
1.2 Selection process



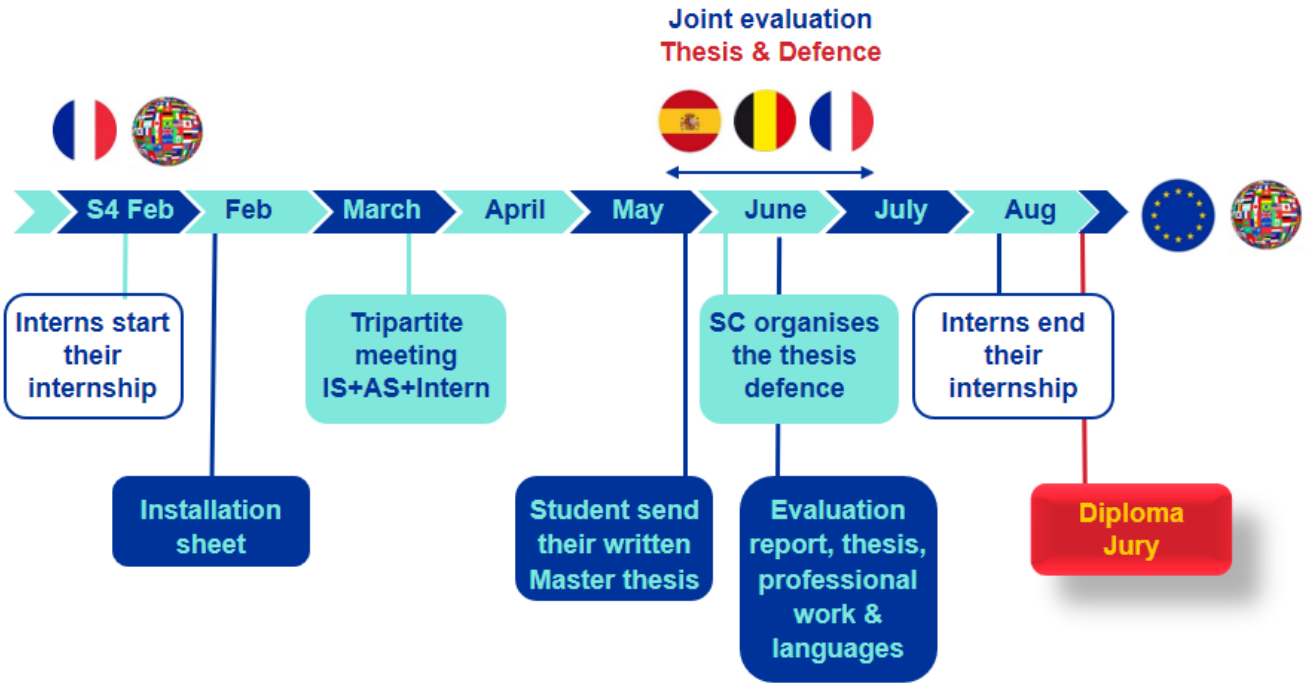
1.3 Mobility path



1.4 Management of the internship proposals



1.5 Management of internship



1.6 Contribution of European universities and countries in LIVE_Innov

Student view with no count of optional TU

University	Semester Country	ECTS	% in master
Universitat de Barcelona (UB)	S1 + S4	6 + 4.5	8.75
Universitat Autònoma de Barcelona (UAB)	S1 + S4	24 + 4.5	23.75
University of Antwerpen (UA)	S2 + S4	30 + 9	32.5
Université Jean Monnet Saint-Etienne (UJM)	S3 + S4	15 + 4.5	16.25
Université Claude Bernard Lyon 1 (UCBL)	S3 + S4	15 + 7.5	18.75
UB + UAB	**Spain**	39	32.5
AU	**Belgium**	39	32.5
UCBL + UJM	**France**	42	35
EMLYON, Les Mines St-Etienne	**France**	6	student exchange
University of Florence	**Italy**	conferences	
Université Libre de Bruxelles	**Belgium**	conferences	
European universities: ARQUS, CHARMEU, ECIU, YUFE	**European university network**	conferences	
All universities	**Mobility**	**120**	**100**

HEI view with count of optional TU

University	Semester Country	ECTS	% in master
Universitat de Barcelona (UB)	S1 + S4	6 + 4.5	8
Universitat Autònoma de Barcelona (UAB)	S1 + S4	27 + 4.5	23
University of Antwerpen (UA)	S2 + S4	33 + 9	31
Université Jean Monnet Saint-Etienne (UJM)	S3 + S4	15 + 4.5	14
Université Claude Bernard Lyon 1 (UCBL)	S3 + S4	24 + 7.5	23
UB + UAB	**Spain**	42	31
AU	**Belgium**	42	31
UCBL + UJM	**France**	51	38
EMLYON, Les Mines St-Etienne	**France**	6	student exchange
University of Florence	**Italy**	conferences	
Université Libre de Bruxelles	**Belgium**	conferences	
European universities: ARQUS, CHARMEU, ECIU, YUFE	**European university network**	conferences	
All universities	**Mobility**	**135**	**100**

1.7 Distribution of the executive functions

Partner organisations		Management tasks
UCBL	**Central Manager (CM)** **Christine DELPRAT**	Programme secretariat, central management of the study programme, monitoring the awarding of the multiple national diplomas and future LIVE joint Diploma, editing the Diploma Supplement, monitoring interface with IT and iCAP dpt at UCBL: MyLIVE application, LIVE website, MOOC dvpt, digital evaluation, e-learning; (ii) Central management of grants: recruitment of LIVE_Innov Assistant, payment of student allowances, distribution of the participation costs, financial agreements with associated partners…; (iii) Meeting organisation: AMB, SC, EliC, I-QAC, E-QAC, editing the CA and the student agreement validated by the AMB; (iv) business development and sponsoring management: recruitment of Business dvpt Manager; (v) Reporting to EACEA
UAB-UB	**Selection Managers (SelM)** **Carme ROURA-MIR** **Thomas STRATMANN**	Organisation of the applicant selection procedures
UAntwerpen	**Quality Assurance Manager (QAM) Peter DELPUTTE**	Organisation of the Quality Assurance (QA) according to the QA scheme
UJM	**Communication Manager (ComM) Stéphane PAUL**	LIVE_Innov communication, advertisement & website contents

1.8 Distribution of the main scientific topics between the four semesters

Topics	S1 ECTS Spain	S2 ECTS Belgium	S3 ECTS France	S4 ECTS SP-BE-FR	TOTAL ECTS / field	% in Master
(1) Immunology, immunopathology	**24**	**3**	**3**		**30**	**25**
(2) Infectiology, Epidemiology		**12**	**3**		**15**	**12.5**
(3) Research, Clinical & Industrial Vaccinology		**9**	**15**		**24**	**20**
(4) GraCWoL – Grasping the changing world & Languages	**6**	**6**	**9**	**3**	**24**	**20**
(5) Professional Internship, Master thesis				**27**	**27**	**22.5**
Total ECTS / semester	**30**	**30**	**30**	**30**	**120**	**100**
(1-3) Core scientific knowledge	**27**	**24**	**21**		**69**	**57.5**
(4-5) Multidisciplinary aspects, grasping the changing world	**3**	**6**	**9**	**30**	**51**	**42.5**

1.9 Common grading system for the LIVE_Innov students

LIVE_Innov grading system Mention - explanation	LIVE_Innov, Belgian, French scores range 0-20	Spanish score ranges 0-10
Excellent – outstanding performance	**X ≥ 18**	**X ≥ 9**
Very Good – above the average standard but with some errors	**16 ≤ X < 18**	**8 ≤ X < 9**
Good – generally sound work with a number of notable errors	**14 ≤ X < 16**	**7 ≤ X < 8**
Satisfactory – fair but with significant shortcomings	**12 ≤ X < 14**	**6 ≤ X < 7**
Sufficient – performance meets the minimum criteria	**10 ≤ X < 12**	**5 ≤ X < 6**
Fail – some more work required before the ECTS can be awarded	**8 ≤ X < 10**	**4 ≤ X < 5**
Fail – considerable further work is required	**6 ≤ X < 8**	**3 ≤ X < 4**

1.10 Teaching unit title, head and ECTS

Table 1: Teaching unit title, heads and ECTS	Field	Head of the teaching unit	S1	S2	S3	S4	TOTAL ECTS
Dynamics of innate and adaptive immunity	Immunology	**VIDAL, Silvia** **VALLEDOR, Annabel**	3				3
Functional anatomy of the immune system	Immunology	**ROURA-MIR, Carme**	3				3
Antigen recognition	Immunology	**ALVAREZ, Iñaki**	3				3
Receptor signalling	Immunology	**SOLER, Concepció**	3				3
Immunopathology and immunotherapy	Immunopathology	**MARTINEZ CACERES, Eva** **HERNANDEZ, Manuel** **MARTINEZ GALLO, Monica**	6				6
Immune responses to pathogens	Immunopathology	**COLOBRAN, Roger**	3				3
Laboratory and computer practicals	Grasping the changing world & Languages	**STRATMANN, Thomas** **ROURA-MIR, Carme** **ASHHAB, Yaqoub**	3				3
Translational immunopathology (option)	Immunopathology	**DE LA CALLE, Oscar** **MARTINEZ, Laura**	3				3
Vaccines in society (option)	Grasping the changing world & Languages	**JARAQUEMADA, Dolores** **ROURA-MIR, Carme**	3				3
Languages 1: French, Spanish (option)	Grasping the changing world & Languages	**PRATS-CARRERAS, Sònia**	3				3
Immune system in early life, pregnant women and elderly	Immunology	**MAERTENS, Kirsten**		3			3
Description & variability of pathogens	Infectiology	**DELPUTTE, Peter** **BARBEZANGE, Cyril** **ARIEN, Kevin**		6			6
Host-pathogen interactions	Infectiology	**CALJON, Guy**		3			3
Novel technologies, vaccine administration routes & adjuvants	Research, clinical & industrial vaccinology	**DELPUTTE, Peter**		3			3
Vaccine manufacturing & quality control, regulatory approval process	Research, clinical & industrial vaccinology	**DELPUTTE Peter**		3			3
Data mining	Grasping the changing world & Languages	**FRANSEN, Erik** **MEYSMAN, Pieter**		3			3
Summer school on vaccinology	Research, clinical & industrial vaccinology	**VAN DAMME Pierre** **MAERTENS, Kirsten**		3			3
Languages 2a: English, French, Dutch, Italian, Spanish	Grasping the changing world & Languages	**HEUGHEBAERT, Els**		3			3

Table 1: Teaching unit title, heads and ECTS	Field	Head of the teaching unit	S1	S2	S3	S4	TOTAL ECTS
Molecular virology (option)	Infectiology	**DELPUTTE, Peter** **BARBEZANGE, Cyril** **ARIEN, Kevin**		3			3
Languages 2b: English, French, Dutch, Italian, Spanish (option)	Grasping the changing world & Languages	**HEUGHEBAERT, Els**		3			3
Epidemiology	Infectiology	**NUNES Marta, VANHEMS, Philippe**			3		3
Immunomonitoring of preclinical and clinical vaccine trials	Research, clinical & industrial vaccinology	**PAUL, Stéphane**			3		3
Clinical vaccine development	Research, clinical & industrial vaccinology	**BOTELHO-NEVERS, Elisabeth**			3		3
Vaccine specific applications	Research, clinical & industrial vaccinology	**PAUL Stéphane**			3		3
Vaccine formulation	Research, clinical & industrial vaccinology	**PAUL, Stéphane**			3		3
Communicating on vaccines & public health	Grasping the changing world & Languages	**PAUL, Stéphane**			3		3
Project management in innovative vaccinology	Grasping the changing world & Languages Research, clinical & industrial vaccinology	**GILBERT, Christophe** **BOURDONNAY, Emilie** **DELPRAT, Christine**			6		6
Immunology & cancer (option)	Immunopathology	**DELPRAT, Christine**			3		3
Neuro-immunology: immune privilege and biotherapies (option)	Immunopathology	**DELPRAT, Christine** **DESESTRET, Virginie**			3		3
Health Management and Data Intelligence (HDIV) (option) (student exchange, EMLYON business school, Mines Saint-Etienne, National School of Engineers)	Grasping the changing world & Languages Research, clinical & industrial vaccinology	**VERSAEVEL, Bruno** **DELPRAT, Christine**			6		6
Expérimentation animale (option in FR)	Research, clinical & industrial vaccinology	**DUCREUX, Sylvie**			6		6
Languages 3: English, French, German, Italian, Spanish	Grasping the changing world & Languages	**DURANT-VALLOT, Angeline**			3		3

Table 1: Teaching unit title, heads and ECTS	Field	Head of the teaching unit	S1	S2	S3	S4	TOTAL ECTS
Master thesis	**Internship**	**STRATMANN, Thomas** **ROURA-MIR, Carme** **DELPUTTE, Peter** **PAUL, Stéphane** **DELPRAT, Christine** **BOURDONNAY, Emilie**				27	27
Vaccinology and infodemiology (option)	Grasping the changing world & Languages	**BOURDONNAY, Emilie** **DELPRAT Christine**				3	3
Languages 4 vaccine future (option)	Grasping the changing world & Languages	**DURAND-VALLOT, Angeline** **BOURDONNAY, Emilie** **DELFATTI Natalia**				3	3

2. S1 Teaching unit sheets of the semester 1 in Barcelona (Spain)

S1 Teaching Units (TU)	Immuno -logy	Immuno -pathology	Grasping the changing world & Languages	TOTAL ECTS
Dynamics of innate and adaptive immunity	3			3
Functional anatomy of the immune system	3			3
Antigen recognition	3			3
Receptor signalling	3			3
Immunopathology and Immunotherapy		6		6
Immune responses to pathogens	3			3
Laboratory and computer practicals			3	3
Optional choices in:				
Translational immunopathology		3		6
Vaccines in society			3	
Languages 1			3	
Total ECTS / field	**15**	**9**	**6**	**30**

DYNAMICS OF INNATE AND ADAPTIVE IMMUNITY					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**35**	**8**	**0**	**0**	**0**

Management Institute:	**Part 1 - Universitat Autònoma de Barcelona** **Part 2 - Universitat de Barcelona**
Teaching unit head(s) Name:	**VIDAL Silvia (Part 1) and VALLEDOR Annabel (Part 2)**
Position:	**Associate Professors of Immunology**
Contact, email:	*silvia.vidal@uab.cat* | *afernandezvalledor@ub.edu*

Keywords: Natural defences; innate immune cells; innate receptors; innate effector mechanisms; inflammation; adaptive response; effector cells; adaptive effector mechanisms; immune regulation; tolerance; peripheral mechanisms of regulation; cytokines

Course content:

Part 1

1. Introduction: the immune system.
2. Cellular and molecular elements of the innate immune response.
3. From recognition to the effective destruction of pathogens
4. Components and phases of inflammation
5. How an innate immune response induces an adaptive immune response.
6. Cells, molecular elements and effector mechanisms of adaptive immune response
7. First barrier against pathogens: Mucosa as physical, chemical, microbial and immunological defence

Part 2

8. Regulation of the immune response. Overview I
9. Regulation of the immune response. Overview II
10. Cytokines I
11. Cytokines II
12. Immunological Tolerance
13. Treg cells
14. immunometabolism
15. Seminar: Interplay between SNC and Immune system. Immunosenescence
16. Seminar: Nuclear receptors in the regulation of the Immune system

Teaching Staff:

- Prof. Silvia Vidal, Head of Part 1, Associate Professor of Immunology, Dept. of Cell Biology, Physiology, and Immunology and Research Group Leader, Institut de Recerca Hospital Sant Pau, UAB.
- Prof. Annabel Valledor, Head of Part 2, Associate Professor of Immunology, Dept. of Cell Biology, Physiology, and Immunology, UB. Group Leader: Nuclear Receptors in metabolism, immune responses and cancer.
- Other speakers will involve seminars given by experts and discussion with the students.

Learning outcomes:

The course is intended for the students to achieve an understanding of the essentials of innate and adaptive immune responses and their regulation.

Assessment methods		
☐ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☒ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test		

Teaching unit jury	
1) VIDAL Silvia	**2) VALLEDOR Annabel**

FUNCTIONAL ANATOMY OF THE IMMUNE SYSTEM					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**21**	**6**	**6**	**0**	**0**

Management Institute:	**Universitat Autònoma de Barcelona**
Teaching unit head(s) Name: **Position:** **Contact, email:**	**ROURA i MIR Carme** **Professor of Immunology** *carme.roura@uab.cat*

Keywords: primary and secondary immune organs, lymphocyte development, cell traffic, homing, tolerance induction, adaptive immune response in lymph nodes, spleen, mucosa, skin. Immunological memory.

Course content:

1. General anatomy of the Immune System.
2. General histology of the lymphoid organs.
3. Primary lymphoid organs. The foetal liver and the bone marrow. Haematopoiesis. Structure and cellular composition of the thymus. Differentiation and maturation of T and B cells.
4. The lymphatic system. Traffic. Homing. High endothelial veinules. Leukocyte extravasation. Homing receptors and chemokines. Inflammation. Effector and memory cell trafficking. Role of adhesion molecules.
5. Secondary lymphoid organs. Cell composition and structure of the resting lymph node. Changes during the immune response. The spleen. Cell composition and structure of the white and the red pulp. The spleen contribution to the immune response.
6. The mucosal immune tissue (MALT). Structure and cellular composition of the tonsils, Peyer patches, appendix. The mucosal immune response.
7. Functional anatomy of the skin immune system. Physical barriers. Network of immune cells of the skin. The skin microbiome and its contribution to the homeostasis of the skin immune response.
8. Functional anatomy of the immune system at the Central Nervous System. The CNS as immune privileged site: a controversy. CNS lymphatic system. Function of glial cells and T cells in the immune response.
9. A practical session on histology of the immune system. Analysis of tissue slides of different lymphoid organs. Search and identification of the structures and cell types characterising each lymphoid tissue.

Teaching Staff:

- Dr. Ricardo Pujol Borrell, Professor of Immunology, Hosp. Univ. Vall d'Hebron, UAB
- Dr. Mercè Martí, Professor of Immunology, Dept. of Cell Biology, Phisiology and Immunology, UAB
- Dr. Dolores Jaraquemada, Professor of Immunology, Dept. of Cell Biology, Physiol. and Immunology, UAB
- Dr. Miguel Vicente-Manzanares, Senior Investigator, Inst. of Cancer Molecular and Cellular Biology, Cancer Research Center, USAL-CSIC, Salamanca, Spain
- Prof. Eduardo Martínez-Naves, Dept. of Immunology and Ophthalmology, Medicine School, Universidad Complutense, Madrid.
- Dr. Carme Roura-Mir, Professor of Immunology, Dept. of Cell Biology, Physiology, and Immunology, UAB
- Dr. Carlos Barcia, Group Leader of the Neuro-immunity Research Group, Neuroscience Institute, UAB
- Dr. Anna Sala M.D, Ph.D., Allergist. Hosp. Univ. Vall d'Hebron. Associate Prof. of Immunology, Universitat Ramon Llull, Barcelona.

Learning outcomes:

After completing the course, the students should achieve a full understanding of the generation, localisation, distribution, and structure of the different components of the immune system. And how do they traffic and interact to produce a distinct immune response in the different secondary lymphoid tissues.

Assessment methods

☐ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test		

Teaching unit jury

1) ROURA i MIR Carme	**2) JARAQUEMADA Dolores**

ANTIGEN RECOGNITION					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**21**	**6**	**6**	**0**	**0**

Management Institute:	**Universitat Autònoma de Barcelona**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**ALVAREZ Iñaki** **Associate Professor of Immunology** *inaki.alvarez@uab.cat*

Keywords: HLA, H-2, MHC, antigen processing, Immunoglobulins, T-cell receptor, NK receptors, bioinformatics, data management.

Course content:

1. The HLA system. Genetic polymorphism. Gene frequency and allele frequency at the population level. Study of the HLA system in different populations. Equilibrium of Hardy-Weinberg. Linkage disequilibrium. HLA and disease: hypothesis. HLA typing methods and analysis of the results. KIR typing. HLA and transplantation: solid organs and bone marrow transplantation. Transplantation of hematopoietic stem cells. Influence of HLA typing in the prognostic of transplantation. Immunosuppression and HLA.
2. The H-2 system and its utilities. Genetics of H-2. Inbred mouse strains. Concepts: syngeneic, congenic, backcross. How is an inbred strain generated? Strains for the study of immune mechanisms. Transgenic, knock-out, knock-in and double transgenic animals. Bone marrow transplantation for the study of its development and function.
3. Antigen processing and presentation. Antigen processing. Ligand generation: pathways of antigen processing. Antigen presentation: MHC and antigen presentation. MHC function. Structure of MHC molecules. Peptide binding to MHC molecules. Non-classic molecules.
4. Genetics of the NK receptors. The NK cluster. Genetics and diversity of KIRs. NK receptors in different species. NK haplotypes. Association with HLA class I genes. Patterns of expression and clonality. KIR and disease.
5. Genetics of Immunoglobulins. B cell receptor (BCR). Genetics of the BCR. Classes of immunoglobulins. Effector function of immunoglobulins.

6-7. Genetics of the T cell receptor (TCR). The TCR. Genetics of the TCR. Generation of the peptide repertoire in the thymus. αβ and γδ receptors. Studies in animals.

8-9. Bioinformatics applied to immunogenetics. Databases. Access to databases for analysis of protein, DNA, sequencing, structure, homology, function, location, polymorphisms

Teaching Staff:

- Dr. Iñaki Alvarez, Head of the Teaching Unit, Senior Lecturer in Immunology, Dept. of Cell Biology, Physiology, and Immunology, Universitat Autònoma de Barcelona (UAB).
- Dr. Eduard Palou, Consultant, Dept. of Immunology, Hospital Clínic, Universitat de Barcelona (UB).
- Dr. Dolores Jaraquemada, Prof. of Immunology, Dept. of Cell Biology, Physiology, and Immunology, UAB.
- Dr. María José Herrero, Senior Researcher, Banc de Sang i Teixits, BST, Barcelona
- Dr. Pablo Engel, Prof. of Immunology, Dept. of Cellular Biology and Pathology. Medical School, UB.
- Dr. Oscar de la Calle, Consultant, Immunology Division, Hospital de Sant Pau and Associate Prof. of Immunology, Faculty of Medicine, UAB.
- Dr. Yaqoub Ashhab, Associate Professor of Biotechnology, Director of the Biotechnology Research Center, Palestine Polytechnic University.

Learning outcomes:

The course is designed to give students knowledge on the immune system genes, the generation of antigen receptor diversity, clonality, MHC genetic polymorphisms, the MHC and other antigen processing and presentation molecules and the genes of the NK receptors. To understand the genetic factors influencing the immune response and their applications to the diagnostic and specific therapies. Also, the use of relevant bioinformatic tools to study the genes of the immune system.

Assessment methods

☐ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☐ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test		

Teaching unit jury

1) ÁLVAREZ Iñaki	**2) JARAQUEMADA Dolores**

RECEPTOR SIGNALLING					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Seminars (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**18**	**6**	**6**	**0**	**0**

Management Institute:	**Universitat de Barcelona**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**SOLER Concepció** **Professor of Immunology** *concepciosoler@ub.edu*

Keywords: Signal transduction: receptors, molecules, systems, pathways. Mechanisms of signal integration.

Course content:

1. Signal transduction in the immune system
2. SMAD signalling pathway
3. Mechanisms of CARD14- induced inflammation
4. Adaptor molecules in mast cell signalling pathways
5. Epigenetic regulation in the Immune system
6. T-cell receptor dynamics and signalling
7. NOTCH signalling pathway
8. mTOR signalling pathway
6. Effects of Signal Transduction during Inflammation Mediated by CD4+ T cells
7. Manipulating innate immune signalling to promote virus- mediated immunotherapy
8. Oral teamwork presentations

Teaching Staff:

Teaching Staff from Faculty of Biology and Faculty of Medicine, Universitat de Barcelona (UB). Other speakers will be invited based on their excellence.
The tutorials will involve the discussion of articles covering various topics of this course.

Learning outcomes:

Students should know and understand the cell signalling as a process integrated multiple signals, the molecular mechanisms involved and the basis for its modulation in immune cells.

Assessment methods

☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test		

Teaching unit jury

1) SOLER Concepció	**2) STRATMANN Thomas**

IMMUNOPATHOLOGY AND IMMUNOTHERAPY					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
6	**40**	**6**	**9**	**0**	**0**

Management Institute:	**Universitat Autònoma de Barcelona**
Teaching unit head(s) Name: **Position:**	**MARTÍNEZ GALLO Mónica, MARTÍNEZ-CÁCERES Eva, HERNÁNDEZ Manuel** **1) Assistant Professor of Immunology, 2) Head, Immunology Division HGTP and Prof of Immunology, 3) Head Immunology Division HVH**
Contact, email:	*monica.martinez@vallhebron.cat* *emmartinez.germanstrias@gencat.cat* *manuel.hernandez@vallhebron.cat*

Keywords: immune-mediated diseases, hypersensitivity, autoimmunity, tumor immunology, immunodeficiencies, immunotherapies

Course content:

This course will introduce the students to the immune response in disease with special emphasis to immune mediated diseases. The students will have to apply their newly acquired concepts on the mechanisms of the normal immune response to these diseases. The students will also learn the principles of experimental immunopathology and the main diagnostics test currently in use in the clinical immunology laboratory.

The course will cover with detail the following issues:

1. Hypersensitivity as cause of disease.
2. Autoimmune and auto inflammatory disease.
3. Tumour Immunology.
4. Transfusion Medicine and Transplantation.
5. Primary immunodeficiencies.
6. Immunotherapies and its applications.
7. Cellular therapies.
8. Tests for immune mediated diseases, the clinical laboratory, and the new molecular tools

Teaching Staff:

- Prof Eva Martínez Cáceres, Prof of Immunology UAB, Head Immunology Division, Hospital Germans Trias i Pujol, UAB
- Dr. Manuel Hernández, Head Immunology Division, Hospital Vall d'Hebron, UAB
- Dr. Mónica Martínez Gallo, Assistant Professor of Immunology, Hospital Vall d'Hebron, UAB
- Other speakers to be announced: sessions will involve seminars given by experts and discussion with the students

Learning outcomes

After the course students will: be able to use immunopathology concepts for reasoning to understand clinical cases; know which immunology tests can help in the diagnosis of the main immune-mediated diseases; know the basis of immunotherapies and their potential in human disease; have the capability to discuss the relevant research results at a journal club or at a research meeting.

Assessment methods		
☒ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test, min attendance 80%		

Teaching unit jury	
1) MARTÍNEZ GALLO Mónica	**2) MARTÍNEZ CÁCERES Eva 3) HERNÁNDEZ Manuel**

IMMUNE RESPONSE TO PATHOGENS					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Seminars (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**24**	**4**	**8**	**0**	**0**

Management Institute:	**Universitat Autònoma de Barcelona**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**COLOBRAN Roger** **Associate Professor of Immunology** *roger.colobran@uab.cat*

Keywords: Immune response to bacteria, virus, fungi, parasites, vaccines, innate immune response, adaptive immune response, HIV, COVID-19, tuberculosis, malaria.

Course content:

1. Immune response to virus. **1.1** Innate and adaptive immune response to virus; **1.2** Inborn Errors of Immunity (IEI) causing viral infections; **1.3** Expert seminars on viral infections (COVID-19, HIV)

2. Immune response to bacteria. **2.1** Immune response to extracellular bacteria; **2.2** Inborn Errors of Immunity (IEI) causing extracellular bacterial infections; **2.3** Expert seminars on extracellular bacteria; **2.4** Immune response to intracellular bacteria; **2.5** Inborn Errors of Immunity (IEI) causing intracellular bacterial infections; **2.6** Expert seminars on intracellular bacteria (mycobacteria, tuberculosis)

3. Immune response to Fungi. **3.1** Innate and adaptive immune response to fungi; **3.2** Inborn Errors of Immunity (IEI) causing fungal infections.

4. Immune response to parasites. **4.1** Innate and adaptive immune response to parasites (helminths). **4.2** Expert seminars on parasites (Plasmodium, malaria)

5. Working group presentations on immune response, evasion mechanisms and vaccines to specific pathogens

Teaching Staff:

Dr Roger Colobran: Head of the Teaching Unit, Associate Professor of Immunology, Dept. of Cell Biology, Physiology, and Immunology, UAB.

Invited speakers:

Dr. Julià Blanco, Head of Cellular Immunology and Virology Group, AIDS Research Institute (IrsiCaixa), Hospital Germans Trias i Pujol (HUGTIP), UAB.
Dr. Javier Martínez-Picado, ICREA Research Professor, AIDS Research Institute (IrsiCaixa), HUGTIP, UAB.
Dr. Christian Brander, ICREA Research Professor, AIDS Research Institute (IrsiCaixa), HUGTIP), UAB
Dr. Esteban Veiga, Centro Nacional de Biotecnología (CNB-CSIC), Madrid.
Dr. María Pérez, Lecturer in Microbiology, Dept of Genetics and Microbiology, UAB.
Dr. Pere Joan Cardona, Senior Investigator, Head of the Experimental Tuberculosis Unit, Research Institute Hospital Germans Trias i Pujol (IGTP), Associate Professor of Microbiology, UAB.
Dr. Alfred Cortés, ICREA Research Professor, Institute of Global Health (ISGlobal) Hospital Clínic, UB.
Dr. Gemma Moncunill, Associate Research Professor, Institute of Global Health (ISGlobal) Hospital Clínic, UB.
Dr. Hernando del Portillo, ICREA Research Professor, Institute of Global Health (ISGlobal), HUGTIP, UAB.

Learning outcomes:

The course is intended for the students to achieve a full understanding of the relationship between the type of immune response and characteristics of each pathogen: the way and the anatomical site of entry, the effector mechanisms of response and evasion. Understanding the relationships between a potential pathogen and its host and how genetic defects of specific immune genes lead to pathogen-specific infections.

Evaluation methods: 2 written examination covering (1) immune response to virus and extracellular bacteria (2) immune response to intracellular bacteria, fungi and parasites. 35% value of total assessment for each exam. The remaining 30% will correspond to the oral presentation of a seminar.

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☐ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test		

Teaching unit jury	
1) COLOBRAN Roger	**2) ROURA i MIR Carme**

LABORATORY AND COMPUTER PRACTICALS					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Practical Sessions (hours/student)**	**Seminars (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**4**	**28**	**3**	**0**	**8**

Management Institute:	**Universitat de Barcelona, Universitat Autònoma de Barcelona**
Teaching unit head(s) Name:	**STRATMANN Thomas, ROURA i MIR Carme, ASHHAB Yaqoub**
Position:	**Associate Professors of Immunology and of Molecular Biology**
Contact, email:	*thomas.stratmann@ub.edu* ; *carme.roura@uab.cat*

Keywords: Wet lab, quantitative analysis, qualitative analysis, functional analysis, genomic databases, *in silico* vaccine design, epitope prediction, gene expression data analysis, pathway enrichment analysis

Course content:

Part 1 Wet lab practicals UB/UAB:

1. Preparation of buffers, calculation of dilutions.
2. Determination of proteins concentrations in solutions by spectrophotometry.
3. Analysis of antibody-antigen interactions by Enzyme Linked Immuno Sorbent Assay (ELISA) and antigen. Quantification. Antibody titration by indirect ELISA.
4. Isolation of PBMCs from peripheral blood, cell concentration and viability determination.
5. Phagocytosis assay and cell phenotype analysis by flow cytometry.
6. T cell proliferation assay and data analysis.

Part 2 Computer practicals UAB:

1. Introduction to Immunoinformatics.
2. Immunological databases: hands-on training.
3. Introduction to vaccine design and reverse vaccinology.
4. Retrieval of genomic and proteomic data for different pathogens: hands-on training.
5. Overview of bioinformatics pipelines for neoantigen-based personalised cancer vaccines.
6. Tools for reverse vaccinology: hand-on training
7. Introduction to gene expression resources for immunology research.
8. Gene list enrichment analysis and pathway enrichment analysis: hands on training.

Part 3 Site visits:

Two visits each year being either:

1. The vaccine producing biotech company Hipra (Amer, Girona) https://www.hipra.com/en/about-hipra, and the Synchrotron Alba (Cerdanyola del Vallès, Barcelona) https://www.albasynchrotron.es/en/about/welcome
2. The vaccine producing biotech company Laboratorios Reig Jofre (St. Joan Despí, Barcelona) https://reigjofre.com/en/ and the BCN Supercomputing Center (Barcelona) https://www.bsc.es/.

The visits will include seminars on the use of AI (artificial intelligence) on the design of vaccines (Hipra, ALBA synchrotron and Barcelona Supercomputing Center (BSC)) and the analysis of epidemiological data (BSC).

Teaching Staff:

- Teaching staff from Faculty of Biology, Universitat de Barcelona (UB)
- Teaching staff from the Dept. of Cellular Biology, Physiology and Immunology, Faculty of Biosciences, UAB
- Invited scholar, Professor Yaqoub Ashhab, Director of the Biotechnology Research Center, Palestine Polytechnic University.

Learning outcomes:

The course is designed to give students a basic understanding to some basic laboratory instruments, understand antibody-antigen interactions, prepare and culture mammalian cells, perform immunophenotyping by flow cytometry and functional analysis of T and mononuclear cells. After completing the Immunoinformatics part the students should be able to: 1) Describe the fundamental concepts of Immunoinformatics; 2) Recognise the major publicly available data sources for immunology research; 3) Gain confidence in using software and tools to perform reverse vaccinology and gene-pathway analysis; 4) Identify and evaluate the potential of different bioinformatics methodologies to their own research.

Assessment methods

☐ **Oral questioning**	☒ **Presentation**	☒ **Practice report**
☐ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test		

Teaching unit jury

1) **STRATMANN Thomas**	2) **ROURA i MIR Carme**

TRANSLATIONAL IMMUNOPATHOLOGY					optional (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
6	**20**	**126**	**12**	**0**	**0**

Management Institute:	**Universitat Autònoma de Barcelona**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**MARTÍNEZ MARTÍNEZ Laura, de la CALLE Óscar** **Prof. of Immunology, Hospital de Sant Pau, UAB** *lmartinezma@santpau.cat* *oscar.delacalle@uab.cat*

Keywords: immune tolerance, autoimmune diseases, systemic autoimmunity, lupus, liver autoimmunity, inflammatory bowel diseases, autoimmunity, myopathies, experimental models, immunotherapy. Primary and secondary immunodeficiencies; innate immunity deficiencies, adaptive immunity deficiencies, diseases of immune disregulation, acquired immunodeficiency syndrome

Course content:

1. General features of the more common organ and non-organ specific autoimmune diseases.
2. Tests used for the diagnosis and follow up autoimmune diseases.
3. Experimental autoimmune diseases.
4. The basis of the therapies applied to autoimmune diseases.
5. Primary Immunodeficiencies (PID) definition, classification and epidemiology.
6. Molecular Basis of the PIDs. Advanced research techniques in PIDs.
7. Severe Combined Immunodeficiencies. Treatment.
8. Predominantly Antibody Deficiencies. Treatment.
9. Combined Immunodeficiencies with associated or syndromic features.
10. Diseases of Immune Dysregulation. Familial Hemophagocytic Lymphohistiocytosis and PID Syndromes with Autoimmunity (ALPS).
11. Congenital Defects of Phagocytes.
12. Defects in Innate and Intrinsic Immunity.
13. Acquired ImmunoDeficiency Syndrome (AIDS).

Teaching Staff:
Dr. Oscar de la Calle, Prof of Immunology, Hospital de St Pau, UAB
Dr. Laura Martínez Martínez, Associate Prof of Immunology, Hospital St Pau, UAB
Other speakers to be announced: tutorials will involve seminars given by experts and discussion with the students

Learning outcomes
After the course students should be able to apply immunopathology concepts to understand clinical cases of autoimmunity and immunodeficiencies; know the immunology tests that help diagnosis of autoimmune diseases; be able to design a strategy to approach research in autoimmune diseases. Know the immunology tests that help diagnosis of immunodeficiency diseases. Have the capability to discuss research results at a journal club or at a research meeting.

Assessment methods

☒ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test, min attendance 80%		

Teaching unit jury

1) MARTÍNEZ MARTÍNEZ Laura	**2) de la CALLE MARTÍN Óscar**

VACCINES IN SOCIETY					optional (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Seminars (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**15**	**5**	**0**	**0**	**6**

Management Institute:	**Universitat Autònoma de Barcelona**	
Teaching unit head(s) Name: **Position:**	**ROURA i MIR Carme, JARAQUEMADA Dolores** **Professor of Immunology**	
Contact, email:	carme.roura@uab.cat	dolores.jaraquemada@uab.cat

Keywords: challenge-based research and innovation, Sustainable Development Goal 11, citizen science, societal challenges.

Course content:
This course will educate students to face challenges of the future. They will learn how to adapt vaccinology to the changing world by addressing issues related to climate change, green energy, one-Health, and global mobility. It will also address worldwide access to healthcare and equality in vaccine design, targets and distribution in line with EU values and the United Nations' Sustainable Development Goals (SDGs).

The course will cover the following topics in relation to the field of vaccines:

1. Big Data & Climate Change adaptations.
2. Adaptation of cities and human settlements to be inclusive, safe, resilient, and sustainable.
3. Promotion of values of social and gender equity in an international and multidisciplinary context.
4. Application and advancement of the principles of ecological, social and economic sustainability through citizen participation mechanisms.
5. Use of AI (artificial intelligence) to sort biological problems. Applications in vaccinology. Bioinformatic tools.

The content of the course will be adapted in each edition depending on the courses offered by the ECIU university, the European Consortium of Innovative Universities (ECIU Erasmus+ project). This consortium is composed by the UAB and 11 universities each from different countries (https://www.uab.cat/web/about-the-eciu-university-1345821748045.html).

Course structure: hybrid teaching combining online and in person classes. Seminars by experts on the proposed topics along the semester will be combined with challenge-based learning in which participants face a specific problem and explore possible options for improvement, leading to proposals of solutions that may be eventually implemented and evaluated.

Teaching Staff:
Teaching staff from the Universitat Autònoma de Barcelona participating at the ECIU University project and other UAB and UB experts on the topics.

Learning outcomes:
The course will prepare students to grasp the changing world and help them adapting future vaccines to new challenges inherent to the Anthropocene.

Assessment methods		
☐ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☐ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☒ **Report / thesis**	☒ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury	
1) ROURA i MIR Carme	**2) JARAQUEMADA Dolores**

LANGUAGES 1					optional
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Seminars (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**21**	**6**	**0**	**0**	**0**

Management Institute:	**Universitat Autònoma de Barcelona Language Service**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**PRATS-CARRERA Sonia** **Director of Studies UAB Language Service** *sonia.prats@uab.cat*

Keywords:Language courses, different levels (in accordance with the Common European Framework): A1, A2, B1, B2.1, B2, C1.1, C1.2.

Course content:

Improving the student's proficiency level, taking into account his or her previous knowledge of the language. The student is asked to take a placement test on arrival at the Language Service so as to be placed in the adequate course, according to his or her level.

Languages offered through in-person teaching:
1. Spanish course
2. French course
3. Advanced English

Teaching Staff:
Experienced teachers at the UAB Language Service http://www.uab.cat/servei-llengues/

Learning outcomes:
Depending on the initial level of the student: a specific level at the end of the course is monitored by the final exam and attested by certificate of level attained.

Assessment methods

☐ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury

1) PRATS Sonia	**2) ROURA i MIR Carme**

3. S2 Teaching unit sheets of the semester 2 in Antwerp (Belgium)

S2 Teaching Units	Immuno -logy	Infectio -logy	Res., clin. & industrial vaccinology	Grasping the changing world & Languages	TOTAL ECTS
Immune system in early life, pregnant women and elderly	3				3
Description & variability of pathogens		6			6
Host-pathogen interactions		3			3
Novel technologies, vaccine administration routes & adjuvants			3		3
Vaccine manufacturing & quality control, regulatory approval processes			3		3
Data mining				3	3
Summer school on vaccinology			3		3
Languages 2a				3	3
Optional choices in:					
Molecular virology		3			3
Languages 2b				3	
Total ECTS / field	**3**	**12**	**9**	**6**	**30**

IMMUNE SYSTEM IN EARLY LIFE, PREGNANT WOMEN AND ELDERLY					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**24**	**0**	**8**	**0**	**0**

Management Institute:	**University of Antwerp**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**MAERTENS Kirsten** **Associate Professor** *kirsten.maertens@uantwerpen.be*

Keywords: Ontogeny; early life; pregnancy; aging immune system

Course content:

1. Immunological changes during pregnancy, in general and in relation to vaccination and vaccination strategies
2. Ontogeny of the human immune system
   - Innate system
   - Adaptive immune system
3. Challenges for immunisation in early life
4. Immune changes in elderly
5. Effect of aging of the immune system on specific vaccine responses

Teaching Staff:

- Prof. Pierre Van Damme, emeritus professor, Vaccine & infectious disease institute, Centre for the Evaluation of Vaccination Group Leader, UA
- Prof. Kirsten Maertens, assistant professor and senior researcher, Department of Vaccine & infectious disease institute, Centre for the Evaluation of Vaccination research group, UA
- Guest speakers: experts in the field will give lectures

Learning outcomes:

The course is intended for the students to be able to understand (i) the changing immunology in pregnancy, (ii) the impact of the changing immunology during pregnancy on vaccine responses, (iii) the rationale for vaccination strategies in pregnant women. To gain knowledge on (i) ontogeny of the human immune system in general, (ii) specific ontogeny of the innate immune system, in general and in relation to vaccines administered during early life, (ii) specific ontogeny of the adaptive immune system in general and in relation to vaccines administered during early life. To understand (i) what the future challenges and possible solutions are for immunisation in early life, beyond the neonatal period, (ii) the impact of aging on the immune system, (iii) what the challenges and possibilities are for immunisation of the elderly population.

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☒ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) MAERTENS Kirsten	**2) NA**

DESCRIPTION AND VARIABILITY OF PATHOGENS					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
6	**55**	**0**	**16**	**0**	**0**

Management Institute:	**University of Antwerp**
Teaching unit head(s) Name: **Position:** **Contact, email:**	**DELPUTTE Peter, BARBEZANGE Cyril, ARIËN Kevin** **Professors** *peter.delputte@uantwerpen.be* *cyril.barbezange@uantwerpen.be* *kevin.arien@uantwerpen.be*

Keywords: Microbiology; virology; bacteriology; parasitology

Course content:

1. A systematic overview of micro-organisms is provided and the course deals successively with virology, bacteriology, parasitology, and limited aspects of mycology
2. For each type of micro-organism, the following aspects are discussed. The anatomy of micro-organisms, metabolism, reproduction, taxonomy, epidemiology, resistance, and pathogenicity
3. Detailed overview is given of specific viruses, bacteria, parasites, and some fungi, with a special focus on the epidemiological aspects and pathogenicity of the various genera. Aspects of ecology, e.g. climate change and interventions in the environment, and how this influences virus epidemiology and disease are discussed (lecture Prof. Herwig Leirs).

Teaching Staff:

- Prof. Peter Delputte, professor, Department of Biomedical Sciences, Laboratory for Microbiology, Parasitology and Hygiene (LMPH) Group Leader of Virology, UA
- Prof. Cyril Barbezange, guest professor Molecular Virology and epidemiology, Department of Biomedical Sciences, UA
- Prof. Kevin Ariën, professor of tropical virology, Department of Biomedical Sciences, UA
- Prof. Louis Maes, professor of Parasitology, Department of Biomedical Sciences, UA
- Drs. Sara Van Looy, graduate teaching and research assistant, Department of Biomedical Sciences, Laboratory for Microbiology, Parasitology and Hygiene (LMPH), UA

Learning outcomes:

The course is intended for the students to gain theoretical and practical insights in infectious diseases with an emphasis on pathogenesis and diagnostics. The course aims at providing the following skills:

1. The student can describe the structure and replication strategies of different pathogens.
2. The student knows the taxonomy of medically relevant viruses and bacteria
3. The student knows the most important fungi and parasites and their taxonomy.
4. The student can explain how viruses, bacteria and fungi can cause diseases.
5. The student has insights in the epidemiology of infectious diseases and can interpret prevention measures in a correct manner.
6. The student knows the different diagnostic methods and their advantages/disadvantages
7. The student can grow and identify bacteria.
8. The student can evaluate the activity of antibiotics and disinfectants.
9. The student can use a microbiological safety cabinet in a proper manner.
10. The student can work with cell cultures.
11. The student can make a primary cell culture.
12. The student knows how to isolate viruses on a cell culture and how to quantify viruses

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☒ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) DELPUTTE Peter	**2) ARIËN Kevin**

HOST-PATHOGEN INTERACTIONS					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**20**	**0**	**12**	**0**	**0**

Management Institute:	**University of Antwerp**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**CALJON Guy** **Research Professor** *guy.caljon@uantwerpen.be*

Keywords: Immunity; protection; host; pathogen; interaction

Course content:

1. To predict theoretical potentially protective immune responses to any given pathogen based on life cycle data
2. To analyse the literature on host-pathogen interaction for a particular pathogen
3. To discriminate potential protective immune responses from immunopathology
4. To anticipate which type of vaccines could be potentially protective for a given pathogen
5. In this course each student compiles and presents, from literature, a detailed overview of the immunity, the known and documented immune (protective) effector mechanisms, related immunopathology, and the progress in vaccine development against a particular pathogen

Teaching Staff:

- Prof. Guy Caljon, research professor, Department of Biomedical Sciences, Laboratory for Microbiology, Parasitology and Hygiene (LMPH) Group Leader of Parasitology, UA

Learning outcomes:

The course is intended for the students to achieve an advanced understanding of the principles and mechanisms of immune protection against (tropical) infectious diseases. Knowledge to predict which immune responses are potentially essential in the defence against a particular pathogen. Justify the vaccine design against a particular pathogen. Acquired skill to give a comprehensive overview of the immunity against a particular pathogen.

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) CALJON Guy	**2) NA**

NOVEL TECHNOLOGIES, VACCINE ADMINISTRATION ROUTES & ADJUVANTS					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**30**	**10**	**8**	**0**	**0**

Management Institute:	**University of Antwerp**
Teaching unit head(s) Name:	**DELPUTTE Peter**
Position:	**Professor**
Contact, email:	*peter.delputte@uantwerpen.be*

Keywords: Novel technology; adjuvant; immunology; vaccine development; mode of action; toll-like receptor; route of administration; clinical research; vaccine safety

Course content:
This course is designed in close collaboration with our industrial partners.

1. Adjuvant definition, adjuvant families and role of adjuvants
2. Matching the right one: Antigens may need help - why and when?
3. General adjuvant mode of action (MoA): immunological interpretation, the relationship between innate and adaptive immunity
4. (Pre-)clinical experience using novel adjuvants in vaccine formulations, impact on immune response
5. Clinical tolerability, safety considerations, and current safety profile of adjuvanted vaccines
6. Learning & challenges in developing, manufacturing, and licensing AS-containing vaccines
7. Considerations for use of adjuvanted vaccines in special populations
8. Novel technologies, including routes of administrations
9. Advances in Immunology and Vaccine Discovery: Considerations for future applications, including antigen identification and selection supported by AI (artificial intelligence) and data mining such as TCR sequencing
10. Tutorials: will involve reading relevant articles covering various topics of this course. Series of didactic presentations and practical exercises through group work

Teaching Staff:
- Prof. Peter Delputte, professor, Department of Biomedical Sciences, Laboratory for Microbiology, Parasitology and Hygiene (LMPH) Group Leader of Virology, UA
- Staff from GSK Vaccines Wavre and GSK global
- Guest speakers: experts in the field will give guest lectures

Learning outcomes:
The course is intended for the students to strengthen their capacity in vaccinology with comprehensive overview of the field, discuss recent scientific advances contributing to the progress of vaccine development, specifically related to adjuvants, novel technologies, and routes of administrations.

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) DELPUTTE Peter	**2) NA**

VACCINE MANUFACTURING & QUALITY CONTROL, REGULATORY APPROVAL PROCESSES					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**30**	**10**	**0**	**0**	**0**

Management Institute:	**University of Antwerp**
Teaching unit head(s) Name: **Position:** **Contact, email:**	**DELPUTTE Peter** **Professor** *peter.delputte@uantwerpen.be*

Keywords: Vaccine development; vaccine manufacturing; vaccine quality; vaccine evaluation; vaccine standards; GMP; vaccine regulation; vaccine licensing; vaccine prequalification programme; international supply chains

Course content:
This course is designed in close collaboration with our industrial partners.

Part 1: Vaccine manufacturing and quality control

1. Vaccine manufacturing: from working seed to filling and packaging
2. Examples of vaccine production: viral and bacterial vaccines, recombinant protein vaccines
3. GMP considerations
4. Industry and new technologies: antigen sparing, cell culture, thermostability, increasing efficiency of manufacturing and minimising environmental impact and carbon footprint
5. Quality control and quality assurance: supply chain protection, monitoring and testing

Part 2: Vaccine regulatory approval processes

6. Laws, regulations and guidance
7. CTD format: content and review
8. From development to licensure: examples of EU, US and international procedures
9. Approval, variations, and renewals
10. Specific requirements: paediatric population, risk management
11. Role of supranational organisations in vaccine approval and distribution: WHO prequalification and article 58
12. The tutorials will involve the study of articles or patents covering various topics of this course. Technological monitoring of different subjects in these areas will be conducted in groups and presented during specific sessions

Teaching Staff:
- Prof. Peter Delputte, professor, Department of Biomedical Sciences, Laboratory for Microbiology, Parasitology and Hygiene (LMPH) Group Leader of Virology, UA
- Staff from GSK Vaccines Wavre and GSK global
- Guest speakers: experts in the field will give lectures

Learning outcomes:
The course is intended for the students to be able to understand vaccine manufacturing principles, rules and regulations related to vaccine development, manufacturing, assessment, and release, to explain regulatory process for vaccine review and approval, to explain role of supranational organisation in vaccine registration and surveillance and how the expedited procedure fits into the existing legal framework for licensing of vaccines.

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) DELPUTTE Peter	**2) NA**

DATA MINING					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**32**	**0**	**8**	**0**	**0**

Management Institute:	**University of Antwerp**
Teaching unit head(s) Name: **Position:** **Contact, email:**	**FRANSEN Erik, MEYSMAN Pieter** **Associate professor, Associate professor** erik.fransen@uantwerpen.be pieter.meysman@uantwerpen.be

Keywords: Datasets; multivariate statistics; data mining; computational analysis

Course content:

Part 1: Theory

1. Introduction to different data types and data mining problems:
   - A formal overview of different data types in biology and medicine: quantitative data (e.g. coming from 'omics' platforms), string data (mainly DNA and protein sequences), text, graph data (biological networks), image data
   - An introduction to the challenges of data mining and machine learning.
2. Overview of data mining techniques:
   - Introduction: preprocessing and basic exploratory analysis (univariate statistics) of quantitative data: a revision of statistical concepts (only a revision in the context of the course).
   - Unsupervised learning: clustering, PCA
   - An introduction to classification methods: overview of classification systems, model validation (e.g. different cross-validation techniques), followed by Biomedical feature selection and dimensionality reduction
   - Supervised learning techniques (a solid introduction to commonly used techniques and algorithms): regression techniques, discriminant analysis, support vector machines, random forests, ensemble classifiers, decision trees, neural networks, naive Bayes, association rule mining
   - Biomedical text mining and Visual data mining
3. Biomedical data mining applications:
   - In a number of case studies, and through real research results it will be shown how these techniques can be employed to extract novel insights from biomedical data. These lectures should cover diverse data types (e.g. quantitative molecular data, molecular sequences, molecular interactions, ontologies, text, physiological measurements, patient meta-data …) and several of the techniques addressed above.

Part 2: Practice

The practical part will familiarise the students with the statistical programming language R:

1. Students should be able to correctly read in a dataset, generate graphs and perform elementary data manipulations.
2. Some techniques for statistical data-analysis (linear regression, ANOVA, multivariate techniques,) are illustrated, whereby students should be able to use the help files and search the internet for the code to solve a particular problem
3. Programming techniques including for-loops and custom-made functions to facilitate repetitive analyse

Teaching Staff:

- Prof. Erik Fransen, associate professor and project coordinator, Department of Biomedical Sciences, Medical Genetics (MEDGEN), UA
- Prof. Pieter Meysman, Associate professor & principal research fellow, Department of Informatics, UA

Learning outcomes:

The course is intended for the students (i) to gain insights in various data types and their associated challenges, in the context of the broad biomedical sciences, and more specifically in the context of vaccinology and infectious diseases. (ii) to understand how and which computational techniques can be used to address common challenges in molecular and biomedical data analysis. (iii) to understand the underlying principles of a selection of computational techniques for biomedical data mining, especially in the context of vaccine development. (iv) to be able to select the appropriate technique for a given problem. (v) to be able to interpret the results of typical data mining task.

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☒ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☒ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) FRANSEN Erik	**2) MEYSMAN Pieter**

SUMMER SCHOOL ON VACCINOLOGY					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**20**	**0**	**10**	**0**	**0**
Management Institute:	**University of Antwerp**				
Teaching unit head(s) Name: **Position:** **Contact, email:**	**VAN DAMME Pierre, MAERTENS Kirsten** **Emeritus Professor, Assistant professor** *pierre.vandamme@uantwerpen.be* *kirsten.maertens@uantwerpen.be*				

Keywords: Vaccinology summer course

Course content:

1. Rationale, context, and history of immunisation
2. Key aspects of immunology
3. Key aspects of vaccines
   - Vaccine preventable diseases
   - Immunisation policy and schedules
   - Future perspectives
   - Communication
4. Practical skills

Teaching Staff:

- Prof. Pierre Van Damme, emeritus professor, Vaccine & infectious disease institute, Centre for the Evaluation of Vaccination Group Leader, UA

Learning outcomes:

The course is intended for the students to understand (i) the historical impact of vaccine preventable diseases, discuss the rationale for implementing immunisation programmes, explain concepts of control, elimination and eradication; (ii) Immunology: Explain innate and adaptive immunity, functions of B- and T cells, role of Ab and Ag, impact maternal Ab; Outline the role of immune response to a vaccine, active /passive vaccination, assess the capacity of immune system; (iii) Vaccines: Definition, components and function, different types of vaccines and their expected side effects and contraindications; Stages in vaccine development, procedures of safety control and monitoring of efficacy; (iv) Vaccines preventable diseases: Pathology, population at risk, available preventive measures for each disease; (v) Policy and schedules: Vaccines in immunisation schedule; Show historical impact of vaccination on epidemiology ; Spread of infections, herd immunity, role of modelling, economic evaluation; Factors informing policy decisions; Role of disease surveillance, vaccination coverage data; (vi) Future: List new target diseases; Vaccines in the pipeline, new ways of administration; Current research on components and techniques; Discuss current developments for HIV, dengue, malaria, hepatitis C; (vii) Communication Describe myths and facts relating to immunisation controversies, list common misconceptions, respond to objections of anti-vaccine movements; Critically evaluate media reporting, understand public perception; List key points for responding to parents' fear; Ethics of communication; how to respond to anti-vaccine lobbies; State advantages and risks that need to be communicated; Direct to other information sources; (viii) Practical skills: immunisation site, immunisation techniques, vaccine reconstitution, cold chain, storage, conditions, prepare and dispose vaccine equipment, avoid needle stick injuries, recognise true contraindications, distinguish anaphylaxis and fainting.

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☒ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) VAN DAMME Pierre	**2) MAERTENS Kirsten**

LANGUAGES 2a					mandatory
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**60**	**0**	**30**	**0**	**0**

Management Institute:	**University of Antwerp**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**HEUGHEBAERT Els** **Language course coordinator** *els.heughebaert@uantwerpen.be*

Keywords: Language course; trimester course; different levels

Course content:

1. Improving language skills in English, French, Dutch, Italian or Spanish via
   - Active and communicative interactions
   - It is competency-focused
   - Formal accuracy
   - Varied teaching methods
   - Homogenous groups
   - Learning result and pleasure

Teaching Staff:

- Els Le Page, linguistic and pedagogical adviser, Department of Linguapolis, UA
- Eva De Volder, French language coordinator, Department of Linguapolis, UA
- Giorgio Rinaldi, Italian language teacher, Department of Linguapolis, UA
- Ana Lopez Antia, Spanish language teacher, Department of Linguapolis, UA
- Sabine Steemans, Dutch language teacher, Department of Linguapolis, UA

Learning outcomes:

The course is intended for the students to develop their language skills to the fullest.

Assessment methods		
☒ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Listening and reading examination		

Teaching unit jury *(Name)*	
1) LE PAGE Els (Linguistic and pedagogical Adviser)	**2) DE VOS Ginny (Foreign Languages Team Co-ordinator)**

MOLECULAR VIROLOGY					optional (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**30**	**0**	**8**	**0**	**0**

Management Institute:	**University of Antwerp**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**DELPUTTE Peter, BARBEZANGE Cyril, ARIËN Kevin** **Professor, Guest Professor, Professor** *peter.delputte@uantwerpen.be* *cyril.barbezange@uantwerpen.be* *kevin.arien@uantwerpen.be*

Keywords: Microbiology; virology.

Course content:
This course will teach students advanced knowledge on virus replication strategies, including

- Target cells and virus entry
- viral genomes and strategies for genome replication
- virus assembly and release.

Attention will be given to pathogenesis and viral immune evasion, virus evolution, emerging and zoonotic viruses and surveillance of viruses, with a focus on medically important viruses and selected methods, such as full genome sequencing of viruses. Practical aspects, and the application of prior lectures will be discussed, including methods to study virus replication and pathogenesis, virus-host interactions, development of antivirals and vaccines, and applications of viruses (pseudotypes, cancer treatment, gene modification, vaccine delivery, study of cell biology…). Finally, students will give a presentation on selected topics of specific viruses.

Teaching Staff:
- Prof. Peter Delputte, professor, Department of Biomedical Sciences, Laboratory for Microbiology, Parasitology and Hygiene (LMPH) Group Leader of Virology, UA
- Prof. Cyril Barbezange, guest professor, Department of Biomedical Sciences, Laboratory for Microbiology, Parasitology and Hygiene (LMPH), UA
- Prof. Kevin Ariën, professor, Department of Biomedical Sciences, Laboratory for Microbiology, Parasitology and Hygiene (LMPH), UA

Drs. Sara Van Looy, graduate teaching and research assistant, Department of Biomedical Sciences, Laboratory for Microbiology, Parasitology and Hygiene (LMPH), UA

Learning outcomes:

- you understand the main molecular virological terminology and specific aspects
- you have an in depth understanding of the molecular biology of viruses
- you have good knowledge of the molecular infection cycle of a selected set of human and animal viruses
- you comprehend the molecular interactions between viruses and their host cells and can explain on molecular level how virus infections may lead to disease
- you can translate the theoretical knowledge towards practical understanding of virus biology and applications of viruses, such as methods to study virus replication and virus infected cells, virus-based gene transfer, development of antivirals and vaccines

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☒ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) DELPUTTE Peter	**2) ARIËN Kevin**

LANGUAGES 2b					optional
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**60**	**0**	**30**	**0**	**0**

Management Institute:	**University of Antwerp**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**HEUGHEBAERT Els** **Language course coordinator** *els.heughebaert@uantwerpen.be*

Keywords: Language course; trimester course; different levels

Course content:

2. Improving language skills in English, French, Dutch, Italian or Spanish via
   - Active and communicative interactions
   - It is competency-focused
   - Formal accuracy
   - Varied teaching methods
   - Homogenous groups
   - Learning result and pleasure

Teaching Staff:

- Els Le Page, linguistic and pedagogical adviser, Department of Linguapolis, UA
- Eva De Volder, French language coordinator, Department of Linguapolis, UA
- Giorgio Rinaldi, Italian language teacher, Department of Linguapolis, UA
- Ana Lopez Antia, Spanish language teacher, Department of Linguapolis, UA
- Sabine Steemans, Dutch language teacher, Department of Linguapolis, UA

Learning outcomes:

The course is intended for the students to develop their language skills to the fullest.

Assessment methods		
☒ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Listening and reading examination		

Teaching unit jury *(Name)*	
1) LE PAGE Els (Linguistic and pedagogical Adviser)	**2) DE VOS Ginny (Foreign Languages Team Co-ordinator)**

4. S3 Teaching unit sheets of the semester 3 in Lyon/Saint-Etienne (France)

S3 Teaching Units	Immuno pathology	Infectio -logy	Res., clin., industrial vaccinology	Grasping the changing world & Languages	TOTAL ECTS
Epidemiology		**3**			**3**
Immunomonitoring of preclinical and clinical vaccine trials			**3**		**3**
Clinical vaccine development			**3**		**3**
Vaccine specific applications			**3**		**3**
Vaccine formulation			**3**		**3**
Communicating on vaccines & public health				**3**	**3**
Project management in innovative vaccinology			**3**	**3**	**6**
Optional choices in:					
Immunology and cancer	**3**				**6**
Neuro-immunology: immune privilege and biotherapies	**3**				
***Healthcare and data intelligence in vaccinology**			**3**	**3**	
Expérimentation animale			**6**		
Languages 3				**3**	
Total ECTS	**3**	**3**	**15**	**9**	**30**

(*) Student exchange: with Master HMDI co-accredited by the high business school “EMLYON” and the engineering and management school "Mines Saint-Étienne".

EPIDEMIOLOGY					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**30**	**0**	**0**	**0**	**0**

Management Institute:	**Université Claude Bernard Lyon 1, UFR Biosciences**
Teaching unit head(s) Name:	**NUNES Marta; ELIAS Christelle**
Position:	**Professor UCBL and Dir. Center of Excellence in Respiratory Pathogens (CERP); University-hospital practitioner (PHU)**
Contact, email:	*marta.nunes@chu-lyon.fr* *christelle.elias@chu-lyon.fr*

Keywords: epidemiology, clinical research, design, cross-sectional studies, case-control studies, cohort studies, role of chance, individual risks; public health surveillance, vaccination investigation, effectiveness and impact

Course content:
Epidemiology is the study of the distribution and determinants of disease frequency in human populations. Human diseases and especially infectious diseases does not occur at random and then has causal and preventive factors that can be identified through systematic investigation in different populations, in different places or at different times. Vaccine is a key preventive factor in the process of transmission and infection. Then, it is an important determinant involved in the natural history of infectious diseases.
Sharing with the students the basic methodological concepts regarding epidemiology
Discussing the applications of epidemiological concepts in the field of diseases, which can be prevented by vaccine.

1. Basic concepts: definition, study designs, measures of disease frequency
2. Types of epidemiologic studies: Descriptive studies, Case-control studies, Cohort studies, Cross-sectional studies, Intervention studies
3. Description and analysis of epidemiological data
4. Role of chance, Bias and Confounding
5. The epidemiology of vaccination
6. Epidemiology of infectious diseases, of non-infectious diseases
7. Design in the field of vaccination, vaccine effectiveness, impact of vaccination

Teaching Staff:
Teaching Staff Epidemiology from Université Claude Bernard Lyon 1
Conferences concerning news, items will be organised. Speakers will be invited based on their excellence.

Learning outcomes:
Student are intended to: use and explain the basic terminology and principles used in epidemiology; distinguish between, and apply, the different measures of frequency, association and impact that are commonly used in epidemiological research; calculate these measures using simple numerical examples; tell apart and explain the different aspects of epidemiological research (causal and descriptive); tell apart and state the (dis)advantages of the different study designs used in epidemiological research: cohort, case-control and cross-sectional studies; read and interpret (simple) epidemiological scientific papers, and recognise in these papers which study design was used; apply the correct measures of frequency and association belonging to the different epidemiological study designs; explain the meaning of the terms 'bias' and 'confounding' and distinguish between them; choose, justify and execute the appropriate epidemiological study set up.

Assessment methods

☐ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test		

Teaching unit jury *(Name)*

1) NUNES Marta	**2) ELIAS Christelle**

IMMUNOMONITORING OF PRECLINICAL AND CLINICAL VACCINE TRIALS					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**10**	**0**	**40**	**0**	**0**

Management Institute:	**Université Jean Monnet Saint Etienne**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**PAUL Stéphane** **Professor-hospital practitioner (PU-PH1)** *stephane.paul@chu-st-etienne.fr*

Keywords: vaccination, animal models, immunomonitoring, flow cytometry, ELISPot, ELISA, , microscopy, mouse, organs, transcriptomics, correlate of protection, big data analysis,artificial intelligence, non-human primate, challenge

Course content:

Laboratory practical work will teach the students how to monitor reactogenicity, innate immunity, humoral and cellular immune response in mice. Immunological techniques include multiparameter flow cytometry analysis, ELISpot, ELISA, microscopy, transcriptomics, routes of administration in mice, mouse immunology.

1. Methods of immunisation in mice, collection of organs, collection of blood and mucosal secretions
2. Multiparameter spectral flow cytometry, big data analysis
3. In vivo imaging
4. Monitoring of B cell responses (ELISpot, antibody titers)
5. Monitoring of T cells (cytometry, polyfunctionality, ELISpot)
6. Transcriptomics, Proteomics and Glyconomics tools to measure vaccine efficiency
7. New methods as the measure of immune diversity, reactogenicity and innate immunity
8. Big datas analysis with AI (artificial intelligence) to identify correlate of protection or vaccine reactogenicity
9. Management of samples for vaccine trial (AQ)
10. Choice of the right animal model and correlates of protection or efficiency

Teaching Staff:

Teaching Staff Immunology from UJM
Conferences concerning news items will be organised. Speakers will be invited based on their excellence.
Practical training for preclinical immunomonitoring (NHP model) will be done with the CEA in Fontenay aux Roses (2 days) and UJM (mouse model).

Learning outcomes:

The course is intended for the students to achieve an understanding of how to monitor and to practice monitoring of vaccine efficiency in animal models and in humans.

Assessment methods

☐ **Oral questioning**	☒ **Presentation**	☒ **Practice report**
☐ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*

1) PAUL Stéphane	**2) LONGET Stéphanie**

CLINICAL VACCINE DEVELOPMENT					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**30**	**0**	**0**	**0**	**0**
Management Institute:	**Université Jean Monnet Saint Etienne**				
Teaching unit head(s) Name: **Position:** **Contact, email**:	**BOTELHO-NEVERS Elisabeth** **Professor-hospital practitioner (PU-PH1)** *Elisabeth.Botelho-Nevers@chu-st-etienne.fr*				

Keywords: clinical trial, phases, biobanking, recruitment, willingness to participate; regulatories, evaluation, efficacy, effectiveness, safety, pharmacovigilance, statistics; clinical data management

Course content:

1. Overview of clinical vaccine development in routine or in an epidemic context, including new strategies in development
2. Challenges in participant's recruitment, determinants associated to participation in a trial, improvement of inform consent form
3. Regulatory affairs, policies
4. Statistical methodology for clinical vaccine trials
5. Clinical data management, big data in vaccine development
6. Markett access, health economics
7. Vaccine life after licensure (real life data, effectiveness, safety), establishment of recommendations (NITAGs, WHO)
8. Clinical trials operations
9. Safety, adverse event following immunisation during trials
10. Good clinical practices
11. Ethics
12. Big datas analysis by AI (artificial intelligence)-assited clinical trials

Teaching Staff:

Teaching Staff Clinical research in vaccinology, Infectious diseases from UJM and from different associated partners (academic and industry).
Conferences concerning news items will be organised. Speakers will be invited based on their excellence and experience being careful to reduce carbon footprints Innovative Teaching such as using an escape game about vaccine clinical development will be done.

Learning outcomes:

To know how vaccines are clinically develop: the methodologies used for evaluation, the challenges in recruitment and retention of participants, the good clinical practices, the monitoring of participants, the regulatory processes, differences in development during epidemics and the life of the vaccine just after licensure.

Assessment methods		
☐ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test, obtention of their good clinical practices certificate		

Teaching unit jury *(Name)*	
1) **BOTELHO-NEVERS Elisabeth**	2) **GAGNEUX-BRUNON Amandine**

VACCINE SPECIFIC APPLICATIONS					mandatory (EN)
ECTS	Lectures (hours/student)	Tutorials (hours/student)	Practical work (hours/student)	Internship (weeks/student)	Digital learning
3	40	0	0	0	0
Management Institute:	Université Jean Monnet Saint Etienne				
Teaching unit head(s) Name: Position: Contact, email:	PAUL Stéphane Professor-hospital practitioner (PU-PH1) stephane.paul@chu-st-etienne.fr				

Keywords: vaccine, infectious diseases, pandemic, epidemic, zoonosis, global warming and climate change, cancer, neurological diseases, allergy, autoimmunity

Course content:

1. Infectious diseases-specific vaccines (Influenza, coronaviruses, Malaria, Schistosomiasis, Leishmaniasis, RSV, HMPV, Haemorrhagic fevers, antibiotic-resistant bacteria, *Pneumococcus, Streptococcus, Staphylococcus*, *H.pylori*, BCG, *Bordetella pertussis*, TB, HIV, HPV, Henipavirus, Orthopoxvirus…)
2. Cancer-specific vaccines (peptide vaccination, oncolytic vaccine, personalised vaccine, combotherapy..)
3. Allergy-based vaccines/immunotherapy (tolerance, specific adjuvantation, allergen definition, schedule of immunisation…)
4. Veterinary-specific vaccines (pets, horses, cow, poultry), type of immunisation strategy, vaccine type, target for zoonosis, concept of the One Health Vaccinology including humans, animals and environment. Influence of climate change and global warming on the emergence of zoonosis. Vaccination of livestock for climate changes.
5. Vaccines for neurological diseases (Alzheimer, Parkinson, Sclerosis)
6. Vaccines for autoimmunity
7. Human challenge models as new way to define vaccine efficacy
8. How to deal with climate change and global warming to restore vaccine immunogenicity

Teaching Staff:

Teaching Staff Immunology from UJM (S Paul, S Longet).
Two days' session on Veterinary vaccines for farm animals and pets will be organised in Boehringer Ingelheim facility (Lyon) and two days' session on human vaccines will be organised in Sanofi-Pasteur facility (Lyon)
Conferences concerning news items will be organised. Speakers will be invited based on their excellence.

Learning outcomes:

The course is intended for the students to achieve an understanding of the different specific applications of the vaccination in the prophylactic and therapeutic ways against different pathogens (preclinical and clinical development) and the development of novel vaccine platforms.

Assessment methods		
☐ Oral questioning	☐ Presentation	☐ Practice report
☒ Written examination	☐ Bibliography report	☐ Internship unwinding
☐ Report / thesis	☐ Digital productions (video, poster, software, wiki…)	
☐ Other (specify):		

Teaching unit jury *(Name)*	
1) Stéphane PAUL	2) Stéphanie LONGET

VACCINE FORMULATION					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**30**	**0**	**16**	**0**	**0**

Management Institute:	**Université Jean Monnet Saint Etienne**
Teaching unit head(s) Name: **Position:** **Contact, email:**	**PAUL Stéphane** **Professor-hospital practitioner (PU-PH1)** *stephane.paul@chu-st-etienne.fr*

Keywords: vaccine, formulation, adjuvant, production, DNA, mRNA, vectors, production

Course content:

1. Description of the different types of vaccine (lived, inactivated, killed, recombinant) and methods of production/inactivation
2. Particulate or nanoparticle-based vaccines (NPs, LNPs, VLPs)
3. Recombinant vaccines (production systems such as *E. coli*, yeast, baculovirus, mammalian cell lines) and characterisation methods
4. Viral/Bacterial-based vaccines (poxvirus, adenovirus, retrovirus, HSV, lentivirus, *Salmonella*…)
5. DNA- and mRNA- basedvaccines (synthesis, production, reactogenicity, controls)
6. Targeted-specific vaccines (immunoantigens, antibody, scFv, ligands)
7. Antigen identification and optimisation (epitopes, antigen structure, reverse vaccinology), vaccinomics, personalised vaccinology, structural vaccinology, artificial intelligence to design novel antigens.
8. Immunisation routes (mucosal administration, devices for intranasal, oral, intradermal administration)
9. Practical approach for vaccine formulation in VFI laboratory (o/w emulsion, aluminium, VLPs, saponins, adjuvants knowledges). Validation and qualification of adjuvants.
10. Machine Learning to reveal immune signatures but also reactogenicity of vaccine formulations.

Teaching Staff:

Teaching Staff Immunology from UJM (S Paul, S Longet).
Practical training for adjuvant formulation will be done with VFI in Geneva (2 days) and UJM
Conferences concerning news items will be organised. Speakers will be invited based on their excellence.

Learning outcomes:

The course is intended for the students to achieve an understanding of the different types of formulated vaccines, type of vaccines, inactivation methods, viral vectors for vaccine, adjuvant, routes of immunisation, production of vaccine including sustainable vaccine manufacturing, choice and design of the antigen, practical approach of the formulation.

Assessment methods		
☐ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) PAUL Stéphane	**2) LONGET Stéphanie**

COMMUNICATING ON VACCINES AND PUBLIC HEALTH					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**30**	**10**	**0**	**0**	**0**

Management Institute:	**Université Jean Monnet Saint Etienne**
Teaching unit head(s) Name: **Position:** **Contact, email**:	**PAUL Stéphane** **Professor-hospital practitioner (PU-PH1)** *stephane.paul@chu-st-etienne.fr*

Keywords: communication, vaccine hesitancy, perception, global health, policies, WHO, CEPI, GAVI, MOOC

Course content:

Vaccines have been and remain a major tool for public health strategies. But the growing complexity of current vaccine agendas for children, the ongoing introduction of new vaccines (conjugate vaccines, programs targeting adults or the aging, addressing chronic or non-infectious diseases) have made decision-making more complex for vaccine producers and authorities in public health and blurred the meanings and purposes of vaccination for the general public. Accordingly, it appears important to provide all apprentices and professionals dealing with vaccines with knowledge pertaining to social sciences as well as biomedical sciences.**(**
1) History of vaccination and vaccines;
2) Epidemiology and vaccination;
3) The place of vaccination in public health decisions;
4) Social factors influencing vaccine policies and strategies in different countries;
5) Anthropology of vaccine acceptance and rejection;
6) Public and media perception of vaccination and vaccines;
7) Health economics and vaccines;
8) the future of vaccinology.

Teaching Staff:

Teaching Staff Immunology from UJM (S Paul, S Longet), University of Claude Bernard Lyon 1 and from the CNRS supporting partner “SPHERE”.
Conferences concerning news items will be organised. Speakers will be invited on specific subjects, selected for their excellence

Learning outcomes:

The course is intended for the students to achieve an understanding of how to collect informations and communicate on vaccination and vaccines, elaborate recommendations to authorities for education, information of the public. History of vaccines and anthropology of human and veterinary vaccines

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☐ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☒ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):**		

Teaching unit jury *(Name)*	
1) Stéphane PAUL	**2) Christine DELPRAT**

PROJECT MANAGEMENT IN INNOVATIVE VACCINOLOGY					mandatory (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
6	**40**	**15**	**36**	**0**	**15**

Management Institute:	**Université Claude Bernard Lyon 1**
Teaching unit head(s) Name: **Position:** **Contact, email:**	**GILBERT Christophe, BOURDONNAY Emilie, DELPRAT Christine** **Associate-Professor, Associate-Professor, Professor (PU-EX)** *christophe.gilbert.bio@univ-lyon1.fr; emilie.bourdonnay@univ-lyon1.fr; christine.delprat@univ-lyon1.fr*

Keywords: analyse, plan, organise, motivate, execute, control, grant application

Course content:
Learning and experimenting the benefits to manage a project to achieve specific goals in the international context of a scientific and multidisciplinary challenge in vaccinology. Student in exchange with EMLYON participate in EMLYON project management.

1. **Life of a project:** from the initiation to the closing including all the planning and executing processes related to the project and the risk analysis
2. **Specific project management expertise** e.g. Managing a project in a P4 laboratory
3. **Risk management**, case-studies
4. **Virtual international project development**: e.g. "Tuberculosis vaccine", recommendations, research aims, research development, regulations, scale-up, GMP production, pre-clinical safety and toxicity studies in animal models, clinical phase I-II-III, industrial production, cost-effectiveness analysis, commercialisation
5. **Project management Methods:** Five W's, brainstorming, Ishikawa diagram, SWOT, SMART, GANTT, PERT, DESC, PDCA…
6. **Practices** corresponds to **Reality International Projects.** Teams of (4-10) students are deployed on projects and placed in a **competitive and collaborative environment** where they will benefit from methodological input and support from a project advisor. They learn in a real-life situation with objectives and deliverables to work on topic that interest them; e.g. vaccinology MOOC production, annual Research Instructive Workshop, Junior scientific committee organising the VaxInLive Symposium, social acute questions in vaccinology, proof of concept for innovation, organising junior interactive research workshop, etc. With innovative project pedagogy, students enjoy their project progress from one week to another along the S3 for a real result "out of the box" of their academic results. Each student carries out a builder role and a manager role in either the same or two different projects. Some projects will be conducted in partnership with the WHO Academy, launched in Lyon in 2024: https://www.who.int/about/who-academy

Teaching Staff:

Prof & Associate Prof from UCBL: Viktor Vochkov for P4 pathogens infectious problem in laboratory and in the natural environment, Emilie Bourdonnay, Christophe Gilbert and Christine Delprat to frame the practices with external advisors, depending on the projects. Industrial staff from LIVE Associated partners (Sanofi Pasteur, Boehringer Ingelheim/Merial, Butantan Institute, etc.) will give conferences and manage tutorials concerning real past project management on infectious problems and vaccines.

Learning outcomes:
To learn different methods and practice them facing to reality project; to develop the ability to analyse, plan, execute and control a scientific and multidisciplinary project linked to vaccinology; to stimulate your creativity through design thinking, to improve your flexibility and you communication abilities.

Assessment methods

☒ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☐ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☒ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** depends on the project deliverables		

Teaching unit jury *(Name)*

1) GILBERT Christophe	**2) BOURDONNAY Emilie**	**3) DELPRAT Christine**

IMMUNOLOGY AND CANCER					optional (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**25**	**0**	**5**	**0**	**0**
Management Institute:	**Université Claude Bernard Lyon 1**				
Teaching unit head(s) Name: **Position:** **Contact, email**:	**DELPRAT Christine** **Professor (PU-EX)** *christine.delprat@univ-lyon1.fr*				

Keywords: cancerogenesis, oncopathogens, immunoediting, immunotherapy, cancer vaccines

Course content:

Using the knowledge of the students in immunology, immunopathology and infectiology, this unit is developing the concepts issued from fundamental research and leading to clinical and pharmaceutical applications in cancerology.

1.Overview of the multi-hits multi-steps and immuno-editing in cancerogenesis
2. Interactions between malignant tumors and the immune system: cancer immunogenicity, immune activation versus suppression by tumor environment
3. Mechanisms of pathogen-induced oncogenesis
4. Cancers of the immune system and consequences
5. Advances in preventive and therapeutic anti-tumor vaccinology, breakthrough in data centres and Artificial Intelligence
6. Protection of immune-suppressed patients against secondary oncogenesis

Teaching Staff:

Teaching Staff Immunology, oncology from University Claude Bernard Lyon 1. Conferences concerning new research development in onco-immunology will be organised. Speakers will be invited based on their excellence. Participation of the CNRS-CRCL Associated Partner.

Learning outcomes:

To analyse, understand and manipulate interactions between tumor cells and the immune system to overcome the cancer progression; to have the capability to present and to discuss research results at a journal club or at a research meeting; to develop speed-reading skills.

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** scientific animation, interactions with invited speakers		

Teaching unit jury *(Name)*	
1) DELPRAT Christine	**2) MAHTOUK Karène**

NEURO-IMMUNOLOGY : IMMUNE PRIVILEGE AND BIOTHERAPIES					optional (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**18**	**4.5**	**0**	**0**	**0**
Management Institute:	**Université Claude Bernard Lyon 1**				
Teaching unit head(s) Name: **Position:** **Contact, email**:	**DELPRAT Christine, DESESTRET Virginie** **Professor (PU-EX), Professor-hospital-practionner (PU-PH1)** *christine.delprat@univ-lyon1.fr; virginie.desestret@univ-lyon1.fr*				

Keywords: bood-brain interfaces, neurodegeneration, neuroinflammation, immune intervention in neuro-immunology,

Course content:

This teaching unit, in English, builds on students' basic neurology and immunology knowledge to develop fundamental research concepts in neuro-immunology that have applications in clinical and pharmaceutical research in the field of oncology and neurology. The topics will be:

1) The nervous system, definition of an immuno-privileged site; migration of immune system cells into the nervous system; role of cerebrospinal fluid in blood / brain exchanges; neuro-immunology detected by the neuropathologist.

2) Interactions between cancer, immune system and nervous system; Anti-tumor immunity and paraneoplastic neurological syndromes

3) Innate neuro-immunity and stress

4) Biotherapies: treatments based on the use of cytokines or antibodies; immuno-targeted therapeutics in neurodegenerative diseases; immunotherapies in multiple sclerosis and related diseases: mechanisms and strategies.

Insight on neuroimmunological structures and diseases, paraneoplastic disorders and central nervous system cancers, with emphasis on research for pathogenesis, diagnosis and biotherapy treatments; to understand interactions of cells from the central nervous system and the immune system; to study recent scientific advances in biotherapy treatments; to develop written and oral communication in English, to present and to discuss research results at a journal club or at a research meeting; to develop speed-reading skills.

Teaching Staff:

Pedagogical team of immunology and neurology of the University of Lyon, UFR Biosciences, Faculty of Medicine of Lyon East and South. Conferences on news items will be organised. The speakers will be invited on the basis of their notoriety.

Learning outcomes:

The student gains theoretical and practical insights in neuro-immunological structures and diseases with an emphasis on pathogenesis and research development for diagnosis and biotherapy treatments.

- Neuro-immunology knowledge: the student can describe central nervous system cells and structure interacting with the immune system and involved in several neuro-immunological diseases, has insights in the epidemiology of these diseases, can interpret measures to diagnose or correct these diseases, explain how biological mechanisms cause these diseases and acquire a comprehensive overview of the field.
- Future: the student can discuss recent scientific advances contributing to the progress of biotherapy treatments, analyse, understand and manipulate interactions between central nervous system and the immune system, specifically related to the context of the immune privilege sites, paraneoplastic disorders and cancers of the central nervous system.
- Practical skills: the student can develop his English proficiency, speed-reading capacities, listening, writing and oral presenting skills, and interactivity in scientific questioning.

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** scientific animation, interactions with invited speakers		

Teaching unit jury *(Name)*	
1) DELPRAT Christine	**2) DESESTRET Virginie**

HEALTHCARE AND DATA INTELLIGENCE IN VACCINOLOGY (HDIV)					optional (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
6	**36**	**30**	**0**	**0**	**0**
Management Institute:		**Université Claude Bernard Lyon 1 EMLYON business school Mines Saint-Etienne, national School of engineers**			
Teaching unit head(s) Name: Position: Contact, email:		**VERSAEVEL Bruno, DELPRAT Christine, Professor, Professor (PU-EX) versaevel@em-lyon.com;christine.delprat@univ-lyon1.fr**			

Keywords: bood-brain interfaces, neurodegeneration, neuroinflammation, immune intervention in neuro-immunology,

Course content:

The Master HIDS is the Master of Science in Healthcare Innovation & Data Science, approved by the Conférence des Grandes Ecoles. HIDS programme is described online at https://masters.em-lyon.com/en/msc-healthcare-innovation-and-data-science co-accredited by the high business school "EMLYON business school" and the engineering and management school "Mines Saint-Étienne". The HDIV module broaden the view of EMJM LIVE_Innov students trained in health economics, business, management, data intelligence and innovation at EMLYON campus. LIVE students on mobility at EMLYON campus are welcome for 15 ECTS chosen among the HDIS TU described below:

1) Patient-centricity in healthcare (2 ECTS, Ayad N'Ciri A.): Bottom-up client-oriented instead of top-down approach: the customer-centric model is progressively being integrated in the healthcare sector, leading to a patient-centric model. This course will give participants specific clues to adapt "client-orientation" methodology and tools to this critical "patient-orientation" posture, which is increasingly required in any activity of the healthcare industry.

2) The pharmaceutical ecosystem (2 ECTS, Versaevel B.): Economic overview of the pharmaceutical industry with vaccinology focus, the central element in an ecosystem that also involves biotech companies, contact-research organisations, academic research institutions, clinical trial sites, non-profit foundations, patent offices and regulators. **3) The MedTech ecosystem** (2 ECTS, Le Masne Q.): Students understand the industry of medical technologies, the diversity of products, the companies being part for the development and go-to-market strategies. Navigating inside the complexity of the MedTech industry, allow to understand key stakeholders, their expectations, and challenges, to identify marketing and registration strategies, and assess business opportunities in the industry. **4) Global health systems & economics** (3 ECTS, Ezzmeni S.): Participants study health system models with economic concepts and tools used in healthcare decision-making and policy analysis. Students acquire conceptual knowledge of how health systems are organized globally, their components, and the economic principles that underpin them. **5) Entrepreneurship in healthcare** (2 ECTS, Le Masne Q.) Students navigate the complexity of the creation and leadership of a company in the healthcare sector, from understanding the challenges of managing a large group of stakeholders, to building, testing, and delivering a great value proposition in a regulated environment, up to the pricing & reimbursement, market access & adoption, as well as funding mechanisms. The objective is to provide the students with insights on the challenges and opportunities of being an entrepreneur in the healthcare industry with past and current entrepreneurs in healthcare. **6) Advanced project management** (2 ECTS, David R.): Students enhance their project management capabilities, with Agile and Scrum methodologies, and fostering adaptability through contextual project management strategies. Participants effectively use hybrid and contextual approaches; and integrate technological tools into project workflows. They will apply adaptive project planning; and use algorithm driven risk detection and management. Students will gain expertise in leveraging innovative, technology-driven, and hybrid methodologies. **7) Healthcare data management & information systems** (3 ECTS, Dalmas B.): This course covers the essential principles of information systems utilized for both managerial and clinical support in healthcare, with a focus on electronic health records. Students will be able to evaluate healthcare IT effectiveness, with regards to delivery systems and their integration, workflow processes or data collection. **8) Decision making in healthcare consulting** (2 ECTS, Zhao C.): Students learn the fundamentals of how to conduct healthcare consulting projects. They will master fundamental decision-making tools to conduct a healthcare consulting project such as methodologies, means for data collection and analysis, innovative tools, and moderation tools for interactive working sessions. **9) Data analysis and visualization with Python** (3 ECTS, Varasteh Yazdi S.): This course offers a comprehensive introduction to programming and data analysis using Python, designed for beginners and those looking to strengthen their skills. The objective of this course is to equip the students with Python programming skills to analyze, explore and visualize data using Python libraries.

EMLYON students on mobility in the Master LIVE are welcome for 15 ECTS chosen among the LIVE_Innov TU S3_Immunology and cancer, S3_Epidemiology, S3_Clinical vaccine development, S3_Communicating on vaccines and public health, S3_Project management, S3_Neuro-immunology, S3_Vaccinology and infodemiology.

Teaching Staff:
Versaevel Bruno, Professor of economics at EMLYON. https://em-lyon.com/bruno-versaevel/brievement; Ayad N'Ciri Axelle, Professor of Patient Centricity at EMLYON and Mines Saint Etienne https://festivalcommunicationsante.fr/axelle-ayad-nciri/ ; Schiavone Francesco, Associate professor in innovation management at University of Naples Parthenope (Italy), Affiliate Professor at EMLYON. https://www.eship.em-lyon.com/francesco-schiavone/; Moisan Frédéric, Associate Prof in Operations, Data & Artificial Intelligence at EMLYON https://em-lyon.com/frederic-moisan/brievement

Learning outcomes:
Students are intendent to (i) know the historical actors involved in the healthcare sector and the new entrants in vaccine research and production; (ii) understand the disruption of existing business model by digital technology to imagine new value in the 2030 horizon; (iii) stimulate their creativity, outline the role of patient centric ecosystems in vaccine deployment; (iv) discuss the current and future healthcare system (in)equalities, addressing healthcare system and social security, supply and demand of vaccine, health prevention and promotion. (v) open their mind to the business implications of AI (artificial intelligence) technologies

Assessment methods		
☐ **Oral questioning**	☒ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** scientific animation, interactions with invited speakers		

Teaching unit jury *(Name)*	
1) VERSAEVEL Bruno	**2) DELPRAT Christine**

EXPERIMENTATION ANIMALE					optional (FR)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
6	**30**	**10.5**	**15.5**		
Management Institute:	**Université Claude Bernard Lyon 1**				
Teaching unit head(s) Name:	**DUCREUX Sylvie** BIO3161L CM30 TD10.5 TP15.5 6ECTS		**MERTANI Hichem** PH201MXV CM22 TD8 3ECTS		
Position:	**Associate-Professor**		**Associate-Professor**		
Contact, email:	*sylvie.ducreux@univ-lyon1.fr*		*hichem.mertani@univ-lyon1.fr*		

Keywords: Sciences des animaux de laboratoire, Concepteur projets utilisant des animaux à des fins scientifiques

Course content:

Le cours est en français. Il utilise la législation française qui régit le droit des animaux et l'expérimentation pour concevoir et conduire de l'expérimentation animale nécessaire aux études pré-cliniques. Il vise à enseigner aux étudiants comment faire un usage optimal et scientifiquement fondé des animaux dans la recherche biomédicale et comment ce type de recherche est mené conformément à la législation française et la législation européenne.
Cours utile dans le cadre d'un stage en France avec manipulation d'animaux au S4
Réglementation et éthique animale.| Modèle animal et méthodes alternatives.| Procédures expérimentales et approches statistiques.| Bien-être animal et prise en charge de la souffrance.| Aspects pratiques de l'expérimentation animale.| Evaluation et validation.
L'UE est une formation diplomante, délivrance d'un diplome d'expérimentation aninale de niveau 2 "Application des procédures".

The course is in French. It uses French legislation which governs animal rights and experimentation to design and conduct the animal experimentation necessary for pre-clinical studies. It aims to teach students how to make optimal and scientifically sound use of animals in biomedical research and how this type of research is conducted in accordance with French and European legislation.
Useful course as part of an internship in France with animal handling in S4.
Animal regulations and ethics. | Animal model and alternative methods.| Experimental procedures and statistical approaches.| Animal welfare and management of suffering.| Practical aspects of animal experimentation.| Evaluation and validation.
The EU is a diploma course, issuance of a level 2 animal experimentation diploma "Application of procedures".

Teaching Staff:

Teaching Staff physiology from University Claude Bernard Lyon 1. Conferences concerning laws and ethics given by invited veterinary from the VetegroSup school of veterinary fo Lyon.

Learning outcomes:

L'étudiant est capable d'analyser une question biomédicale, et peut formuler une stratégie de recherche utilisant l'expérimentation animale cfr. l'état de l'art (par exemple 3R, selon la norme européenne directives et la loi française, selon les dossiers éthiques). L'étudiant peut communiquer par écrit et oralement en anglais sur l'expérimentation animale. Il/elle peut réfléchir sur le social et l'éthique implications des études animales et a développé une attitude d'apprentissage tout au long de la vie afin de suivre les évolutions dans ce domaine.

Assessment methods

☒ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☒ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☒ **Other (specify):** Multiple choice test		

Teaching unit jury *(Name)*

1) **DUCREUX Sylvie**	2) **DUPRE-AUCOUTURIER Sylvie**

LANGUAGES S3					optional
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**20**	**0**	**20**	**0**	**0**

Management Institute:	**Université Claude Bernard Lyon 1**
Teaching unit head(s) Name: **Position:** **Contact, email:**	**DURAND-VALLOT Angeline** **Director of the Common Service Language Department** TALAVERA-GOY Solange *solange.talavera-goy@univ-lyon1.fr*

Keywords: language courses, different levels: A1, A2, B1, B2.1, B2, C1.1, C1.2.

Course content:
Improving the student's proficiency level, taking into account his or her previous knowledge of the language in French, English, Spanish, Italian, and German. The student will be placed in the adequate course, according to the level he/she reached after the first two semesters in Barcelona and Antwerp.
The language level is defined in accordance with the Common European Framework)
A language user at A1 level: Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. Can introduce himself/herself and others and can ask and answer questions about personal details.
A language user at A2 level: Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography and employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters.
A language user at B1 level: Can understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure, etc. Can deal with most situations likely to arise whilst travelling in an area where the language is spoken. Can produce simple connected text on topics which are familiar or of personal interest.
A language user at B2 level: Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation. Can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party.
A language user at C1 level: Can understand a wide range of demanding, longer texts, and recognise implicit meaning. Can express fluently and spontaneously without much obvious searching for expressions. Can use language flexibly and effectively for social, academic and professional purposes.

Teaching Staff:
Experienced teachers at the UCBL Service Commun des Enseignements de Langues

Learning outcomes:

The student will be placed in the adequate course; according to the level he/she reached to improve language skills in accordance with the Common European Framework of Reference for Languages.

Assessment methods

☐ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☐ **Written examination**	☐ **Bibliography report**	☐ **Internship unwinding**
☐ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	

☒ **Other (specify):** continuous assessment and final exam assessing the 4 linguistic skills (listening, speaking, reading and writing).

Teaching unit jury *(Name)*

1) PIGAT Joann	**2) TALAVERA-GOY Solange**

5. S4 Teaching unit sheets of the semester 4

S4 Teaching Units	Master thesis	Grasping the changing world & Languages	TOTAL ECTS
Professional work evaluation	**2.7**		**2.7**
Master thesis	**13.5**		**13.5**
Oral defence	**10.8**		**10.8**
Total Master Thesis ECTS			**27**
Optional choices in:			
Vaccinology and infodemiology		**3**	**3**
Languages 4 vaccine future		**3**	
Total ECTS	**27**	**3**	**30**

MASTER THESIS					mandatory
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
27	**0**	**0**	**0**	**25**	**0**
Management Institute:	**Universitat Autònoma de Barcelona / Universitat de Barcelona / University of Antwerp / Université Jean Monnet Saint Etienne / Université Claude Bernard Lyon 1**				
Teaching unit head(s) Name:	**ROURA i MIR Carme / STRATMANN Thomas / DELPUTTE Peter / PAUL Stéphane / DELPRAT Christine / BOURDONNAY Emilie**				
Position:	**Professor / Associate-Professor / Professor / Professor-hospital practitioner (PU-PH) / Professor (PU-EX) / Associate-Professor**				
Contact, email:	*carme.roura@uab.cat ; thomas.stratmann@ub.edu; vaccinology@uantwerpen.be; stephane.paul@chu-st-etienne.fr; christine.delprat@univ-lyon1.fr*				

Keywords: knowledge review, practical skills, professional expertise

Aims of "Master thesis":

The students will have the chance to investigate research or clinical or industrial or public health environment in vaccinology at the forefront of current knowledge and expertise.

1.Overview of specific knowledge through an introductory bibliographic review

2. Acquire professional experience in labour environment

3. Learn how to conduct experimental research or industrial project or clinical trials or health policy

4. Write a practical professional report by using digital tools wisely to create the media for the report, manage its references, be helped by artificial intelligence

5. Acquire the ability to present and report his/her own professional work, in front of an international specialised audience

Supervisors:
Academic Supervisor from the Master teaching staff of Barcelona, Antwerp, Saint-Etienne or Lyon and Internship Supervisor of the internship hosting institution.

Learning outcomes:
How to be productive in a professional environment and communicate his/her production and conclusions in written and oral international context.

Assessment methods		
☒ **Oral questioning**	☐ **Presentation**	☐ **Practice report**
☐ **Written examination**	☒ **Bibliography report**	☒ **Internship unwinding**
☒ **Report / thesis**	☐ **Digital productions (video, poster, software, wiki…)**	
☐ **Other (specify):** Multiple choice test		

Teaching unit jury *(Name)*		
1) **Emilie BOURDONNAY**	3) **Christine DELPRAT**	5) **Carme ROURA-MIR**
2) **Peter DELPUTTE**	4) **Thomas STRATMANN**	6) **Stéphane PAUL**

VACCINOLOGY AND INFODEMIOLOGY					optional (EN)
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**0**	**0**	**0**	**0**	**30**

Management Institute:	**Université Claude Bernard Lyon 1**
Teaching unit head(s) Name: **Position:** **Contact, email:**	**Emilie BOURDONNAY, Christine DELPRAT** **Associate Professor (MCU), Professor (PU-EX)** *emilie.bourdonnay@univ-lyon1.fr ; christine.delprat@univ-lyon1.fr*

Keywords: vaccine history, safety, pharmacovigilance, vaccine access, infoveillance, infodemiology

Course content:
The teaching unit is a MOOC 100% online teaching unit, open from October to June. Vaccinology is the science for vaccine development & use with major safety and public health concerns.
During epidemic or pandemic, we observe a rapid and far-reaching spread of (mis)information. Infoveillance (or surveillance of information) refers to public health concerns to analyse online behaviours by collecting, investigating, and visualising data from various sources on the Internet in real time during epidemic or pandemic.
Infodemiology (or epidemiology of information) is the science that manages infoveillance, actions of communication and their impacts to instruct public with global health challenges and induce good protective behaviours.
Using the knowledge of the students in immunology and infectiology, vaccine calendar, oral and written communication, this unit is developing the ability to grasp the context of a vaccine-preventable disease to make decision for communication and public health management.
Modules A-E to train decision-makers in vaccinology while modules F-H will introduce learners to the new multidisciplinary science called “infodemiology”:

A. Vaccines, lessons from the past
B. Vaccine efficacy and safety
C. Overview of global vaccine access
D. Vaccines for whom: children, pregnant women, travelers and seniors
E. Perception, monitoring and impact of immunisation on Public Health
F. Introduction to infodemiology
G. Ten years of infodemiology evolution
H. Infodemiology, the practice at UNICEF

In-person and video co-modal conferences on infoveillance and Infodemiology, partnership with WHO

World Health Organization

Teaching Staff:
Teaching Staff, from UFR Biosciences, University Claude Bernard Lyon 1. Conferences concerning new concepts about Infodemiology and Infoveillance will be organised. Speakers will be invited based on their excellence.

Learning outcomes:
You will understand basic clinical and social aspects of vaccinology including: the different kinds of vaccines that exist and how they work, herd immunity and correlates of protection, how the vaccine is developed and how its quality and safety is assessed, challenges of vaccine access in the world, importance of vaccination for different ages and social categories, disease eradication and outbreaks, how vaccination campaigns are organised.
Moreover, you will develop decision-making skills to: discern quality information from unreliable source, perform risk-benefit analysis, assess clinical data on vaccine safety and efficacy, exert good clinical and manufacturing practices thanks to a variety of interactive exercises, videos and other resources available in this course.
Finally, you will discover the power of facts, rumors, fears & syndromic surveillance for global health infodemiology management.

Assessment methods

☒ **Bibliography essay** to discuss part of vaccinology facing the changing world, demonstrating their skills in grasping complexity to elaborate bilingual recommendations according to the multidisciplinary angle(s) they choose and use for:
☒ **Digital video production:** Students pitch recommendations, justified by their essay, in 2-min short video formats to feed a new social network account, possibly use for further public interactions; the video is delivered in two languages thanks to its subtitles, one of them being English.

Teaching unit jury *(Name)*

1) Emilie BOURDONNAY	**2) Christine DELPRAT**

LANGUAGES 4 VACCINE FUTURE					optional
ECTS	**Lectures (hours/student)**	**Tutorials (hours/student)**	**Practical work (hours/student)**	**Internship (weeks/student)**	**Digital learning**
3	**30**	**0**	**30**	**0**	**30**
Management Institute:		**Université Claude Bernard Lyon 1**			
Teaching unit head(s) Name: **Position:** **Contact, email:**		**DURAND-VALLOT Angeline, TALAVERA-GOY Solange, BOURDONNAY Emilie, DELPRAT Christine, DELFATTI Natalia** **Director Common Service Language Department, Assistant-Prof, Associate-Prof, Prof, Associate- Prof** *solange.talavera-goy@univ-lyon1.fr ; emilie.bourdonnay@univ-lyon1.fr christine.delprat@univ-lyon1.fr; natalia.del-fatti@univ-lyon1.fr*			

Course content

Choice (exclusive) between basic French or advanced English to acquire vocabulary and specific subject to acquire GraCWoL vocabulary in advanced French or advanced English to choose between:

1) A1 A2 B1 basic French

2) B2+ Advanced French for Climate and Transitions: les conférences-débats permettent d'acquérir le vocabulaire pour discuter du changement climatique et de l'effondrement de la biodiversité. Qu'est-ce que le climat ? Dans quel monde viv(r)ons-nous ? Les conférences-débats forment aux aspects scientifiques qui font du changement climatique et de l'extinction du monde vivant un enjeu global. **Keywords:** climat, Anthropocène, biodiversité, agriculture, alimentation, maladies infectieuses.

3) B2+ Advanced English for onco-Immunology & therapeutic vaccines: The conference-debates allow students to acquire the vocabulary of onco-immunology. What are the next innovative challenges in the development of therapeutic vaccines to control cancers?

4) B2+ Advanced English for neuro-Immunology & therapeutic vaccines: The conference-debates allow students to acquire the vocabulary of neuro-immunology. What are the next innovative challenges in the development of therapeutic vaccines to control neuro-inflammatory diseases?

5) B2+ Advanced English for the world of biotherapies: The MOOC content allow students to acquire the vocabulary of biotherapies, understanding the fundamentals and applications of these treatments to better understand the place of vaccines in the pharmacopoeia. A wide range of biotherapies are presented from gene therapies and biotherapies with peptide, protein or monoclonal antibodies, biotherapies with dendritic cells or CAR-T cells, to biotherapies with probiotics, oncolytic viruses or helminths. What are advantages and limits of vaccines compared to those biotherapies to develop a personalised medicine?

6) B2+ Advanced English for aging and cell death: The conference-debates allow students to understand the recent advances on cell death and cellular aging fields supporting the aging process. **Keywords:** necrosis, necroptosis, apoptosis and autophagy and their relationship to aging, cellular senescence, cellular aging and damage: reactive oxygen species, protein aggregation, telomere shortening, theories of caloric restriction, metabolic signalling pathways, aging diseases and neurodegenerative diseases. What does aging change for vaccinology interventions?

6) B2+ Advanced English for EMLYON exchange programme: TU choice among Global health systems & economics, Healthcare data management & information systems, Data analysis and visualization with Python

Teaching Staff: The content of these thematises is based on conference-debates annually organised by UCBL teaching staff in existing teaching units and invitations of expert speakers from the ARQUS European University Alliance, which brings together the universities of Granada, Graz, Leipzig, Lyon 1 (UCBL), Maynooth, Minho, Padua, Vilnius and Wroclaw, nine longstanding comprehensive research universities (https://arqus-alliance.eu/)

Learning outcomes: this student-vaccinologist-centred innovative teaching and learning experience intends to increase student vocabulary and interdisciplinary knowledge of vaccinologists to complement their GraCWoL competency, transforming them into societal actors, influencers, with the capacity to create and disseminate recommendations in society for the benefits of global health.

Assessment methods

☒ **Bibliography essay** to discuss part of vaccinology facing the changing world, demonstrating their skills in grasping complexity to elaborate bilingual recommendations according to the multidisciplinary angle(s) they choose and use for:

☒ **Digital video production:** Students pitch recommendations, justified by their essay, in 2-min short video formats to feed a new social network account, possibly use for further public interactions; the video is delivered in two languages thanks to its subtitles, one of them being English.

Teaching unit jury *(Name)*

1) Emilie BOURDONNAY	**3) Christine DELPRAT**	**5) Carme ROURA-MIR**
2) Peter DELPUTTE	**4) Thomas STRATMANN**	**6) Stéphane PAUL**

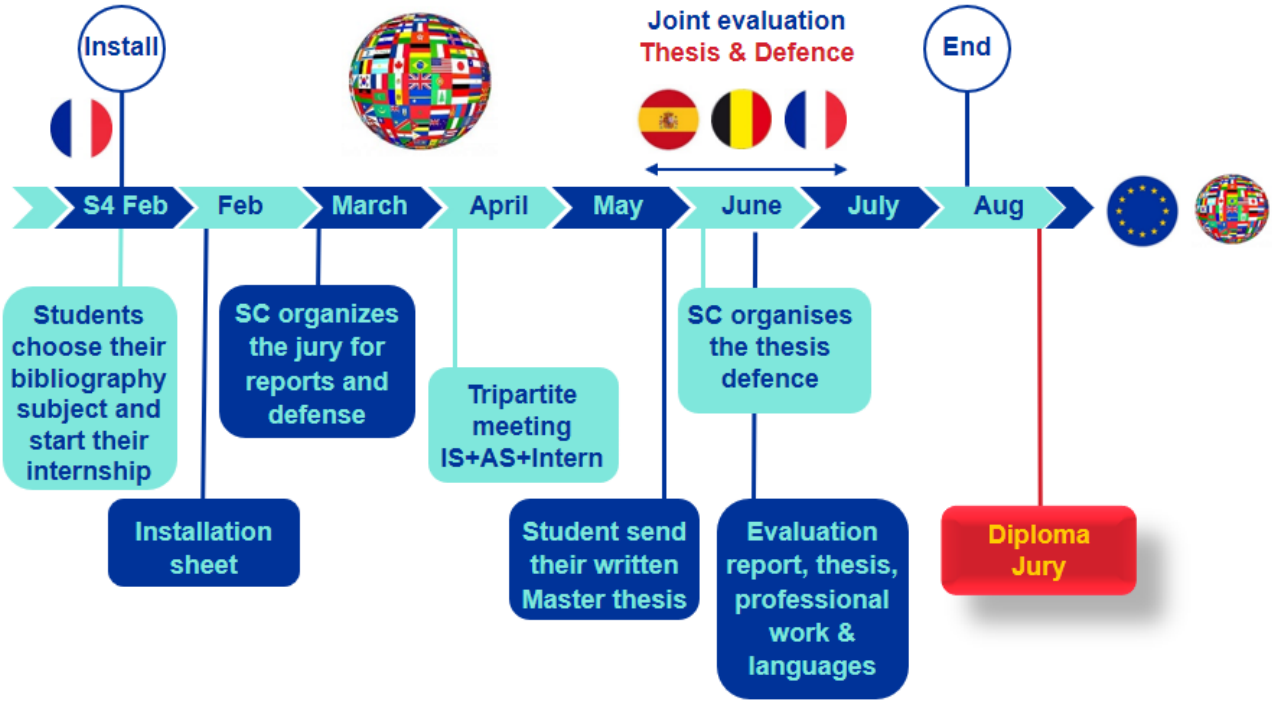
6. Assessment methods of teaching unit

Teaching unit title	Oral exam	Presentation	Practice report	Written exam	Bibliography report	Internship unwinding	Report/ thesis	Digital production	Others
S1- Dynamics of innate and adaptive immunity				X	X				**Multiple Choice test**
S1 - Functional anatomy of the immune system				X					**Multiple Choice test**
S1 - Antigen recognition				X					**Multiple Choice test**
S1 - Receptor signalling		X		X					**Multiple Choice test**
S1 – Immunopathology and immunotherapy	X			X					**Multiple Choice test**
S1 – Immune response to pathogens		X							**Multiple Choice test**
S1 – Laboratory and computer practicals		X	X						**Multiple Choice test**
S1 – Translational immunopathology (option)	X								**Multiple Choice test**
S1 – Vaccines in society (option)								X	
S1 - Languages 1: French, Spanish (option)				X					**continuous assessment LR**
S2 - Immune system in early life, pregnant women and elderly		X		X			X		
S2 -Description & variability of pathogens		X	X	X					
S2 - Host-pathogen interactions		X		X					
S2 - Novel technologies, vaccine administration routes & adjuvants		X		X					
S2 - Vaccine manufacturing & quality control, regulatory approval processes		X		X					
S2 - Data mining		X	X	X			X		
S2 -Summer school on vaccinology		X	X	X					

Teaching unit title	Oral exam	Presentation	Practice report	Written exam	Bibliography report	Internship unwinding	Report/ thesis	Digital production	Others
S2 – Languages 2a: English, French, German, Italian, Spanish	X			X					**Listening and Reading examination**
S2 – Molecular virology (option)		X	X	X					
S2 – Languages 2b: English, French, German, Italian, Spanish (option)	X			X					**Listening and Reading examination**
S3 - Epidemiology				X					**Multiple Choice test**
S3 - Immunomonitoring of preclinical and clinical vaccine trials		X	X						
S3 - Clinical vaccine development				X					**Multiple Choice test**
S3 - Vaccine specific applications				X					
S3 - Vaccine formulation				X					
S3 - Communicating on vaccines & public health		X						X	
S3 - Project management in innovative vaccinology	X	X						X	**depends on the reality project deliverables**
S3 - Immunology & cancer (option)		X		X					**Scientific animation, interaction with invited speakers**
S3 – Neuro-immunology: immune privilege and biotherapies (option)		X		X					**Scientific animation, interaction with invited speakers**
S3 – Healthcare and data intelligence (option)		X		X					**Scientific animation, interaction with invited speakers**
S3 – Expérimentation animale (option in FR)	X			X					
S3 – Languages 3									**Continuous assessment LSRW**

Teaching unit title	Oral exam	Presentation	Practice report	Written exam	Bibliography report	Internship unwinding	Report/ thesis	Digital production	Others
S4 - Master thesis	X				X	X	X		
S4 – Vaccinology and infodemiology					X			X	
S4 – Languages 4 vaccine future					X			X	
TOTAL	**8**	**17**	**6**	**25**	**4**	**1**	**3**	**5**	**11 MCQ 3 Scientific animation 3 LSRW**

6.1 Master Thesis (example year 2024-25) schedule, guidelines & evaluation



FEBRUARY 2025	
By Jan 31 (Fri)	The **Student** sends the **Internship Installation Sheet (§4)**, signed by the Internship Supervisor, to the Academic Supervisor with copy to the **LIVE Secretariat**. Note: for installation later than this date, the installation sheet must be sent the very day of installation. The **Student** provides the **Professional Work Evaluation Form (§4)** to the Internship Supervisor.
By Feb 7 (Fri)	The Academic Supervisor appoints 2 reviewers / thesis from the national Masters supporting the Master LIVE and sends their First name, Last name, Institution, Function and email address to the **LIVE Secretariat**.
MARCH-APRIL 2025	
	The **Student** organizes at least one mandatory tripartite meeting with both Supervisors. Formally, this meeting is divided into 3 stages of minimum 10 min each: the three together, then the two Supervisors, then the Academic Supervisor with the Student. If applicable, difficulties must be shared with the Supervisors, with no delay and without waiting for this formal meeting.
MAY 2025	
By May 12 (Wed)	The **Student** sends his/her advanced work of **Master thesis with the introductory bibliographic review** to the Academic and Internship Supervisors in order to obtain some independent advices.
By May 31 (Sat) 23:59 Lyon / Central European Time (CET)	The **Student** submits electronically his/her final version of **Master thesis with the introductory bibliographic review** to the Academic Supervisor with copy to the **LIVE Secretariat**. Note: following the decision of the hosting institution or because the size of the thesis is exceeding 4 MB (pay attention to limit the size), the trainee can transfer the thesis via secured platform https://filesender.renater.fr/ with a link sent by email to the LIVE secretariat.

	CDA WARNING: Master thesis with a **Confidential Disclosure Agreement (CDA)** must contain one **additional title page to provide a title with an abstract in lay terms** that can be formally published by the University of Antwerp (mandatory to issue the Belgian Diploma). If required to secure the transfer, it is also possible to send a password separately to the Coordinator email or mobile phone.
JUNE 2025	
By June 3 (Tue)	The Academic Supervisor provides the Master thesis and its evaluation form (§4) with the deadline (June 19, Fri) to the **Reviewers** (2/thesis). **WARNING**: Confidential Disclosure Agreement should be signed by the Reviewers beforehand, if applicable.
By June 8 (Sun)	The **Student** sends electronically his/her **PDF show** to the Academic and Internship Supervisors to obtain some advice.
By June 15 (Sun)	The **Student** submits electronically his/her **PDF show** on Claco > LIVE S4 > Resources > PDF defence show". PDF is mandatory, pptx is facultative. About the rights for this directory: Students can upload and edit the uploaded file, but neither download, nor delete the uploaded files. If your PDF is confidential, you should protect opening by a password and provide the password by email to the **LIVE Secretariat.**
From June 16 - 20 (Mon to Fri)	The Steering Committee with the LIVE Secretariat organizes the **Oral Defence** of the **Students** in Saint-Etienne. **The Jury will include 5 members** from the LIVE Steering Committee and academic professors from the national Masters supporting the Master LIVE and possibly Associated Partners (when there is no Confidential Disclosure Agreement). The defence won't be open due to signed Confidential Disclosure Agreement that should be signed by the Jury members before the defence, if applicable. For the equity of treatment between students, Supervisors cannot participate in Jury of their own supervised student. At the end of the defence, the jury transfers the **Master Defence Evaluation Form (§4)** to the **LIVE Secretariat**.
On June 17 (Tue)	If necessary, the Academic Supervisor sends a reminder to the **Internship Supervisors** (**Professional Work Evaluation Form)** and a reminder to the **Reviewers** (**Master Thesis Evaluation Form)** to answer their June 19 deadline below.
By June 19 (Wed)	The Internship Supervisor sends the **Professional Work Evaluation Form** to the **LIVE Secretariat,** with copy to the Academic Supervisor by June19. The Academic Supervisor sends the **Master Thesis Evaluation Form** filled out by the 2 reviewers to the **LIVE Secretariat**. In case the two reviewer scores are very different (SD score >20%), the LIVE Steering Committee (five members) will study the thesis to provide a third assessment.
By June 23 (Mon)	If applicable, the 3rd reviewer sends the scores of the **thesis** to the **LIVE Secretariat.**
By June 23 (Mon)	The **LIVE Secretariat** provides all scores to the Coordinator who transfers to the UCBL-UJM administration to prepare the Jury.
On June 27 (Fri)	The **session 1 of the LIVE M2 semester 4 Jury** is held in France.
JULY 2025	
By July 14 (Mon)	The **Students** who failed at the session 1 submits electronically his/her final version 2 of the **Master thesis with the introductory bibliographic review** to the Academic Supervisor with copy to the **LIVE Secretariat** for the session 2 evaluation.
AUGUST 2025	
On August 28 (Thu)	The **session 2 of the LIVE M2 semester 4 Jury** and the **final LIVE Diploma Jury** are held in France.

6.2 Criteria for the Master thesis

General advice & warning:

- It is not an absolute requirement that the Student shall make an original contribution to the advancement of science. This is the objective of the doctoral thesis. The Student must demonstrate, however, the ability to use the education received in order to address a problem in a scientific manner, related to the courses studied during the academic programme. It shall be the responsibility of the Internship Supervisor to work with the Student to develop a schedule of tasks to be performed and to follow the elaboration of the topic. As a rule, the Master thesis shall be structured as a scientific article.
- It is an absolute requirement that the Master thesis is an original document, written by the Intern. It shall be the responsibility of the Academic and Internship Supervisors to guide and give advices for the writing but not to write the Master thesis.
- Automatic plagiarism detection will be applied to the Student report with the powerful tool available at UCBL: text recognition and anti-plagiarism online server covering the web. More than 20% of plagiarism is not authorized in your text and will turn into 0 your score. Therefore, pay attention to elaborate your thought with your own sentences

Layout of the text

- The text is produced in A4 format with 2.5 cm margins, single-spaced. The font may be chosen from the following: Times New Roman (12 point), Verdana (10 point) or Calibri (11 point) and the text must be left and right justified. Title and subtitle styles will be chosen or set up to have an automatic table of contents, managed by your word processing software. The pages are numbered. Editorial text conventions for example concerning punctuation and spaces are applied.
- Tables or figures are inserted into the text, inasmuch as they are directly related to or clarify the text. Each table and figure must be accompanied by a number, title and legend. Text accompanying tables and figures should appear in the same font, but can be one size smaller.
- The reference number shall not exceed 50.

Objectives

The objectives of the master thesis are as follows:

- The Student situates the subject within the scientific context.
- The Student understands the scientific questioning around this subject.
- The Student looks up and selects relevant information from the scientific literature.
- The Student synthesizes the relevant information and report it in writing.
- The Student conducts scientific research under supervision.
- The Student performs various techniques correctly and accurately.
- The Student demonstrates critical thoughts on the information collected, the research conducted and the results obtained.
- The Student discusses and draws perspectives: noticing the questions to solve around the subject.
- The Student clearly reports in writing in accordance with current academic standards following guidelines.
- The Student presents and defends the professional work conducted in a clear and comprehensible manner.

Formatting requirements for the core of your Master Thesis

The Master thesis comprises maximum **40 pages**, including tables and figures, excluding title page, abstract, abbreviations and references.

The Master thesis shall be written in English with the following components:

1. A **title page**
2. The **acknowledgement, abstract and abbreviations**: acknowledgement of funding and beyond, if applicable; the abstract of maximum **250 words** in English contains the essential details regarding objective, materials and methods, results and conclusions. A list of abbreviations used is placed at the beginning of the text. Common abbreviations for important biochemical substances (e.g. ATP, NADH, DNA and amino acids in proteins) should not be explained. The names of enzymes are usually not abbreviated, except for those substrates that are customarily abbreviated. For example: ATPase, RNase. The trivial and systematic names

shall be those recommended by international Gene Nomenclature Committee such as HUGO (http://www.genenames.org/).

3. The **introductory bibliographic review** of maximum **10/40 pages**, including tables and figures, that positions the scientific problems and offers a clear statement of the research question.
4. The **material and method** chapter describes the: reagents by category and alphabetical order, Cell culture / animals / patients, 1 technique / 1 paragraph in the order of use in the results, Static analysis techniques if applicable
5. The **result** chapter describes the Student's own observations and findings.
6. The **discussion** should not re-iterate the observations; it compares them with the background of the international literature to make some conclusions.
7. The student **draws perspectives**.
8. The **literature references** (up to 50) are arranged at the end of the text, conforming to the following formatting requirements (according to the journal *Immunity*): for comprehensive information, please go to the section references of the guidelines for authors that you find at https://www.cell.com/immunity/authors

6.3 Defence

Objectives

The objectives of the defence are as follows:

1. The Student creates a slideshow with current academic standards.
2. The Student presents and defends the professional work reported in the Master thesis and performed during the internship in a clear and comprehensible manner, respecting the allowed time.

Format of the Master thesis defence

The Student shall defend the Master thesis through an oral defence. This must include a slideshow presented in **no more than 15 minutes**, after which the jury members raise questions, as time allows with **no more than 15 minutes questioning**.

The mandatory PDF (possibly with a facultative PowerPoint file) presentation should be submitted electronically according to the calendar §3.1

Confidentiality

The Confidential Agreements and their applications are managed by the LIVE Coordinator and Assistant. All parties involved will have to read, respect and sign the CDA validated by the LIVE Coordinator with the hosting institution.

7. Evaluation form and sheets provided

List of the documents:

- Internship installation sheet
- Professional work evaluation form
- Master thesis report evaluation form & criteria
- Master defence evaluation form

2026 INTERNSHIP INSTALLATION SHEET

The student must fill out and send this document by email to mylive@univ-lyon1.fr and his/her Academic Supervisor with the following title: StudentSURNAME_2026_Installation.
Deadline: February 4 (Note: if the installation if later than this deadline, the installation sheet must be sent the very day of installation.)
Title of the research project:

Student Name: Email: Address: Phone (international format):		
Internship address:		
Legal Representative, name:		
Department, Service, Laboratory:		
Internship Supervisor (IS) Name: Grade: Email: Effective internship starting date: Tile of the research project: Date and Signature of the IS:		
Academic Supervisor Name:		
KEYWORDS: tick words defining your topic		
☐ Immunology	☐ Immunopathology	☐ Statistics
☐ Molecular Biology	☐ Biochemistry	☐ Bioinformatics
☐ Microbiology	☐ Virology	☐ Host-pathogen interactions
☐ Vaccinology	☐ Vaccine formulation	☐ Vaccine manufacturing
☐ Adjuvants	☐ Quality control process	☐ Immunomonitoring
☐ Epidemiology	☐ Infectiology	☐ Diagnosis
☐ Preclinical trial	☐ Clinical trial	☐ Public health
☐ Vaccine advertisement	☐ Oncology	
	☐ Other (specify):	

2026 MASTER THESIS EVALUATION FORM

The student must attach this evaluation form to his/her Master Thesis and send them in one PDF by email to mylive@univ-lyon1.fr and to his/her Academic Supervisor, with the following title: StudentSURNAME_2026_EvalThesis. Submission deadline for the students: May 31. The reviewers place their crosses in the boxes or write a score in the related box, as they prefer.
Evaluation deadline for the reviewers: June 17

Student Name:

Academic Supervisor Name:

Reviewer Name:

Criteria	<10 fail mark	10-12 pass	13-14 honors	15-16 high honors	17-18 highest honors	19-20 highest honors +
1. Max 10-pages introductory bibliographic review (weighted 10)						
a. Is the topic situated well within the broader scientific context?						
b. Is relevant, original and recent research cited and discussed critically?						
c. Quality of the structure of the introduction? Is specific vocabulary clearly defined and appropriately used?						
d. Formulation of the concepts, questioning & objectives						
2. Critical material and method approach (weighted 10)						
e. Definition of the applied methodology						
f. Does the Student adopt a critical view of the applied methodology?						
3. Results & discussion-perspectives (weighted 20)						
g. Are the results presented clearly?						
h. Are the results processed and analysed in a correct and critical manner?						
i. Are the results interpreted within a broader context and relevant open questions proposed for the next future?						
j. Structure and readability of the discussion and perspectives						
4. Structure of the final document (weighted 10)						
k. Is there a clear and logical structure, with coherence between the various components?						
l. Linguistic usage						
m. Quality of tables/figures and graphs						
n. Quality of the abstract						
o. Display of references and footnotes						
Please kindly comment on the report below:						

Reviewer date & signature:

MASTER THESIS EVALUATION CRITERIA

	1. Critical scientific approach		2. Results and discussion	3. Structure of the final document
	Introduction and objectives	**Materials and methods**		
19-20 **highest honours +**	a. Exceptionally good positioning of the topic within the broader scientific context; the literature is critically interpreted and processed by the student b. The literature cited is relevant, original and recent c. The structure of the introduction demonstrates exceptional insight into the topic, the introduction is structured from an original but very functional perspective d. The objectives are formulated in a very clear manner and are challenging but feasible within the time frame of the study	e. The applied methods are exceptionally well defined f. The relevance of the applied methods for achieving the objectives is demonstrated clearly; limitations of the methods are stated exceptionally well	g. The results obtained are processed exceptionally well and analysed critically, and the analysis is of an exceptionally high level h. The results are presented in an exceptionally clear and logical manner, and only the relevant results are displayed i. The discussion places the obtained results within a broader scientific context and shows exceptional insight into the background of the research j. The discussion is pleasant to read, comprehensive, yet 'to the point'	k. Exceptionally smooth and pleasurably readable text, logical and coherent structure l. Perfect linguistic usage m. Tables, figures and graphs of exceptional quality and perfectly integrated into the text n. Perfect use of references o. High-quality summary that very clearly reflects the structure and conclusions of the study
17-18 **highest honours**	a. Outstanding positioning of the topic within the broader scientific context, most of the cited literature is critically interpreted and processed by the student b. The cited research is relevant and recent c. The structure of the introduction demonstrates outstanding insight into the topic d. The objectives are clearly formulated and feasible within the time frame of the study	e. The applied methods are very clearly defined f. The relevance of the applied methods for achieving the objectives is demonstrated; limitations of the methods are stated very clearly	g. The results obtained are processed in an outstanding manner and analysed critically, and the analysis is of an outstanding level h. The results are presented clearly and logically, and only the relevant results are displayed i. The discussion places the obtained results within a broader scientific context and shows good insight into the background of the research j. The discussion is pleasant to read and comprehensive	k. Smoothly readable text with a logical and coherent structure l. Very good linguistic usage m. Tables, figures and graphs of very good quality and very well integrated into the text n. Very good use of references o. High-quality summary that clearly reflects the structure and conclusions of the study
15-16- **high honours**	a. Very good positioning of the topic within the broader scientific context; a portion of the cited literature is critically interpreted and processed by the student b. The cited research is relevant c. The structure of the introduction demonstrates very good insight into the topic d. The objectives are clearly defined	e. The applied methods are clearly defined f. The limitations of the method are discussed clearly to a certain extent	g. The results obtained are processed and analysed very well h. The results are presented clearly, but some of the results presented are not relevant i. The discussion demonstrates insight into the background of the research j. The discussion is pleasant to read	k. Easily readable text, logically structured l. Good linguistic usage m. Tables, figures and graphs of good quality and well integrated into the text n. Good use of references o. Good summary
13-14	a. The topic is well situated within the broader scientific context, and the literature is interpreted critically to a limited extent by the student	e. The applied methods are present and defined to a limited extent	g. The results obtained are processed and analysed well	k. Easily readable text with a largely logical structure l. Occasional grammatical errors

	1. Critical scientific approach		2. Results and discussion	3. Structure of the final document
	Introduction and objectives	Materials and methods		
honours	b. The cited research is largely relevant c. The structure of the introduction demonstrates good insight into the topic d. The objectives are formulated	f. The limitations of the method are discussed to a minimal extent	h. The results are presented clearly enough, but not all of the presented results are relevant i. The discussion demonstrates limited insight into the background of the research j. The discussion is pleasant to read, but lacks some essential points or is not always clear	m. Tables, figures and graphs can be clearer and better integrated (more info ...) n. Good use of references o. Solid summary
10-12 **pass**	a. The subject is situated within the broader scientific context to a limited extent; the literature is barely interpreted by the student b. The cited research is not entirely relevant or recent c. The structure of the introduction demonstrates limited insight into the topic d. The objectives are unclear/incomplete	e. The applied methods are present but not clearly defined f. The limitations of the method are not discussed	g. The results obtained are insufficiently processed and analysed h. The results are presented incorrectly in part i. The discussion demonstrates very limited insight into the background of the research j. The discussion is difficult to read and misses essential points or is not clear	k. Text is acceptable, but not easily readable and has no clear structure l. Multiple grammatical errors m. Tables, figures and graphs can be clearer and are not well integrated into the text n. Limited use of references o. Summary does not accurately reflect the structure and conclusions of the research
<10 **fail mark**	a. The topic is incorrectly situated within the broader scientific context; the literature is not interpreted by the student b. The cited research is not relevant c. The structure of the introduction demonstrates very limited insight into the topic d. The objectives are not reflected accurately	e. The applied methods are not presented correctly or they are missing f. The limitations of the method are discussed incorrectly	g. The found data are not processed and analysed, or they are processed and analysed incorrectly h. The results are presented incorrectly i. The discussion demonstrates incorrect insight into the background of the research j. The discussion is very difficult to read and misses essential points or is not clear	k. Very unclear text l. Frequent grammatical errors m. Tables and figures and graphs are unclear or incorrect n. Incorrect use of references o. Summary is unclear or absent

2026 PROFESSIONAL WORK EVALUATION FORM

The Student must timely provide this evaluation form to his/her Internship Supervisor (IS), with the following title: StudentSURNAME_2026_EvalPro. The Internship Supervisor will fill out and send it by email to mylive@univ-lyon1.fr with copy to the Academic Supervisor. When there are no or not only laboratory experiments, the IS can transpose "experiments" into "tasks", "good (laboratory) practice", etc…. If some section(s) cannot be evaluated, please write "NA" for "not applicable" so that the line is neutralised for the mean calculation. The IS places his/her crosses in the boxes or writes a score in the related box, as (s)he prefers.
Evaluation deadline: June 23

Student Name:

Internship Supervisor Name:

Criteria	<10 fail mark	10-12 pass	13-14 honors	15-16 high honors	17-18 highest honors	19-20 highest honors +
1. Practice (weighted 2)						
a. Quality in protocol preparation						
b. Precision in the execution of the experiments						
c. Writing laboratory notebooks						
d. Computer use						
e. Learning new methods quickly						
2. Laboratory life (weighted 2)						
f. Apply Good Laboratory Practice						
g. Communication with researchers and Students						
h. Questioning in discussions and seminars						
i. Initiatives in contacts outside the laboratory						
3. Aptitude for research (weighted 6)						
j. General knowledge in biology						
k. Precision and critical reading of papers						
l. Classify and prioritise information						
m. Level of critical analysis of the results						
n. Fluency in writing						
o. Tenacity						
p. Quality and originality of the results obtained						
q. Display of references and footnotes						
r. Ability to pursue doctoral studies						

Please kindly comment on the student's behaviour in the work environment:

IS date & signature:

2026 MASTER DEFENCE EVALUATION FORM

The jury will fill out this evaluation form and send it by email to mylive@univ-lyon1.fr StudentSURNAME_2026_EvalDefense. The Jury members place their crosses in the boxes or write a score in the related box, as they prefer.
Evaluation deadline: June 16

Student Name:

Jury Member Names:

Criteria	<10 fail mark	10-12 pass	13-14 honors	15-16 high honors	17-18 highest honors	19-20 highest honors +
1. Presentation (weighted 20)						
a. Structure of the presentation & time control						
b. Knowledge: quality & quantities						
c. Quality of the slides						
d. Linguistic usage						
e. Interactive behaviour						
2. Questions (weighted 20)						
f. Accuracy of the response						
g. Correctness of the answer						
h. Critical point of view						
i. Linguistic usage						
j. Dynamic behaviour						

Please kindly comment:

Date:

Jury Member signatures:

8. LIVE students on mobility at EMLYON

Each year, EMLYON and UCBL will consider exchanging maximum five Master 2 students who wish to start a career in the pharma industry or related public health organizations, during fall semester of the period 2025-2030, and for maximum 15 credits (ECTS) per student.
The UCBL mobility students are selected by the LIVE Steering Committee.
The courses offered by EMLYON are part of the Master HIDS.
The Master HIDS is the Master of Science in Healthcare Innovation & Data Science, approved by the Conférence des Grandes Ecoles under the reference # 658/0225/CGE/HB/RK.. HIDS programme is described online at https://masters.em-lyon.com/en/msc-healthcare-innovation-and-data-science
The Master HIDS courses will contribute to enhancing the knowledge of UCBL students on specific health management practices and related technological issues.

The EMLYON scores obtained by the LIVE students in the Master HIDS will be considered for maximum 15 ECTS in the LIVE teaching units:

- Project management in innovative vaccinology (6 ECTS)
- Healthcare and data intelligence in vaccinology (6 ECTS)
- Languages 4 vaccine future (3 ECTS)

LIVE students on mobility choose maximum 15 ECTS among the 21 ECTS offered in the table below. The teaching unit sheets are reported after the table.

MSc HIDS 2025 course proposal for LIVE students on mobility at EMLYON

#	**Master HIDS fall course proposal**	**ECTS**
1	Patient centricity in healthcare (M1)	2
2	The pharmaceutical ecosystem (M2)	2
3	The MedTech ecosystem (M2)	2
4	Global health systems & economics (M2)	3
5	Entrepreneurship in healthcare (M2)	2
6	Advanced project management (M2)	2
7	Healthcare data management & information systems (M2)	3
8	Decision making in healthcare consulting (M2)	2
9	Data analysis and visualization with Python (M2)	3

Nom du module	**TU#1 (M1)** **Patient centricity in healthcare**		
Volumétrie horaire	12 hours	Crédits ECTS	2 ECTS
Descriptif du module	The constantly changing landscape of healthcare requires professionals in the industry to change the way care is provided and tracked. This course will give participants specific clues to adapt 'client-orientation' methodology and tools to this critical 'patient-orientation' posture that is more and more required in any activity of the healthcare industry.		
Objectif du module	The goal of the course is to exchange with professionals of the sector about the different issues and challenges surrounding patient centric ecosystems facing the current external factors such as innovation.		
Contenu du module et de la méthode d'apprentissage	The course will introduce the concept of customer-centricity in healthcare and how the companies are transitioning towards this model. The course content includes concepts and examples of: - Value-based care - Predictive medicine (analytics) - New digital customer - Patient experience - Patient data driven strategy <u>Teaching methods:</u> Theoretical approaches with discussions Case studies Guest speakers from industry		
Evaluation	Collective: Presentation - 50% Individual: Class participation – 50%		
Bibliographie	Documents to be shared via the school's e-learning platform.		
Nom de l'enseignant	AYAD N'CIRI Axelle		

Nom du module	**TU#2 (M2)** **The pharmaceutical ecosystem**		
Volumétrie horaire	12 hours	Crédits ECTS	2 ECTS
Descriptif du module	The course offers an overview of the pharmaceutical industry, which is the central element in an ecosystem that also includes biotech companies, contract research organizations, academic research institutions, clinical trial sites, nonprofit foundations, and regulators.		
Objectif du module	The objective of this course is to equip the participants with the necessary understanding of the pharmaceutical sector and the interactions involving a range of complementary organizations that contribute to the development and commercialization of new drugs or vaccines. They will also be better equipped to evaluate the trade-offs that characterize the incentives to invest in innovation and the collective need to make drugs and vaccines accessible to populations on a global scale.		
Contenu du module et de la méthode d'apprentissage	Participants will explore cases related to the R&D industry, oncology treatments, prophylactic vaccines, and the pricing strategies that affect access to innovative medicines in both high- and low-income economies. They will gain knowledge on: - the medicine life cycle - basic and translational technological changes - recent developments in selected market segments - pricing and access issues in high- and low-income markets <u>Teaching methods:</u> Theoretical approaches with discussions Case studies Guest speakers from the industry		
Evaluation	Collective: Group presentation - 50% Individual: Assignment - 50%		
Bibliographie	Documents to be shared via the school's e-learning platform.		
Nom de l'enseignant	VERSAEVEL Bruno		

Nom du module	**TU#3 (M2)** **The MedTech ecosystem**		
Volumétrie horaire	12 hours	Crédits ECTS	2 ECTS
Descriptif du module	This course guides the students to gain a profound understanding of the industry of medical technologies, looking at the diversity of products, the companies being part of this industry as well as the development and go-to-market strategies.		
Objectif du module	The objective of this course is to provide the participants essential understanding and knowledge to navigate the complexity of the MedTech industry, understanding key stakeholders, their expectations, and challenges, identify marketing and registration strategies, and assess business opportunities in the industry.		
Contenu du module et de la méthode d'apprentissage	The course will focus on: - The key driving factors coming from the health care ecosystem, including opportunities and limitations. - The categories of medical technologies and the associated diversity, as well as the associated regulations and reimbursement strategies. - The current landscape of companies, from current large players to the start-up ecosystem, as well as the dynamics. - The most recent trends, from the "quantify self" trend to digital health, AI-based care, robotic surgery, and more. <u>Teaching methods:</u> Theoretical approach and discussion Interactive workshop sessions Quiz with discussion on results Case studies Potentially guest speakers from the industry		
Evaluation	Individual: Class participation & workshop - 30% Assignment - 30% + Quiz - 40%		
Bibliographie	Documents to be shared via the school's e-learning platform.		
Nom de l'enseignant	LE MASNE Quentin		

Nom du module	**TU#4 (M2)** **Global health systems and economics**		
Volumétrie horaire	24 hours	Crédits ECTS	3 ECTS
Descriptif du module	The course integrates the study of health system models with economic concepts and tools used in healthcare decision-making and policy analysis.		
Objectif du module	The objective of the course is to equip students with conceptual knowledge of how health systems are organized globally, their components, and the economic principles that underpin them.		
Contenu du module et de la méthode d'apprentissage	The course content includes: - Introduction to global health systems and health economics - Health system models: structure, function, and outcomes - Universal Health Coverage: concepts, principles, and implementation - Health financing mechanisms and economic theories in healthcare - Health insurance, risk pooling, and equity in healthcare - Health economics and policy in low, middle, and high-income countries - Global health challenges: economics of public health interventions and infectious diseases - Healthcare policy, reform, and economic evaluation of health technologies <u>Teaching methods:</u> Theoretical approach and discussion Interactive workshop sessions Quiz with discussion on results Case studies Potentially guest speakers from the industry		
Evaluation	Collective: Group project - 60% Individual: Class participation - 40%		
Bibliographie	Documents to be shared via the school's e-learning platform.		
Nom de l'enseignant	Sarra EZZMENI		

Nom du module	**TU#5 (M2)** **Entrepreneurship in healthcare**		
Volumétrie horaire	9 hours	Crédits ECTS	2 ECTS
Descriptif du module	This course introduces the participants to the tools to navigate the complexity of the creation and leadership of a company in the healthcare sector, from understanding the challenges of managing a large group of stakeholders, to building, testing, and delivering a great value proposition in a regulated environment, up to the pricing & reimbursement, market access & adoption, as well as funding mechanisms.		
Objectif du module	The objective of this course is to provide the students with insights on the challenges and opportunities of being an entrepreneur in the healthcare industry. The course blends focused testimonials from past and current entrepreneurs with targeted interventions on the key topics relating to entrepreneurship in healthcare.		
Contenu du module et de la méthode d'apprentissage	Through interviews with multiple entrepreneurs, the course will focus on methods to address the following key questions that each entrepreneur in healthcare must answer for their venture: - What are the unmet medical needs? - Who pays and what's the price? - What's the clinical & regulatory strategy? - How do you get to the market in a quick & safe manner? - How do you reach adoption and maintain your position? - What are the challenges & opportunities of international expansion? Teaching methods: Interviews and discussions with professionals Case studies Interactive workshop sessions and quizzes		
Evaluation	Individual: Class participation & workshop - 50% + Assignment - 50%		
Bibliographie	Documents to be shared via the school's e-learning platform.		
Nom de l'enseignant	LE MASNE Quentin		

Nom du module	**TU#6 (M2)** **Advanced project management**		
Volumétrie horaire	18 hours	Crédits ECTS	2 ECTS
Descriptif du module	This course will focus on enhancing current project management capabilities, introducing new agile and scrum techniques, and fostering adaptability through contextual project management strategies. Participants will be able to apply advanced Agile and Scrum methodologies; effectively use hybrid and contextual approaches; and integrate technological tools into project workflows. They will also be able to apply adaptive project planning; and use algorithm driven risk detection and management.		
Objectif du module	This course is designed to provide participants with advanced project management skills, building on fundamental knowledge acquired from prior courses or experience. Participants will gain expertise in leveraging innovative, technology-driven, and hybrid methodologies.		
Contenu du module et de la méthode d'apprentissage	This course is structured to build upon the foundational knowledge of project management. Adopting a contextual and technology-driven approach, students will engage in an in-depth exploration of agile and scrum methodologies, integrating advanced project management tools, and applying hybrid methods tailored to specific project contexts. The curriculum includes: - Advanced techniques for PM (data integration, technology integration, VR simulation) - Comprehensive study and application of Agile & Scrum methodologies with practical exercises - Exploration and implementation of Hybrid methodologies combining traditional and agile approaches - Contextualization and customization of PM techniques based on project-specific requirements - Emerging Topics and Designing Future-oriented Projects <u>Teaching methods:</u> Theoretical frameworks and guided discussions Interactive and practical work sessions Analysis of real-world case studies Guest speakers from the industry		
Evaluation	Collective: Capstone project - 50% Individual: Assignment - 30% + In-class quiz – 20%		
Bibliographie	Documents to be shared via the school's e-learning platform.		
Nom de l'enseignant	DAVID Rodreck		

Nom du module	**TU#7 (M2)** **Healthcare data management & information systems**		
Volumétrie horaire	24 hours	Crédits ECTS	3 ECTS
Descriptif du module	This course covers the essential principles of information systems utilized for both managerial and clinical support in healthcare, with a focus on electronic health records.		
Objectif du module	The objective of the course is to equip students with the necessary tools and knowledge to manage healthcare information systems effectively. The students will be able to evaluate healthcare IT effectiveness, with regards to delivery systems and their integration, workflow processes or data collection.		
Contenu du module et de la méthode d'apprentissage	The course content includes: - Introduction to Healthcare Information Systems - Electronic Health Records (EHR) and their integration - Workflow processes in healthcare - Data collection and storage management - Confidentiality and security in healthcare data - Evaluation of healthcare IT effectiveness and ROI - Developments in healthcare informatics <u>Teaching methods:</u> Theoretical discussions Interactive and practical work sessions Analysis of real-world case studies		
Evaluation	Individual: Exercise - 50% + Assignment - 30% + Quiz - 20%		
Bibliographie	Documents to be shared via the school's e-learning platform.		
Nom de l'enseignant	DALMAS Benjamin		

Nom du module	**TU#8 (M2)** **Decision making in healthcare consulting**		
Volumétrie horaire	18 hours	Crédits ECTS	2 ECTS
Descriptif du module	This course is designed to introduce the students to the dynamics and complexity of the healthcare consulting ecosystem. The students will master fundamental decision-making tools to conduct a healthcare consulting project such as methodologies, means for data collection and analysis, innovative tools, and moderation tools for interactive working sessions and so on.		
Objectif du module	This course guides the students to learn the fundamentals of how to conduct healthcare consulting projects.		
Contenu du module et de la méthode d'apprentissage	The course is designed to equip the students with the fundamental tools and methodologies that empower them to conduct a healthcare consulting project. The course content includes: - The ecosystem of healthcare consulting - Types of missions, trends, challenges of healthcare consulting - Role of data and artificially intelligence in the healthcare consulting - Basic tools of critical analysis, design thinking and moderation tools for interactive working sessions with healthcare players - Typical methodology for conducting a healthcare consulting project and means for data collection and analysis - Soft skills as a healthcare consultant such as convincing oral presentation skills, interpersonal communication skills, etc. <u>Teaching methods:</u> Theoretical approach and discussion Interactive work-sessions Case studies Guest speakers from the industry		
Evaluation	Collective: Project report - 30% + presentation - 50% Individual: Assignment - 10% + Class participation - 10%		
Bibliographie	Documents to be shared via the school's e-learning platform.		
Nom de l'enseignant	ZHAO Chaoyue		

Nom du module	**TU#9 (M2)** **Data analysis and visualization with Python**		
Volumétrie horaire	24 hours	Crédits ECTS	3 ECTS
Descriptif du module	This course offers a comprehensive introduction to programming and data analysis using Python, designed for beginners and those looking to strengthen their skills.		
Objectif du module	The objective of this course is to equip the students with Python programming skills to analyze, explore and visualize data using Python libraries.		
Contenu du module et de la méthode d'apprentissage	In this course, the students will explore key Python libraries that are essential for data analysis, including NumPy, pandas, Matplotlib, and Seaborn. Throughout the course, they will learn the fundamental techniques for managing and manipulating data within DataFrames—such as selecting, sorting, aggregating, and modifying data. Additionally, they will develop proficiency in visualizing and exploring data. Key topics include: - Python basics - review - Object-oriented programming - Python external libraries - Graphics in python - MPL visualization - Pandas basics - Data manipulation (exploration/visualization) with pandas <u>Teaching methods:</u> Interactive working sessions Tutorials Data case study		
Evaluation	Individual: Assignment - 60% + Final exam - 40%		
Bibliographie	Python for Everybody, Charles R. Severance Other documents to be shared via the school's e-learning platform.		
Nom de l'enseignant	VARASTEH YAZDI Saeed		