



Annex 2: Curriculum description

First Semester : University of Tours			Hours	ECTS
Introductory course	Basic Immunology	Independent work Tutorials/ flipped classrooms	12h 8h	3
	Statistics	Lectures Independent work	15h 40h	
Infectious diseases & Public health	Major infectious diseases affecting humans and animals, Emerging pathogens, "Omics", Pathogen-induced cancers, Introduction to One Health, Sociological and economic approach to health /International standards and protection of health sectors 	Lectures Tutorials Independent work	30h 10h 60h	4
 Environmental health	Climate change and infectious diseases, waste management, water resources, biodecontamination, sustainable development in medical and research laboratories	Lectures Tutorials (Climate Fresk) Independent work	30h 5h 40h	3
Immune response against infectious diseases at systemic and mucosal levels	Innate immune response, Dendritic cells, Neonate immunity, Mucosal barrier, Lymphoid tissues of mucosa, Passive immunity, Immunity against pathogens	Lectures Practical courses Independent work	35h 15h 50h	4
Host-pathogen interactions	Molecular and cellular mechanisms of host-pathogen interactions: Virus morphogenesis, Pathogen entry and trafficking in infected cells, interference and viral restriction.	Lectures Tutorials Independent work	25h 6h 44h	3
Virulence and Resistance	Virulence genes and regulation, Microbial diversity and escape, Anti-infectious chemotherapy, Pathogen resistance and evolution, Mobile genetic elements	Lectures Tutorials Practicals Independent work	30h 10h 10h 50h	4
Animal Welfare, Animal Models and their alternatives	Animal Welfare Comparative anatomy Animal models for diseases and imaging Alternatives (explants, organoids, embryonated eggs, xenopus eggs, ex vivo)	Lectures Tutorials Practicals Independent work	14h 5h 16h 40h	3
 Digital project e-Health	Creation of digital content covering diverse themes related to One Health (video capsules, podcasts, websites or animations)	Lectures Tutorials Independent work	4h 25h 46h	3
French language	Basic linguistic tools. Oral and written expression	Tutorials Independent work	48h 27h	3

Second semester : UAB			Hours	ECTS
One Health Approach in Major & Endemic zoonoses	<ul style="list-style-type: none"> - Multidisciplinary approach to major viral, bacterial, parasitic and fungal zoonosis. - Tools for diagnosis, control, risk assessment, management and communication of major zoonosis. - Lab practices for infectious diseases diagnosis (microbiology, micology, immunology and molecular diagnosis) 	Lectures Seminars Practices Independent work	58h 9h 11h 147h	9
One health Approach in Emergent zoonoses and in special situations	<ul style="list-style-type: none"> - Multidisciplinary approach to Antimicrobial Resistance impact (human, animals and environment). - Emergent zoonoses (Arboviruses, tropical parasitosis, hemorrhagic fever viruses...) - Vector identification lab practices -Management of zoonoses in Low-income countries. - Zoonoses in immunosuppressed populations. - Emergencies in Public Health (disease outbreak protocols, vaccination campaigns, refugees and human crisis). 	Lectures Practices External visits Independent work	58h 12h 3h 102h	7
One health in Food Safety and Security	<ul style="list-style-type: none"> - Food Safety and Security under the One Health approach. - Evolution of food borne zoonosis. - Principal Food borne bacteria, parasites, viruses, prions, mycotoxins and biotoxins. -  One Health in aquiculture and aquatic environmental pollutants and infectious diseases. - Nutritional crisis 	Lectures & seminars Tutorials Practices Independent work	33h 18h 22h 77h	6
Epidemiology 	Surveillance Descriptive epidemiology and epidemiological studies Spatial analysis and Geographic Information Systems. Outbreak investigation	Lectures & seminars Practices Tutorials Independent work	16 16 2 16	2
Biosafety and biosecurity	<ul style="list-style-type: none"> -Hazard Criteria and Categorisation of Microbes. -BSL3 and BSL4 Lab Technical specifications. -Risk assessment procedures and Biosecurity. -Experimental procedures with animals under biocontainment. 	Lectures Practices Independent work	20h 20h 35h	3
Spanish language	Basic linguistic tools	Lectures Independent work	50h 25h	3
Summer School: Soft skills (creative thinking, effective communication, assertive leadership)			Organized by UAB	

Third Semester : MHH			Hours	ECTS
Infectious Diseases and Diagnostics	Medical microbiology, medical virology, Infection of organs (gastrointestinal tract, respiratory and nervous systems). Monitoring infectious diseases following antiviral or anti-bacterial therapy. Bacterial protein toxins.	Lectures Seminars Practices Independent work	38h 28h 40h 104h	7
Translational Medicine & Innovative Therapies	Major classes of therapeutics. Coding and noncoding RNA. Monoclonal antibodies and innovative antibody formats, Vaccines, Combination therapies. Preclinical testing- Regulatory framework for clinical trial application in the EU. Phase I clinical trials and translational medicine.	Lectures Seminars Practices Independent work	28h 28h 14h 80h	5
Genomes and Gene Editing	Gene transfer. Gene expression. Gene Therapy. Genome editing. Bioinformatics and artificial intelligence 	Lectures Seminars Independent work	32h 32h 86h	5
Emerging Viral Infections: Discovery and Intervention Strategies	Virus discovery: NGS, sequence analysis, phylogeny. Molecular toolbox: Reverse genetics. Host restriction/adaptation: receptor usage and replication. Viral pathogenesis. Development of prophylactic and therapeutic intervention strategies . Metagenomics on environmental DNA 	Lectures Tutorials Practices Independent work	46h 8h 16h 80	5
Biorisk Management in Research and Diagnosis	Comprehensive biorisk management approach. New concept of WHO on the relationship between risk groups of organisms and containment requirements.	Lectures Seminars Practices Independent work	28h 28h 14h 80	5
Scientific Reading, Writing and Presentation	Searching the scientific literature. scientific writing style. writing graduate level papers, proposals, projects, and thesis components. preparing scientific presentations; presentation of data.	Lectures Seminars Independent work	21h 35h 34h	3

Fourth Semester : Internship/Master Thesis		ECTS
Written report (50%)		15
Oral presentation (20%)		6
Answers to jury question (20%)		6
Supervisor Evaluation (10%)		3

Introductory Course - Immunology Part

Organization: Université de Tours

Coordinator: Isabelle DIMIER-POISSON

Position: Professor (PhD)

Outline

This module focused on immunology to ensure that all the students share the same basic knowledge in this core discipline. A teaching approach close to the “flipped classrooms” concept will be adopted for this introductory course to support independent learning and collaborative work.

Topics

Lymphoid tissues

General introduction to the immune system

Structure and organisation of the immune system

Complement Immunoglobulins and B lymphocytes: Structure and function of immunoglobulins, Molecular genetics, antigen-antibody interactions, lymphocyte development, B lymphocyte biology, signaling mechanisms and activation

T lymphocytes: T cell antigen receptors, T lymphocyte signaling mechanisms and activation, development of T cells, peripheral T lymphocyte responses and function

Macrophages and phagocytosis

Major Histocompatibility complex (MHC) molecules: Structure, Function and genetics

Cell biology of antigen processing and presentation

Assessment

Oral presentation 100%

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
2	4h	16h			20h

Introductory Course - Statistics part

Organization: Université de Tours

Teaching unit coordinator: Clovis TAUBER- Bruno GIRAUDEAU

Position: Assistant Professor (PhD). Professor (MD; PhD)

Outline

This module will expose the basis of statistics and the use of R software

Topics

Probability, Bayes rule, correlation versus causation, Mean, Median, Mode; Standard Deviation, Variance, Normal distribution, linear regression, Confidence intervals, Statistical tests

Assessment

Computer based exam 100%

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
2	15h				20h

Public Health and Infectious diseases

Organization: Université de Tours

Coordinator : Adeline Patuszca

Position: Assistant Professor (PharmD ; PhD)

Outline

This module will present the general concepts in infectiology and public health, and in epidemiology. Lectures and tutorials will give an understanding of the most currently used epidemiological tools, including new approaches in phylogenetics and molecular epidemiology. The module will introduce the One-Health concept. It will also give an overview of the impact of major infectious diseases affecting humans and animals as well as some recently emerged diseases.

Topics

General concepts

- . General methods in infectiology
- . Basic concepts in epidemiology
- . Big data and management of infections
- . European networks (VetBioNet, EU-JAMRAI, One Health EJP)
- . New tools of phylogenetics and molecular epidemiology
- . Healthcare acquired infections
- . Surveillance and emergency
- . Viral contamination of the environment
- . Emerging infections in animals

Specific infectious diseases

- . Bacteria: Tuberculosis, Buruli ulcer, Legionellosis
- . Viruses : Influenza, HIV, Measles
- . Parasites : Malaria
- . Pathogen-induced cancers (papillomavirus and polyomavirus, Helicobacter pylori, Herpesviridae, HCV, HBV, retroviruses)

One Health concept

- . Introduction to the One Health concept
- . World Health Organization (WHO)
- . International organization in Animal health and welfare (OIE)
- . International organizations in food safety (FAO)

Assessment

Written exam (70%)

Oral presentation (workgroup about One Health topic) (25%)

Review of a scientific paper (5%)

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
4	30h	10h			60h

Environmental risks

Organization: Université de Tours

Coordinator : to be determined

Outline

This module will present how environmental issues can directly impact infectious disease emergence and propagation. This teaching unit includes 30h of courses with different speakers, including faculty members from other universities, and tutorials on the model of the "Climate Fresk" workshop.

Topics

Climate change,
Waste management and biodecontamination
Water resources,
Biodiversity and impact of anthropization
Sustainable development in medical and research laboratories

Assessment

Oral presentation (100%)

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
3	30h	5h			40h

Host-Pathogen Interactions

Organization: University of TOURS

Coordinators: Emmanuelle BLANCHARD, Caroline DENESVRE, Agnès WIEDEMANN

Position: Professor of Cell Biology at the Faculty of Medicine (PhD), INRA Researchers (DVM-PhD and PhD)

Outline

This teaching unit includes 20h of courses with about ten different speakers from the fields of bacteriology, virology and parasitology. Speakers will also include faculty members from other universities. These courses explore the fundamental aspects of host-pathogen interactions at the molecular level by focusing on the mechanism by which a given pathogen hijack, modify and/or disrupt host cell functions to its benefit. Methods and research approaches based on specific examples will also be studied (e.g. *in vitro* infection/entry models, cell imaging, protein-protein interactions, tools to inhibit expression or function of proteins).

Topics

. Introduction to the cellular architecture, cytoskeleton and organelles.
. Methods for imaging the interplay between cells and pathogens (*different methods of microscopy with applications, protein-protein interactions such as co-immunoprecipitation, affinity chromatography, yeast two-hybrid method...*).

. Bacterial adhesion & virulence (*E coli*);
. Mechanism of cellular invasion by bacteria & secretion systems (*Salmonella, Yersinia, Listeria, Shigella*), intracellular growth and multiplication of bacteria;
. Bacteria and bacteriophages.

. Virus entry into host cells and tropism;
. Intracellular transport of viruses on cytoskeleton;
. Morphogenesis of enveloped viruses;
. Lipids and viral multiplication (Flipped classroom);
. Virus cell-to-cell spread.

Various examples of viruses will be described to illustrate the host-virus interaction models such as HIV, Coronavirus, Hepatitis B Virus, Hepatitis C virus, Herpesvirus, Influenzavirus, Rabies lyssavirus.

. Invasion strategies of intracellular parasites.
Several parasites of medical importance such as Toxoplasma gondii and Plasmodium falciparum and others of veterinary importance such as Eimeria tenella will be studied in this course.

Assessment

50% oral presentation (scientific article)

50% written examination

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
3	25 h	6 h			44 h

Immune response against infectious diseases at systemic and mucosal levels

Organization: Université de Tours

Teaching unit coordinator: Isabelle DIMIER-POISSON (PhD)

Position: Professor

Teaching unit coordinator 2: Sonia LAMANDE (PhD)-Fabrice LAURENT (PhD)

Position: INRA Researchers

Outline

In this module, the fundamental aspects of the innate and adaptive immunity will be taught. These two topics are central to understanding the host's interaction with an environment containing a wide range of potentially pathogenic microorganisms. The major role played by the dendritic cells at the interface of the innate and adaptive immune responses will be a major focus of interest. Practical works will complement this teaching by examining the immune response (Cell sorting, imaging, FACS analyses)

Topics

Innate response: Toll like receptors, Natural Killer cells, Macrophages, Mucosal barrier

Adaptive response : Dendritic cells (presentation, subsets, functions), Mucosal lymphoid tissues,

Antiviral immunity, anti parasitic immunity, antibacterial immunity,

Microbiome

Practicals : Cell sorting, imaging, FACS analyses

Assessment

40% Oral presentation of a scientific article

40% Written exam

20% Scientific report on the practical courses

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
4	35h		15 h		50h

Virulence and Resistance

Organization: University of Tours

Teaching unit coordinators: Catherine GAUDY-GRAFFIN; Aurélia Hiron

Position: Professor (MD, PhD); Assistant Professor (PhD)

Outline

After an initial short presentation to introduce the whole module, lectures will highlight different mechanisms of virulence associated with disease pathogenesis for a selection of important pathogens in humans and/or animals. Subsequent lectures and tutorials will give students an understanding of the mechanisms of drug resistance occurring with various viruses, bacteria and fungi. Treatment options for some major pathogens in humans and animals will be discussed.

Topics

Virulence:

Diversity of the mechanisms of bacterial virulence
Mechanisms of plant colonization by zoonotic bacterial pathogens
HIV diversity and escape
Influenza pathogenesis and virulence mechanisms
Virulence of apicomplexan parasites
Pathogenic fungi
Malaria infection
Non conventional pathogens
Parasitic wasp virulence

Resistance:

Principles of antiviral therapy and molecular basis of viral resistance (models of HIV, HBV, Covid-19), illustration by interactive work using bioinformatic tools
Mechanisms of bacterial resistance (including practical work)
Fighting antimicrobial resistance (AMR), development of innovative products
Antifungal drugs and resistance mechanisms

Assessment

50% Oral presentation of a scientific article
50% Written exam

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
5	36 h	10 h	10 h		69 h

Animal welfare, animal models and their alternatives

Organization: Université de Tours (UT), INRA and Oniris

Coordinator: Stéphanie GERMON

Position: Assistant Professor (PharmD, PhD)

Outline:

This module will focus on animal models and their use in infectious or non infectious diseases with a strong emphasis on animal welfare and the ethical issues. Moreover, students will learn about bioengineering and *in vitro* models for limiting the use of live animals in compliance with the 3Rs (Reduce, Replace, Refine) principles.

Topics

Animal Welfare

Comparative anatomy (mice, fish, sheep, rabbit)

Animal models for vectorized diseases

Fish and zebrafish models : imaging

Animal models for such as cancer, atopy, heart disease and neurodegeneration.

Alternatives (explants, organoids, embryonated eggs, xenopus eggs, blood pockets for insect feedings, ex vivo experiments)

Assessment

Laboratory notebook - reports (50%)

Written exam (50%)

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
3	14 h	5 h	16 h		40 h

Digital project e-Health

Organization: Université de Tours (UT)

Coordinators: Aurélia Hiron/ Guillaume Desoubeaux

Position: Assistant Professor (pHD) / Professor (MD, PhD)

Outline: The aim of this module is to create digital content covering diverse themes related to One Health. Various digital supports such as video capsules, podcasts, websites and animations will be employed. The students will have the opportunity to explore and present a health problem or environmental risk while incorporating both scientific and social-cultural aspects. This unit will consist of 4h of lectures to introduce digital tools and potential topics and 25h hours of tutorials to support project development with the support of scientists and digital engineers.

Topics

Use of new digital tools

One Health topics

Assessment

Presentation of the project: Technics (50%); Scientific content (50%)

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
3	4 h	25 h			46 h

French language

Organization: Université de Tours (UT)

Coordinator: Dominique CHARBONNEAU,

Position: CUEFEE director (CUEFEE: University Centre of French as a Foreign Language)

Outline

This module will be an introductory course of French language. The aim of this course is to provide to the students the basic linguistic tools to understand and communicate efficiently from the very first day of class. Through this module, students will also learn the main aspects of French culture, geography and history.

Topics

Oral expression in French Language

Written expression in French Language

Assessment

Oral expression (50%)

Written expression (50%)

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
3	48 h				27 h

One Health and Major & Endemic zoonosis

Organization: Universitat Autònoma de Barcelona

Coordinator: Laia SOLANO

Position: FULL Professor

Outline

This module will start with a brief introduction to general concepts of zoonosis and the evolutionary mechanisms of infectious agents for persisting in nature. The relevance and the final impact on the public health of these pathogens' escape and resistance mechanisms will be also evaluated. The biological, epidemiological, pathogenic, diagnosis and control mechanisms of the most relevant zoonoses in the world will be presented from One Health concept perspective.

Topics

Introduction to zoonoses and etiological agents: history of zoonoses; definitions, pathogens' mechanisms to avoid immune system.

Major Bacterial Zoonoses: mycobacterias' molecular epidemiology; tuberculosis in humans and animals, new vaccine strategies and sanitation campaigns, control and communication; human and animal health actions against brucellosis; rickettsiosis; Lyme disease and other borrelias; Q fever; zoonoses of companion animals; tularaemia.

Major Viral Zoonoses: evaluation, control and communication of rabies; influenza A and the role of domestic and wild animals, the surveillance programme, antiviral resistances and new treatments; Coronavirus (covid-19), MERSCo, SARS.

Research and communication skills in human outbreaks.

Major Parasitic and mycotic Zoonoses: Toxoplasmosis (control in cats, wild reservoirs, in pregnant women; leishmaniasis (in dog, in humans, new vaccines,); hydatidosis/ *Echinococcus multilocularis*; other parasitic zoonoses from companion animals; mycotic zoonoses in domestic animals.

Lab practices and virological workshop: microbiology and mycology cultures, immunological and molecular diagnostic tools and interpretation.

Assessment

Attendance and active participation in class 15 %

Attendance and active participation in the laboratory practices 20 %

Self-learning activities, deliverables and work oral expositions 25 %

Evaluation Tests (synthesis exam) 40%

ECTS	Lectures	Seminars	Practical work	Digital learning	Personal work
9	58 h	9h	11h		147 h

One health in emergent diseases and in special situations

Organization: Universitat Autònoma de Barcelona

Coordinator: Laila DARWICH

Position: FULL Professor

Outline

The impact of antimicrobial resistance (AMR) in the world will be presented under the human, animal and environmental health approach.

The biology, epidemiology, pathology, diagnosis and control mechanisms of exotic and emergent diseases and the zoonoses in special situations will be presented under the OH approach in monographic sessions and round tables or debates.

These special situations comprise: HIV immunosuppressed populations, emergency sanitation and health system management in low-income countries. A One Health vision of the topics will be implemented, and the particularities of tropical and subtropical ecosystems will be studied with special emphasis in the endemic zoonotic microorganisms' lifecycles and the importance of vectors and the globalization effect on OH (international human transits and animal-plant free trade).

Topics

Antimicrobial Resistance: multi-resistant zoonotic bacteria; use of antibiotics in animal production and MDR; consume and self-medication in human medicine and MDR; impact of MDR in nosocomial infection; resistance against antiparasitic and antifungal products; new treatments and therapeutical approaches; the role of wild animals as AMR reservoirs.

Emergent and re-emergent pathogens:

Introduction and risk assessment in exotic and emergent zoonoses (effect of climatic change in vectors and diseases; arboviruses; entomology; surveillance systems and vector control; other viral hemorrhagic zoonoses outbreaks; bacterial (ie. *C difficile*), and tropical parasites (epidemiology, clinics, diagnose and treatment of malaria; helminths; neurocysticercosis; trypanosomiasis)

Veterinary Border control: role and mission of veterinary border inspection posts (BIPs)

Management of zoonoses in situations of public health alerts, threats or emergency sanitation: management of epidemics and public health crisis; risk communication in emergencies; risk assessment and contingency protocols.

Zoonoses in HIV and immunodepressed population: VIH situation updates; role of pets and companion animals as a zoonotical risk; New therapies in immunosuppressed patients.

Control and management of zoonoses in low-income countries: public health, risk evaluation and communication in developing countries

Lab practices : entomology identification; parasitology

External visits: the Clinical Lab of Vall d'Hebron Hospital in Barcelona

Workshop : Humanitarian Emergency response (NGOs)

Assessment

Participation in the laboratory practices, lab reports and classroom activities 25 %

Self-learning activities, deliverables and work oral expositions 35%

Evaluation Tests (synthesis exam) 40%

ECTS	Lectures		Practical work	External Visits	Personal work
7	58 h		12 h	3h	102 h

One health in food safety and security

Organization: Universitat Autònoma de Barcelona

Coordinator: Artur Xavier ROIG

Position: FULL Professor

Outline

In this module, the fundamental elements of food safety and security will be taught under the One Health approach through theoretical and practical sessions or by solving case studies. The main zoonoses transmitted by food, the factors associated with their presentation and their consequences for human health will be studied. Reservoirs, the most likely forms of contamination and their impact on different types of food will also be presented. The main policies related to food security will be discussed from a national, European and global perspective. Also, the procedures for risk assessment and the detection of pathogens usually carried out by public health agents and the food industry will be taught. Finally, One Health approach in aquaculture and AQUATIC Environments will be introduced as an important topic in food safety, with special attention to Pollutants and Infectious diseases in aquatic environments. **NEW**

Topics

Evolution of management and communication policies in food safety and security: principles and proceedings for risk assessment in food safety; management and communication of risk in food safety; the concept of “Food defense” in food borne zoonoses.

Evolution of food borne zoonoses in Spain, Europe and Worldwide: effect of globalisation in food borne zoonoses; control tools in primary production; on-line information tools about food-borne outbreaks.

Food borne bacterial zoonoses: *Salmonella* spp., *Campylobacter* spp., *Yersinia enterocolitica*, *Listeria monocytogenes*, *Escherichia coli* VT, *S.aureus* and other coagulase-positive *Staphylococcus*; *Clostridium botulinum*, *C. perfringens* and *Bacillus cereus*.

Food borne parasitic zoonoses: protozoa; trematodes and cestodes; anisakiasis, trichinellosis and other zoonoses caused by nematodes.

Other food borne agents: viruses, like hepatitis A and E viruses, calicivirus and noroviruses; prions; mycotoxicosis and biotoxines.

One Health approach in aquaculture and AQUATIC Environments: 1) POLLUTANTS IN AQUATIC ENVIRONMENT: - Microplastic /Microliter (nano), - Heavy metals - Organic pollutants; - Chemicals (different treatments and with special focus on antibiotics)

2) INFECTIOUS DISEASES IN AQUATIC ENVIRONMENTS: zoonotic pathogens and Foodborne diseases; waterborne diseases; Aquatic pathogens and climate change; Dispersion of pathogens between farmed and wild, environmental impact, the problem of introduction or invasive species; Noticeable diseases in aquatic environments. **NEW**

Practical sessions: tertiary predictive models for process validation and risk assessment; data assessment from “challenge tests”

Laboratory practical sessions: protocols for the evaluation of the presence of pathogenic microorganisms in foods; use of microbiological biomarkers.

Workshop : nutritional crisis response (NGOs)

Assessment

Attendance and active participation in class 10 %

Attendance and active participation in the laboratory practices 20 %

Self-learning activities, and deliverables 40 %

Evaluation test of theoretical and practical content 30 %

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
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6	33 h	18h	22 h		77 h
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Epidemiology Week NEW

Organization: Universitat Autònoma de Barcelona

Coordinator: Alberto Allepuz

Position: FULL Professor

Outline

This module will provide an overview on concepts related with the design of surveillance systems, sampling, and temporal and spatial patterns of pathogens. Theoretical concepts will be implemented through different hands-on exercises in which students will work with data from surveillance systems and will be challenged to design different epidemiological studies to address specific questions and to investigate an outbreak of a disease. During this module students will be trained in using different tools such as Geographic Information Systems and programs to analyze the spatial pattern of diseases by using free and open-source programs.

Topics

Surveillance: concepts on surveillance and sampling, how to design and implement surveillance programs.

Descriptive epidemiology and epidemiological studies: measures of disease frequency, temporal and spatial patterns of diseases. Type of epidemiological studies and discussion on different designs.

Spatial analysis and Geographic Information Systems: methods to detect clusters of diseases and applications in surveillance. Visualization of spatial data (point and choropleth maps).

Outbreak investigation: temporal and spatial analysis of outbreaks, identification of potential sources of infection.

Assessment

Attendance and active participation in class 30 %

Self-learning activity, oral exposition 70 %

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
2	16h	2h	6h	10	16h

Biosafety and biosecurity

Organization: Universitat Autònoma de Barcelona

Coordinator: Joaquim SEGALÉS

Position: FULL Professor

Outline

In this module, students will be introduced to the concept of biosafety and biosecurity and will know the hazard criteria and the categorisation of most important disease agents. The risk assessment and the management and handling of human people and animals under biocontainment will be discussed. The characteristics and specifications of different biosafety laboratory levels will be presented. Students will be trained to work in the highest levels of biosafety laboratories and animal housing facilities (BSL3 and BSL4).

Topics

Hazard Criteria and Categorisation of Microbes

BSL3 and BSL4 Lab Technical specifications

Risk assessment procedures and Biosecurity

Experimental procedures with animals under biocontainment

Practices: how to move in and out of BSL3 lab, handling of virus, cell cultures and spore forming bacteria in BSL3, handling positive pressure masks.

Assessment

50% Lab performance.

50% Risk assessment report

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
3	20 h		20 h		35 h

Spanish Language

Organization: Universitat Autònoma de Barcelona

Teaching unit coordinator: Sònia PRAT

Position: Director of UAB Language Service

Outline

This module will be an introductory course of Spanish language. The aim of this course is to provide to the students the basic linguistic tools to understand and communicate efficiently from the very first day of class. Through this module, students will also learn the main aspects of Spanish and/or Catalan culture, geography and history.

Topics

Spanish Language

Assessment

50% Oral expression.

50% Written expression.

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
3	50 h				25 h

Infectious Diseases and Diagnostics

Organization: Hannover Medical School

Coordinator: Abel VIEJO-Borbolla, Guntram GRASSL

Position: Professor, Institute of Virology / Institute of Med. Microbiology

Outline

This module will focus on pathogenesis, toxin biology, clinical aspects and diagnostic methods of bacteria and viruses. A series of lectures combined with practical work and tutorials will provide both theoretical and practical knowledge on relevant aspects of these topics. The students will also improve other skills including teamwork, preparation of written reports, presentation and discussion of scientific reports

Topics

Medical microbiology, medical virology with a focus on diagnostic methods and pathogenesis. Infection of organs including those within the gastrointestinal tract, respiratory and nervous systems. Monitoring infectious diseases following antiviral or anti-bacterial therapy. Bacterial protein toxins.

Key tools

Lectures on: Medical virology, bacteriology and immunology, bacterial protein toxins, human pathogenic viruses and bacteria, disease manifestations, diagnostic methods, therapy, antivirals and antibiotics.

Independent work:

POL (problem-oriented learning) Cases: Clinical case presentation and discussion with tutor.

Journal Club: Medical virology, bacteriology and toxicology papers.

Practical work: ELISA for anti-HBs antibodies, immunofluorescence, neutralisation, virus titration, culture of bacteria, identification of bacterial species, antibiotic susceptibility testing, toxin detection, diagnostic PCR, etc.

Assessment method:

100 % Written exam

Ungraded course work:

Oral presentation (scientific paper)

Practical work (including written report)

Short lab project (including oral presentation)

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
7	38 h	28 h	40 h		104 h

Translational Medicine & Innovative Therapies

Organization: Hannover Medical School

Coordinator: Ulrich KALINKE

Position: Professor, TWINCORE Centre for Experimental and Clinical Infection Research

Outline

The focus of this module is the transfer of knowledge in translational medicine in infectious disease and early phase clinical research with specific focus on vaccine development.

This module will address the classification of the three major classes of medicines, small molecules, biologicals, and medicinal devices. State of the art preclinical test systems will be introduced, including animal experimentation, with a focus on systems that are particularly suited to predict effects in humans. Key principles to be considered to prepare for application of clinical trial authorization at the competent authorities will be discussed. Finally, relevant infrastructure and measures necessary in order to carry out first-in-human clinical trials will be addressed.

Topics

- The three major classes of therapeutics: natural compounds, biologicals, devices
- Coding and noncoding RNA
- Monoclonal antibodies and innovative antibody formats
- Vaccines
- Combination therapies
- Preclinical testing: Animal experiments vs. assays based on primary human cells
- Regulatory framework for clinical trial application in the EU
- Phase I clinical trials and translational medicine

Students will gain knowledge about all relevant steps towards clinical development of innovative therapies after a new therapeutic strategy has been envisioned.

After successfully completing the module, the students are able to

- understand how a new medicine is clinically developed in a phase I trial,
- discuss the specific characteristics of vaccine development,
- understand novel approaches in drug development (e.g. telomerase modulation)
- understand the importance of animal phenotyping during drug development,
- get an overview about bioinformatics tools in drug development, perform key experiments in RNA biology (detection, quantification of RNA molecules).

Assessment

100 % Written exam

Ungraded course work:

Oral presentation (scientific paper)

Practical work (including written report)

Short lab project (including oral presentation)

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
5	28 h	28 h	14 h		80 h

Genomes and Gene Editing

Organization: Hannover Medical School

Coordinator: Axel SCHAMBACH

Position: Professor, Institute of Experimental Hematology

Outline

This module will focus on current state-of-the-art technologies employed in basic research and used to develop gene and cell therapy applications. The different scientific methods to transfer genetic information into target cells will be explained. This will provide students with the necessary background for teaching the various gene therapy strategies that have been tested pre-clinically and clinically, including control of gene expression and available approaches for targeted genome editing.

Topics

Gene Transfer: Overview of the appropriate use of non-viral and viral gene transfer methods, including discussion of the strengths and weaknesses of each approach. Systems commonly used in pre-clinical and clinical studies will be presented, such as electroporation, Sleeping Beauty transposon, adeno-associated virus (AAV) and retroviruses (lentiviral, alpha- and gammaretroviral systems).

Gene Expression: Genetic and pharmacological mechanisms to control gene expression will be presented, including antisense oligonucleotides, inhibitory RNAs (e.g. short-hairpin RNA) and microRNA.

Gene Therapy: Students will learn the history of gene therapy and the principal concepts behind gene therapy applications. We will cover the early gene therapy failures and the important lessons learned from these studies, which led to modified strategies based upon improved understanding of genetic components and how this knowledge led to successful translation for the treatment of human diseases like genetic disorders and cancer.

Genome Editing: Students will be introduced to genome editing technologies, including transcription activator-like effector nucleases (TALENs), zinc-finger nucleases (ZFNs) and clustered regularly interspaced short palindromic repeats (CRISPR)-associated nuclease Cas9.

Bioinformatics: Students will get an overview of bioinformatics resources for analysis of protein sequences. They will be introduced to immunomic and infectivity databases and learn how to deal with immunogenicity analysis.

Assessment method

50 % Oral presentation

50 % Review of a research paper

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
5	32 h	32 h			86 h

Emerging Viral Infections: Discovery and Intervention Strategies

Organization: Hannover Medical School

Coordinators: Albert OSTERHAUS, Guus RIMMELZWAAN

Position: Professor, Research Center for Emerging Infections and Zoonoses (RIZ)

Outline

This module will address fundamental aspects of viral zoonotic pathogens, such as discovery of novel viruses and assessment of their zoonotic potential, genetic analysis and phylogeny, host restriction factors and virus adaptation to novel host species, pathogenesis, intervention strategies and the use of a molecular toolbox to investigate viral determinants of virulence and transmissibility. Some important well characterized viral pathogens will be discussed in depth to illuminate different prophylactic and therapeutic intervention strategies.

Topics

- (i) Virus discovery: NGS, sequence analysis, phylogeny
- (ii) Molecular toolbox: Reverse genetics to produce molecular clones of -ve and +ve RNA viruses, generation and use of pseudotyped viruses
- (iii) Host restriction/adaptation: receptor usage and replication
- (iv) Viral pathogenesis: virus tropism, tissue damage caused by virus replication and host response
- (v) Development of prophylactic intervention strategies
- (vi) Development of therapeutic intervention strategies

This module will involve lectures, tutorials, self-study and both the writing of a mini review on a known specific zoonotic virus and presentation of this review as a team effort. In addition, the students will have the opportunity to partake in a two-day practical course on virus discovery.

Assessment

100 % Written exam

Ungraded course work

Oral presentation

Review of a research paper

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
5	46 h	8 h	16 h		80 h

Biorisk Management in Research and Diagnosis

Organization: Hannover Medical School

Coordinator: Jens BOHNE

Position: PD Dr., Head of Biosafety Department

Outline

This module will extend the basics of biosafety, biosecurity and biocontainment into a comprehensive biorisk management approach. The students will be introduced to the new concept of WHO on the relationship between risk groups of organisms and containment requirements. A further topic will be the handling of ethical issues, e.g. the estimation of "Dual-use-research-of-concern - DURC".

After successfully completing the module, the students will acquire knowledge on the 16 components of a comprehensive biorisk management programme and will be able to understand how these multiple components can be integrated into a Plan-Do-Check-Act-cycle driven management system in place.

Topics

After successfully completing the module, the students will acquire knowledge on the 16 components of a comprehensive biorisk management programme and will be able to understand how these multiple components can be integrated into a Plan-Do-Check-Act-cycle driven management system in place.

The students will be trained to use different tools for risk assessment in biosafety and biosecurity in order to understand and implement safety measures to reduce the risk of spreading infectious agents during lab work. In the Journal Club, they will master theoretical basics and discuss case studies of laboratory acquired infections.

Finally, students will attend the state approved course "Genetic engineering, Biosafety and Biosecurity" and will understand the legal regulations on the handling of genetically modified organisms in Germany.

Practices: Working with a mobile containment laboratory unit.

Assessment method

100% Written exam

Ungraded course work

Risk Assessment

Scientific paper review

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
5	28 h	28 h	14 h		80 h

Scientific Reading, Writing and Presentation

Organization: Hannover Medical School

Coordinator: Jens BOHNE

Position: PD Dr., Head of Biosafety Department

Outline

This module is designed to teach master's students the skills to write a paper and master thesis, also to give a presentation of scientific data.

They will learn to use professional materials for presentations or publications.

Topics

Searching scientific literature; scientific writing style; writing graduate level papers, proposals, projects, and thesis components; preparing scientific presentations; presentation of data.

Key tools

Lectures on: skills to understand scientific papers, searching scientific literature, using scientific terminology and formatting, scientific writing style, communication the results of a review of the scientific literature, preparing professional materials for presentation and publication.

Assessment method

100% Creating a scientific poster

Ungraded course work

Oral presentation (Scientific paper)

ECTS	Lectures	Tutorials	Practical work	Digital learning	Personal work
3	21 h	35 h			34 h

Internship - Master thesis

The internship will last 6 months and can be done either as a placement in the industry or an internship in any full or associate partner institute.

The master's thesis will be written in English and defended in English as well during the annual workshop. The thesis defense lasts for 30 minutes, including questions.

Assessment:

Written dissertation: 50%

Oral presentation: 20%

Answers to the jury: 20%

Supervisor evaluation: 10%

The evaluation grid used by the reviewers is the following:

Mark		A	B	C	D	E	F
Written dissertation	Grammar and spelling						
	Structure						
	Understandability						
	References and related work						
	Correspondence with the work done						
Oral presentation	Speaking style						
	Support						
	Structure						
	Understandability and pace						
	Summarisation						
	Correspondence with the work done						
	Subject mastering						
	Answer to questions						
Work and results	Amount						
	Use of knowledge acquired in courses						
	Originality and creativity						
	Critic spirit						
	Relevance to infectious diseases / One health						
	Scientifically valid arguments						
	Methodology						
	Weaknesses and further work findings						

