# CLUSTER 2: TROPICAL BIOMEDICAL SCIENCES
# (Course leaders: Ruth Müller & Kevin Ariën)

Students will learn how to write a research proposal for their thesis topic in the context of selected tropical diseases. The main activity is focussed on the development of their thesis project supported by active discussions of different sections of their research by peers and teaching staff. These activities will additionally be supported by lectures and self-directed learning.

The module accounts for 10 ECTS which are divided over two blocks of 5 ECTS: Research methodology and Biomedical Methods I.

## NUMBER OF CREDITS

10 ECTS

## MODE OF STUDY

- Face-to-face and self-directed study
- Organisational and teaching methods
- Organisational methods: collective feedback moment; Lecture
- Teaching methods: Discussion, Paper, Presentation

## LEARNING OBJECTIVES

At the end of the course the student should be able to:

1. Develop a research proposal in the field of tropical biomedical sciences
2. Understand advanced laboratory techniques in a selected domain of biomedical sciences
3. Apply selected research methods within the specificities of the context

## CONTENT

### Block A: Biomedical Research Methodology (Course leader: Prof Rüth Muller)

- This course will guide students in the development of a research proposal and prepares them to present the proposal in a poster format to an scientific audience.
- Prerequisites
    - Knowledge and good understanding of basic statistics
    - Be able to find relevant literature in scientific databases
    - Able to communicate in writing in English
- Study duration in credits: 5 ETCS
- Time schedule

| Week | Date | topic |
|---|---|---|
| **1** | 4-8/01/2021 | Block A |
| **2** | 11-15/01/2021 | Block A |
| **3** | 18-22/01/2021 | Block A |

- Learning outcomes

This block covers the overall module 2 learning outcomes 1, 3 and 4. Specific learning outcomes for this block are:

- Review and assess the quality of existing research proposals
- Formulate a good problem statement, purpose and significance of the proposed study
- Formulate a feasible and specific research question and objectives
- Define a research hypothesis and theoretical framework
- Understand types of experimental study designs and justify the selected design for the problem
- Select the appropriate data analysis plan for a chosen study design
- Effectively design a scientific poster

- Content

**Theme I: The research proposal development**

- Elements of a research proposal
- Writing a research proposal
- research project management
- Ethics committee and forms

**Theme II: Experimental research**

- Types of experimental designs in biomedical research
- pretest/poststest, control, randomized controlled, Bayesian probability…
- Types of Sampling designs, allocation procedures
- Data analysis plan

**Theme III: Systematic review and meta-analysis**

**Theme IV: Presentation of research proposal**

- Scientific posters design
- Scientific poster presentations do's and don'ts
- Preparing for Q&A sessions

- Staff Involved: Mieke Stevens & Veronique Dermauw

- Learning resources

1. Research. Basics : https://explorable.com/research-basics
2. Research Methodology: https://explorable.com/research-methodology
3. Experimental Research: https://explorable.com/experimental-research
4. Research design: https://explorable.com/research-designs
5. Research variables: https://explorable.com/research-variables
6. Statistical Tutorial: https://explorable.com/statistics-tutorial

7. A First Course in Design and Analysis of Experiments: http://users.stat.umn.edu/~gary/book/fcdae.pdf
8. Penzhorn, B.L. 2006. Identifying, formulating and testing a research question.
9. Gummow, B. 2005. Experimental design: Types of studies.
10. Shortland, M & Gregory, J 1992. Communicating science. London: Longman Scientific and Technical (Section III: Speaking; pp 103-139)
11. Sides, CH 1992. How to write and present technical information. Cambridge: Cambridge University Press. (Chapter 21: How to make professional presentations; pp 147-157)
12. The Art of Grantsmanship By Jacob Kraicer (http://www.hfsp.org/sites/www.hfsp.org/files/webfm/Communications/The%20Art%20of%20Grantsmanship.pdf)

## Block B: Biomedical methods I (Course leader: Prof Kevin Ariën)

- This block will consist of two parts: i) the students will further define and refine their research topic through in-depth literature study and consultation of their research topic supervisor(s)and ii) students will get a theoretical training on the methods needed to address the research question.
- Prerequisites
  - basic knowledge and understanding of microbiology, molecular biology and genetics
  - know how to find relevant primary literature
  - critically read a scientific paper
- Study duration in credits: 5 ETCS
- Language of tuition: English
- Time schedule

| week | dates | course |
|---|---|---|
| **4** | 25-29/01/2021 | Block B |
| **5** | 1-5/02/2021 | Block B |
| **6** | 8-12/02/2021 | Block B |

- Learning outcomes

This block covers the overall module 2 learning outcomes 2 and 3. Specific learning outcomes for this block are:

- Retrieve information on the thesis topic and draw up the theoretical framework/concept for the proposed study
- Select appropriate methods to address the research question
- Acquire theoretical background on the required techniques

- Content

Based on the student's thesis topic, the student will draw up a study plan together with the coach in order to acquire the necessary theoretical background on the thesis topic. This theoretical background will enable the student to complete the theoretical framework/purpose of the study and methods section in the proposal. Examples of training topics which can be offered:

- Pathogen models: viruses, bacteria, mycobacteria, protozoa, helminths
- ELISA, bead-based multiplexing (Luminex xMAP), flow cytometry, microscopy

- Molecular biology: PCR, QPCR, Next-Generation Sequencing, Western blot, protein-protein interactions, cloning, transfection, CRISPR/Cas9 knock out
- General cell culture techniques (cell lines and primary cells), isolation and propagation of viruses, (myco)bacteria and parasites

- Learning resources: For each student a specific information package will be compiled based on the thesis topic. This package will include scientific papers and video tutorials.

## ASSESSMENT

At the end of the module each participant will submit their thesis research proposal in a 2 pager document which will be evaluated by an expert panel. It is compulsory to pass this assignment in order to proceed to the seminar week.

A template including the following sections will be provided to the students:

-Title Page

- Abstract

- Purpose of the Study

- Theoretical Framework

- Hypothesis

- Objectives

- Study Design

-Methods

-Budget estimation

-Timeline

The final grade is based on the Quality of the project proposal evaluated as follows

| **Section** | **Assessment criteria** |
|---|---|
| PPP format style | Conform the format |
| Title page | Provides info according to the dissertation format: contact info student and supervisor provided |
| Abstract | Info provided in appropriate format (max 250 words; including 3 keywords)<br><br>Giving a comprehensive overview of the proposal by stating clearly the research question, scope and conclusions reached |
| Purpose of the study | Indicates clearly what is being examined. Purpose aligned with the need, research question, theoretical framework and methodology |

| | |
|---|---|
| Theoretical framework | What is the central theory studies through the research? What theory/conceptual framework/model drives the research question/hypothesis |
| Research question | well-grounded in current theoretical and empirical knowledge; feasible within time and budget |
| hypothesis | Clearly formulated, testable, relevant, logic |
| objectives | Specific, measurable, achievable, realistc and time-bound |
| Study design | Appropriate to answer research question, addresses potential sources of bias, realistic in terms of resources, efficient, precision or power based |
| methods | Relevant for given context, availability of expertise, efficient, feasible given resources and time, appropriate tools for the selected design |
| Budget plan | Comprehensive, efficient, flexible, within the limits |
| timeline | Realistic planning, comprehensive overview of the work to be done within the allocated time for the thesis, clearly formulated deadlines |