

Joint Degree in Infectious Diseases, Vaccinology and Drug Discovery

1. Goal

Provide a high quality MSc-level research-based training on novel approaches to tackle major communicable and emerging disease problems at national and global level.

2. General Objectives of Programme

- Introduce, update and strengthen basic concepts in scientific disciplines (Immunology, biotechnology, vaccinology, biology of infection and microbiology) necessary to diagnose, monitor and prevent communicable diseases of major public health importance.
- Introduce and discuss strategies that ensure effective use of novel technologies for laboratory and field research as well as for diseases surveillance and control.
- Familiarize with key laboratory technologies/approaches specifically related to control of bacterial, parasitic and viral (including HIV) infections of public health importance.
- Perform and evaluate laboratory methods for a) the measurement of immune response to infectious agents and b) the detection of infectious agents in biological samples.
- Outline, discuss and experience through case studies the problems related to drug discovery and development against major communicable and emerging diseases.
- Outline, discuss and experience through case studies the problems related to vaccination (vaccines development, delivery, efficacy testing {epidemiological studies with immunological correlates of protective immunity}).
- Illustrate and discuss the cost-effectiveness of laboratory technologies for the control of communicable diseases.
- Strengthen the partnership, between basic researchers and professionals of academia, R&D companies and public health laboratories necessary for optimal R&D and control of communicable and emerging diseases.

3. Degree to be conferred

MSc degree jointly conferred by NUS and the UoB. The programme is designed so that a harmonic continuation from a MSc project into a PhD programme is possible.

4. Admission Requirements

Entry criteria are either a B.Sc. (with Honors and an average grade of B if applicable) or a completed MD. For the course starting in 2009, a maximum of 20 participants will be admitted.

5. Period of Candidature

The course will start on September 14, 2009 and the duration of the programme is 18 months (see Table 1 for details).

6. Curricular Requirements

This joint curriculum has a strict focus on infectious diseases. Students will learn the cellular and molecular basis of the biology of infection.

The research work, leading to the M.Sc. thesis forms the backbone of the structure. Each student will typically have two tutors assigned (co-supervision). One tutor is usually a senior member of the research team where the research project is undertaken. The other tutor would be from NUS, NITD and UoB, respectively, depending on where the research project is carried out.

Course structure: Lectures by leading scientists in the field of study (25%); practical exercises/group work and discussions (15%); pursuit of the research project (60%); The general course structure is depicted in Table 1.

7. Continuation & Termination of Candidature

Students originating from Singapore will be registered at NUS, while Swiss and international student will be registered at the UoB. The prevailing conditions for continuation, withdrawal and termination of candidatures of the student's home university will apply. (Home university = university at which the student is registered).

8. Grading

In principle the prevailing NUS conditions for grading will apply and UoB grading will be adapted as closely as possible.

9. Examinations & Graduation requirements

It is expected that each research project, besides fulfilling the criteria for an MSc thesis, will result in at least one publication for a peer-reviewed journal.

9.1. Examinations

There will be two written examinations, the first one at the end of phase 1 and the second one at the end of Phase 4. Students have to obtain an average of B- grade (CAP 3 out of 5) in these two examinations in order to pass.

9.2. Written Thesis

The students are required to submit a written thesis and pass the written thesis of the research project. Two examiners are appointed to mark the thesis. The final mark will be the weighted average of the Phase 1 (1/6 of total) and Phase 4 (1/6 of total) examinations as well as the MSc written thesis (2/3 of total).

10. Stipends

Selected students will be supported by a stipend which covers the 18 months of studies, including tuition fees, research and travel costs.

11. Abbreviations

BSc	Bachelor of Science
CAP	Cumulative Average Point
HIV	Human Immunodeficiency Virus
JAC	Joint Academic Committee
MD	Doctor of Medicine
MSc	Master of Science
NITD	Novartis Institute for Tropical Diseases
NUS	National University of Singapore
PhD	Doctor of Philosophy
R&D	Research and Development
STI	Swiss Tropical Institute
UoB	University of Basel

Table 1. General Course Structure

Phase	Time Required	Content	Start	End	Location
1	4 months	Taught courses at UoB & STI in the field of biology of infection, Immunology (See APPENDIX 1)	14. September 2009	18. December 2009	Basel, Switzerland
2	2 weeks	Travel to Singapore and acclimatization	18. December 2009	11. January 2010	n.a.
3	10-12 months	Pursuit of research project at host institution in Singapore	11. January 2010	31. December 2010	Singapore
4	1 semester	Summer School with lecturers from Singapore and the endemic areas (see APPENDIX 1)	2. August 2010	10. December 2010	Singapore
5	Individually but max. 2 months	Completion of research project, write-up of thesis and defense of thesis	Individual	Individual	Singapore

n.a. = not applicable

Host Institutions: Singapore

National University of Singapore (NUS)
Novartis Institute for Tropical Diseases (NITD)

Basel

University of Basel (UoB)
Swiss Tropical Institute (STI)

APPENDIX 1 – Lecture contents

A. Phase 1 Lectures

Phase 1 lectures will be taken from “Cycle A: Infection Biology” which is taught at the Biozentrum of the University of Basel. These lectures include:

- A1) **Advanced Immunology (2 hrs/week)**
This lecture series discusses various diseases caused by abnormalities within the immune system. During the first hour an overview of the clinical aspects of such a disease will be given while during the second hour the immunological basis of this disease will be discussed in the form of a journal club.
- A2) **Molecular Virology I: Introduction Into Virology (2 hrs/week)**
This course covers virus nomenclature, virion structure and assembly, viral life cycles, viral coding, replication and expression strategies, virus-host interaction such as virus transmission and spreading, tumor virology, virus vectors, virus evolution.
- A3) **Molecular Virology II: HIV and its Relatives (2 hrs/week)**
This course introduces RNA retroviruses such as RSV, MLV and HIV; Pararetroviruses, i.e. Hepadna, Caulimo and Badna viridae; retrotransposons, e.g. Ty, copia etc. We will discuss specific retroviral features, such as reverse transcription, virus structure, virus assembly, interaction with the host life cycle, virus replication and integration, recombination with the host genome, virus movement (from cell to cell and organism to organism) and generation of oncogenic retroviruses.
- A4) **Microbial Cell Structures and Drug Targets (1 hr/week)**
- A5) **General Mechanisms of Microbial Pathogenesis (2 hrs/week)**
Pathogenic bacteria manipulate the cells of their host and paralyze the immune response. They synthesize and secrete effector proteins that interfere with various key intracellular processes like actin polymerization and signal transduction. Some of these effectors can enter the cells by themselves (A-B toxins) or be injected by highly sophisticated organelles, called injectisomes. In addition, pathogenic bacteria have “defensive” weapons allowing them to resist the action of complement, to acquire iron, to escape the antibody response. The lectures describe all the basic mechanisms of virulence and underlying cell biology concepts, using the best understood model systems.
- A6) **Major Microbial Diseases and Vaccine Development (2 hrs/week)**
Every bacterial pathogen is endowed with a unique combination of virulence factors and mechanisms, giving a well-defined syndrome. This second course on microbial pathogenesis describes individual bacterial pathogens: ecology, pathology, virulence functions including the genetic and regulation aspects and the possible targets for vaccine development.

B. Phase 4 Lectures

NUS - (~30 contact hours)

NITD - (~20 contact hours)

NUS – Topics

- 1) Infectious Diseases
 - a. Dengue
 - b. Influenza
 - c. Malaria
 - d. Tuberculosis

- 2) Immunology and Vaccinology
 - a. Viral immunology
 - b. Immunoregulation
 - c. Antibody therapeutics
 - d. NK T-cells
 - e. Vaccination

NITD – lectures & contents

NITD will deliver a 2-week lecture module on “Anti-infective Drug Discovery”: from 9 – 10.30, Monday to Fridays for two weeks at Biopolis:

- 1) Introduction
- 2) History of antiinfective drug discovery
- 3) Target finding and assay development
- 4) Lead finding and optimization
- 5) Pharmacokinetics
- 6) Animal models
- 7) New methods for clinical drug development
- 8) Case study: Artemisinin, Lumefantrin
- 9) Case study: Oseltamivir
- 10) Case study: Atazanavir

APPENDIX 2 – Participating institutions

A. Swiss Tropical Institute (STI) – Basel, Switzerland

<http://www.sti.ch>

Contact: Prof Marcel Tanner (Director)

Prof Niklaus Weiss (Deputy Director)

Prof Gerd Pluschke

The STI is an Institute founded in 1943 to carry out teaching and research, and to provide services. The goals of the STI is to contribute to improving the health of populations and groups on both national and international levels. It is financed by grants from the Canton of Basel-Stadt and the Swiss Federal Government, and to a large extent (75%) by its own income from the provision of medical services, services in support of international health, grants for research projects from the Swiss National Science Foundation and other bodies, and foundations. The Institute is also a partner in a number of development projects overseas.

B. Biocenter of the University of Basel (UB) – Basel, Switzerland

<http://www.biozentrum.unibas.ch/>

Contacts: Prof Guy Cornelis (Head, Molecular Microbiology)

Prof Christoph Dehio (Group Leader, Molecular Microbiology)

Prof Joachim Seelig (Chairman)

The Biozentrum is a Department of the University of Basel. It is a basic research institute, covering the research areas of biochemistry, biophysical chemistry, microbiology, structural biology, and cell biology of the Faculty of natural sciences, as well as the areas of pharmacology and neurobiology of the medical Faculty. The Biozentrum was funded in 1971, giving room to – at that time – a quite innovative idea: the unification of various domains of the biological and natural sciences under the same roof. Its goal was to facilitate collaboration with other research areas – a successful concept, as it turned out that nowadays the different research areas cannot be considered separately.

C. Novartis Institute for Tropical Diseases (NITD) – Singapore

<http://www.nitd.novartis.com/>

Contacts: Dr Thomas Keller (Deputy Director)

Dr Thomas Dick (Head TB)

NITD is a Public-Private Partnership between Novartis and the Singapore Economic Development Board (EDB). Its mission is to discover novel treatments and prevention methods for major tropical diseases. In those developing countries where these diseases are endemic, the Novartis Group intends to make treatments readily available and without profit. The discovery technology is state-of-the-art and the scope of activities range from target discovery through to screen development and compound optimization up to readiness for clinical testing. The current focus for the institute is dengue, malaria and tuberculosis.

D. National University of Singapore (NUS) – Singapore

www.nus.edu

Contacts: Prof Markus Wenk (Principal Investigator, Biochemistry)

Prof Vincent Chow (Principal Investigator, Microbiology)

Acknowledged as one of the finest universities in the Asia-Pacific region, National University of Singapore (NUS) is a comprehensive university offering a broad-based curriculum underscored by multi-disciplinary courses and cross-faculty enrichment. NUS has 13 faculties, with an enrolment of more than 22,000 undergraduate and 8,000 graduate students. NUS actively promotes innovation and entrepreneurship. NUS enjoys a close teaching-research nexus with 13 national-level, 11 university-level and 70 faculty-based research institutes and centres. The University is strongly committed to advancing knowledge and fostering innovation, educating students and nurturing talent in the service of country and society.