Institute of Immunology

NUI MAYNOOTH
Ollscoil na hÉireann Má Nuad

M.Sc. Degree in Immunology and Global Health

Introductory Manual

Information for Students taking the MSc in Immunology and Global Health 2013 - 2014

The staff of the Institute of Immunology, Departments of Biology, Anthropology, Geography, Mathematics, and the Hamilton Institute at NUI Maynooth extend a warm welcome to all students. We hope you will enjoy your year with us and gain valuable skills and knowledge.

This taught modular programme has two aims: to give postgraduate students a thorough understanding of theoretical and practical immunology that can be applied in an academic or private sector environment; and to position that understanding within the context of global health and development. This course will provide broad training in academic and clinical immunology suitable for the professional advancement and personal development of students.

The programme will be delivered as 12 taught modules (60 ECTS) and one research project (30 ECTS). It will be taught by lectures as the major vehicle, but will also include seminars, workshops, laboratory demonstrations, practicals and problem-solving approaches. Most modules will be supported by online provision through Moodle (the NUIM virtual learning environment). All modules will have prescribed recommended reading and associated tutorials. In addition students will be expected to undertake independent study of current research literature relating to each module. A small amount of practical work is associated with some modules, but the majority of laboratory-based experience will be in the form of a research project supervised by an academic investigator. The research project may be based in NUIM or elsewhere. To assist students a series of workshops and seminars are scheduled which will cover all aspects of postgraduate study, including study skills, grant and report writing, scientific writing etc.

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Staff Research Interests

Paul Moynagh, Institute of Immunology & Department of Biology, NUI Maynooth

Toll-like receptor signalling

Work in the laboratory has focused increasingly on proinflammatory stimuli and the signal transduction pathways that they employ in effecting an inflammatory phenotype. Studies especially concentrate on human Toll-like receptors (TLRs). TLRs recognise pathogen-associated molecules. As examples, TLR2 recognises peptidoglycan and bacterial lipoprotein from Gram-positive bacteria, TLR3 mediates responses to double-stranded RNA, TLR4 is involved in recognition of Gram-negative lipopolysaccharide (LPS), TLR-5 recognises bacterial flagellin and TLR9 functions as a receptor for bacterial DNA containing CpG motifs. The engagement of TLRs by pathogenic components results in induction of co-stimulatory molecules that facilitate T-cell activation and pro-inflammatory proteins that effect elimination of the pathogen from the body. TLRs employ many of the same signalling components as the type I IL-1 receptor (IL-1RI). This is hardly surprising since the intracellular regions of TLRs and IL-1RI share a conserved Toll / IL-1R (TIR) domain that is important in initiating various signalling pathways especially that regulating the transcription factor NFkB. My research group is currently exploring the signal transduction pathways employed by the TLRs. We have identified some novel regulators of the TLR pathways and hope to explore their potential value as therapeutic targets in inflammatory diseases.

Inflammation and the brain

My research group has a continuing interest in characterising the effects of pro-inflammatory cytokines in brain. This area of research probes the effects of the cytokines interleukin-1 (IL-1) and tumour necrosis factor (TNF) in brain cells. We have shown that both cytokines induce the cell adhesion molecules VCAM-1 and ICAM-1 and chemokines such as IL-8 in glial and neuronal cells. The induction of these genes appears to play important roles in cerebral recruitment of leukocytes which may lead to neuropathology. Indeed IL-1 and TNF promotes sustained expression of these genes and this may underlie the chronic cerebral inflammatory responses seen in neurological disorders such as multiple sclerosis. We are thus very interested in exploring the mechanism by which IL-1 and TNF can cause sustained expression of the genes and we have published findings that show that the sustained expression is likely to be due to prolonged activation of the transcription factor NFkB by IL-1 and TNF. We have also resolved the mechanism underlying this prolonged activation of NFkB. This work is currently being extended in my laboratory with a view to identifying novel agents to block the expression of adhesion molecules and chemokines in brain cells. Such agents include cannabinoids and we have recently published data describing a novel mechanism by which they can produce anti-inflammatory effects in the brain. Such molecules may be of therapeutic value in the treatment of various neuropathological conditions.

Marion Butler, Institute of Immunology & Department of Biology, NUI Maynooth

My research interest is probing at the molecular level key signaling events that ultimately lead to an effective immune response to pathogen. Specifically my research focuses on gaining insight into the complexity of Toll-like receptor (TLR) signaling, the activation of these receptors which is now recognized to be central to pathogen elimination. TLRs are expressed by cells from both the innate and adaptive immunity, including dendritic cells, macrophages and B cells. Stimulation of these receptors activates a number of intracellular signaling cascades that lead to an immediate immune response against pathogen by promoting an inflammatory response as well as leading to the more specific later activated adaptive immune response. Research in my laboratory is currently exploring novel roles of interleukin-1 receptor associated kinase-1 and -4 in TLR-signalling pathways. Probing the contribution of TLR-signaling to B cell proliferation will be a key focus of the research group. This work will involve defining the B cell stimulation context under which TLR stimulation contributes to B cell proliferation, before analyzing the downstream TLR-intracellular signaling cascades that are activated and defining the critical events at the molecular level in these pathways that connects TLR stimulation to B cell activation.

Bernard P. Mahon, Vice President for Research, NUI Maynooth

We are asking the fundamental questions “How is immunity switched on?” “How is it maintained?” and “How is it turned off?” Asking these questions has led us to follow two inter-related themes: the cell mediated immune response in the airways and the immunology of the neonate or newborn.

Our studies of the cell mediated immune response in the airways have focused on pathogen-host interaction during *B. pertussis* infection (the causative agent of the childhood disease, whooping cough). With our academic partners, we have shown that efficacious vaccines generate a type of immunity dominated by interferon-γ production (termed Th1) whereas less efficacious vaccines generate a different (Th2) type of response. This work has led to advances in vaccine adjuvant design resulting in high quality publications and patents with industrial partners and new ways to make safer vaccines. We have gone on to check if Th2 driving vaccines influence asthma. We have demonstrated that a number of existing Th2 driving vaccines do not exacerbate asthma and the reason why this is the case, work of considerable interest to vaccine control authorities.

Our fundamental studies have focused on the role of a signal molecule in the airways that might be involved in amplifying the asthmatic response. We have focused on the chemokine (CCL28) and uncovered some of the insults that induce this signal. With our clinical partners we are about to publish work showing how this signal is important in asthma.

The other related theme of our group examines the neonatal immune response. This has grown out of our interests in childhood immunisation. We have examined immunity in a number of diseases important during pregnancy (B19 virus) or early life (*B. pertussis*). This work has shown how immunity in early life can be different to that in adults and how pathogens can alter immune responses. In a major recent development we have extended this work with partners in REMEDI from NUI Galway. Together we are exploring how adult derived stem cells can be transplanted even when mismatched (allogeneic transplantation). We believe that adult stem cells maintain many aspects of the fetal graft, which allows these cells to be successfully used in regenerative medicine. If we are correct it may mean that adult derived stem cells can be used in a wide variety of new therapies.

Sinead Miggin, Institute of Immunology & Department of Biology, NUI Maynooth

My research focuses on the molecular mechanisms involved in regulating the innate immune system through the Toll-like receptors (TLRs). TLRs play a critical role in the evolutionary conserved innate immune response and represents our first line of defense against invading pathogens. TLRs are activated in response to a broad spectrum of pathogen-associated molecular patterns (PAMPs) ranging from bacterial and viral components to fungal and protozoal molecules. The capacity not only to respond appropriately but also to self-regulate host responses to invading pathogens is vital in our ability to mount an appropriate primary immune response. The TLRs mediate their actions via adaptor molecules of which there are five, namely MyD88, Tirap/Mal, Trif, TRAM and SARM. Each of these molecules interacts heterophilically with defined TLRs. MyD88 is the central adapter molecules interacting with all TLRs except TLR3. Upon ligand activation, MyD88 recruits members of the IRAK family and TRAF-6 eventually leading to activation of NF-kB and production of pro-inflammatory cytokines including IL-1beta, TNFalpha and IL-18. This is termed the MyD88-dependent pathway. The second adaptor molecule, Mal is thought to act as a bridging adaptor between TLR4, TLR1/2, TLR2/6 and MyD88. Figure 2 shown the expression of Mal (depicted in green) on the cell surface of HEK293 cells. In addition, the TRIF-dependent pathway may also be activated, as is the case for TLR3 and TLR4. Whereas Tram is thought to act as a bridging adaptor between Trif and TLR4, Trif interacts directly with TLR3. Activated Trif recruits TBK1 and together with IKKi mediate interferon regulatory factor (IRF)3 phosphorylation, dimerisation and nuclear translocation leading to Type-1 interferon induction. Trif also interacts with TRAF6 and receptor-interacting protein (RIP)-1 which mediate NF-kB activation.

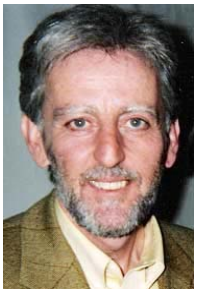
Toll-like Receptor Signalling:

My group are interested in exploring the molecular architecture of the TLR and adaptor molecule complexes in response to various pathogens and to endogenous TLR ligands with the aim of identifying ligand-specific TLR complexes. My group are primarily interested in characterising TLR4, TLR2 and TLR3 signalling. My group are currently investigating some novel aspects to TLR3 signalling. I am interested in knowing how the Toll-like Receptors are regulated at the molecular level. Why are different TLRs activated by different ligands? Why do different TLRs selectively use different adaptor molecules?

Chronic Inflammation:

Chronic Inflammatory Diseases such as Rheumatoid Arthritis (RA), Osteoarthritis (OA) and Type 2 Diabetes, whilst having apparently unrelated aetiologies, share a common late stage pathogenic process, characterized by increases in pro-inflammatory cytokines, such as TNFa, IL-1b, IL-6 and IL-18. During chronic inflammatory episodes, the ‘in-born’ or innate immune system may become dysregulated through mechanisms involving Caspase-1 and Toll-like receptors (TLRs). We have recently shown that TLR2 and TLR4 signalling is modulated by cleavage of Mal by Caspase-1 (Miggin et al., PNAS). Given these findings, I am interested in exploring the molecular mechanisms involved in the pathogenesis of chronic inflammatory diseases. My group are particularly interested in investigating TLR signalling during RA and OA disease episodes following stimulation with endogenous and exogenous TLR ligands. My group are also exploring the role of TLRs in the pathogenesis of Type II Diabetes using biological samples from diabetic patients with good and poor glucose control. Overall, our research aims to develop our understanding of the molecular mechanisms involved in regulating Rheumatoid and Osteoarthritis and Type II Diabetes.

Noel Murphy, Institute of Immunology & Department of Biology, NUI Maynooth



My research interests focus on the African trypanosomes which are protozoan parasites of both medical and veterinary importance in sub-Saharan Africa. The African trypanosomes also represent important biological organisms that have been central to discoveries on mechanisms of antigenic variation, mechanisms of adaptation to different host species, gene expression, RNA processing and editing and glycosome biology. With support from Enterprise Ireland (2002-2004) and Science Foundation Ireland (2004-2006) research conducted by the group is directed at gaining insights into trypanosome-host and trypanosome-trypanosome interactions that contribute to the establishment and maintenance of infection and the causes of disease. Current research is focused elucidating the molecular processes by which parasites communicate with each other to control their population size, proliferation and differentiation status. Communication between strains and species of trypanosomes is achieved through a parasite-produced factor. The process by which this factor arrests proliferation of dividing parasites and induces differentiation is currently being elucidated. I am also interested in mechanisms of host resistance through studies on African wildlife species that do not succumb to disease caused by trypanosomes. Studies have elucidated a mechanism of innate resistance and evidence for acquired immunity, and the basis of this acquired immunity is currently being studied through linkages with European, North American and African partners. The overarching aims these studies are to identify new options to control the devastating diseases caused by African trypanosomes by gaining a greater understanding of the biology of these organisms and their interactions with their host species.

Shirley O'Dea, Institute of Immunology & Department of Biology, NUI Maynooth

My team is studying the lung epithelium and the signalling networks that influence its functions in health and disease. The airway epithelium is not merely a passive barrier preventing the entry of harmful substances into the host. The cells within the epithelium carry out a range of specialised functions including detoxification of harmful substances and active defence against microorganisms as well as communicating directly with the immune and inflammatory systems. To carry out these essential functions, the epithelium must be intact and contain the appropriate subpopulations of specialised cells. Chronic exposure to harmful substances and underlying genetic factors can compromise defence and repair mechanisms in the lungs, leading to long term damage and disease.
My group is interested in interactions between the lung epithelium and its microenvironment and the ways in which lung epithelial cells, mesenchymal cells and immune and inflammatory cells modulate each other's functions in health and disease. In particular, we are interested in mechanisms of regeneration within damaged airways and we are investigating both normal repair processes and the alterations in these pathways that lead to the development of disease. We are examining the effects of signals emanating from 1. inflammatory and immune cells, 2. underlying mesenchymal cells and extracellular matrices and 3. neighbouring epithelial cells on epithelial cell proliferation and function. Understanding these signalling networks should result in the identification of potential areas for intervention strategies to prevent, treat and cure lung disease.

Martina Schröder, Institute of Immunology & Department of Biology, NUI Maynooth

Research in the lab centers on the recognition of pathogens, in particular viruses, by pattern recognition receptors. A hallmark of all anti-viral pattern recognition receptors is the induction of type I interferons, which are potent anti-viral mediators. A lot of viruses have therefore evolved mechanisms to interfere with interferon induction or action. We are interested in the signalling pathways leading to interferon induction after receptor engagement, and aim to identify novel regulatory components of the system using proteomics techniques.
We have recently identified the human DEAD-box protein 3 as a positive regulator of interferon-beta induction. Interestingly, DDX3 is targeted by several different viruses, like HIV, HCV, HBV and poxviruses to either aid in the replication of the viral genome or for the purpose of evading interferon induction. Since DDX3 also appears to be a highly multifunctional cellular protein with roles in gene expression regulation and cell cycle control, research in the lab is currently focused on understanding the biology of DDX3 and its interaction with viruses in more detail.

Mark Mellet, Institute of Immunology & Department of Biology, NUI Maynooth

My research interests include examining how the Interleukin-17 family of cytokines contribute to chronic inflammatory disease and auto-immunity. Interleukin-17 cytokines have been implicated in the pathogenesis of rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, psoriasis and some carcinomas. My research focuses on identifying the underlying inflammatory mechanisms responsible for these diseases with a view to identifying novel therapeutic targets.

James McInerney, Department of Biology, NUI Maynooth

Studies of adaptive evolution in protein-coding genes, synonymous codon usage variation and the application of this information to gene identification. Analysis of genome evolution, strain-specific sequence differences and the evolution of mutational biases in completed genomes. Development of bioinformatic software for the analysis of large genomic datasets. Phylogenetic analysis of Bacteria, Archaea, Eukarya and Multi-gene families.

David Fitzpatrick, Department of Biology, NUI Maynooth

My research focuses on the evolution of unicellular microorganisms paying special attention to fungal species. We use comparative genomics, phylogenomics, phylogenetics and synteny based tools to elucidate fungal gene and genome evolution. We are currently using comparative genomics to perform

an analysis of 8 Candida and related species, both pathogenic and non-pathogenic, to identify species-specific metabolic pathways and lineage-specific loss or gain of metabolic genes. The presence or absence of particular pathways or pathway components can be correlated with pathogenesis and species-specific virulence characteristics, which can lead to the development of novel therapeutic strategies. We are also investigating the frequency of horizontal gene transfer within the Candida genus. Acquired genetic material from an external source can lead to increased virulence and can provide novel antifungal drug targets. We are also interested in sequencing and annotating medically / biotechnological important fungal strains.

Gemma Kinsella, Department of Biology, NUI Maynooth

Research activities focus on protein structure prediction and the early stages of drug development for diseases encompassing Type II Diabetes, genetically pre-disposed obesity, auto-immune conditions and Parkinson's Disease. An emphasis is placed on G-protein coupled receptors and experimental approaches used include protein expression and purification; binding and functional assays; computational modelling techniques. Studies involve the screening of chemical libraries to identify small molecules which disrupt protein interactions or which can act as pharmacological chaperones.

Thomas Strong, Department of Anthropology, NUI Maynooth

Thomas Strong conducted ethnographic research in the eastern highlands of Papua New Guinea between 1998 and 2003 on social transformation, especially as it is revealed through people's concepts of vitality and bodily fortitude. He has also participated in ethnographic and historical research projects on HIV and sexual risk in the urban United States, on the (post)colonial politics of scientific investigation, and on the symbolism and sociality of transfusion medicine. His publications include essays on beliefs about withering male bodies in highland New Guinea, new theories of kinship in anthropology and cultural studies, artificial heart experiments, altruistic blood donations, and blood donor activism. Presently, he is undertaking new research on changing cultures of HIV/AIDS in rich and poor settings.

Jan Rigby, National Institute for Regional and Spatial Analysis, NUI Maynooth

I am a health geographer, so my research attention is inevitably captured wherever aspects of health in one place differs from another. This can range from the incidence of a disease, through to access to healthcare. The research is framed within socio-environmental justice and inequality. I am particularly interested in life course approaches to understanding health (or, more accurately, ill-health) and in capacity building in the use of geographical information systems (GIS) for health research and policy.

Steve Buckley, Dept of Mathematics, NUI Maynooth

Steve Buckley is a mathematician whose primary research is in various areas of geometry, mathematical analysis, and the interplay between the two of them. He has recently worked extensively on general notions of curvature. He also has an interest in the application of statistics in biology and medicine.

Donal O'Mathuna, School of Nursing, Dublin City University

I have two main areas of research interest: ethics and evidence-based practice. The latter has led to my involvement in the Cochrane Collaboration and systematic reviews, particularly of complementary therapies and herbal remedies. My research in ethics has focused on issues of personhood, human dignity and moral reasoning. I am interested in their interplay with biotechnology, especially nanotechnology and stem cell research. Another general research interest is Disaster Bioethics: the ethical issues that arise for healthcare practitioners and researchers during disasters. The role of emotions in ethics is another research interest, especially in moral perception and how narratives help engage people with ethics. I am involved in projects examining the role of various types of narrative (novels, film, song lyrics, etc.) in ethics education. I am also interested in how religious belief influences ethics and the role of spirituality in health and healing.

Structure of the MSc programme

The programme consists of 12 taught modules, 6 in each semester and a research project, which is carried out during the summer months. Examinations for semester 1 modules will take place in January and examinations for semester 2 modules will take place in May.

Semester 1

BI 601:	Fundamental Immunology
MT 601:	Epidemiology and the modelling of human disease
BI 602:	Advanced Immunology
BI 603:	Molecular Parasitology and Diseases of Poverty
BI 604:	Bioethics, biopharmaceuticals and clinical trials
BI611:	Seminars in Advanced Immunology and Global Health
GY606:	Geography of Health and Health Care

Semester 2

BI 605:	Clinical Immunology
BI 606:	Applied and Molecular Immunology
BI 607:	Introduction to Bioinformatics
BI 608:	Vaccines and adjuvants
BI611:	Seminars in Advanced Immunology and Global Health
AN615A:	Global Health

Summer project

BI 609: Immunology Masters Research Project

Modules

BI 601: Fundamental Immunology

This module will give students a good grounding in the scientific theory underlying modern immunology. Topics studied include innate immunology, inflammation and signaling, B cell biology, the structure and function of antibody and how diversity is generated. Cell-mediated immunology will be examined contrasting T cell recognition with B cell recognition of antigen. T cell development, effector and regulatory functions and cytokine production will be discussed in detail, following an in depth examination of the major histocompatibility complex structure, organisation and function. Lecture material will be supported by tutorials and an essay assignment. Students will undertake 9 hours of practical work to introduce basic techniques in immunology.

Course structure: 16 lecture hours, 9 hours practicals and 4 hours of workshops/tutorials with an essay assignment.

Marks out of 100: 75 marks for one 1.5 hour written exam at the end of semester 1. 15 (3 x 5 marks) for practical assignments, 10 marks for MCQ.

MT 601: Epidemiology and the modelling of human disease

***Module objectives*:** The aim of this module is to provide students with an understanding of epidemiology and the mathematical modelling of human disease/ immunisation. By the end of the module students will have a broad appreciation of the processes underlying disease modelling, and a detailed knowledge of how epidemiology can inform health policy.

***Module content*:** Topics covered include: History of epidemic modelling, components of the modelling process, study design including case control, cross sectional, cohort and experimental studies. Inferential statistics: hypothesis tests and confidence intervals for means and proportions. Analysing, solving and interpreting various models of diseases such as the Kermack-McKendrick Susceptible, Infectious and Recovered (SIR) models using differential equations, applications to childhood diseases. Estimating epidemiological parameters and vaccination rates using serological and survey data. Throughout the course emphasis will be placed on the implications of the models and their results for policy and planning in the health services.

***Teaching Methods*:** 20 lecture hours and 4 hours of workshops/tutorials with class assignments.

***Recommended Reading*:**

Anderson, R.M. and May, R.M. (1992). Infectious Diseases of Humans, Dynamics and Control, Oxford University Press.

Brauer, F. and Castillo-Chavez, C. (2001). Mathematical Models in Population Biology and Epidemiology, Texts in Applied Mathematics 40. Springer.

Murray, J.D. (2001). Mathematical Biology, 1, An Introduction, Springer

Slome, C., Brogan, D., Eyres, S. and Lednar, W. (1986). Basic Epidemiological Methods and Biostatistics, A workbook. Jones and Bartlett, Boston.

Marks out of 100: 30 marks by continuous assessment and 70 marks for one 1.5 hour written exam at the end of semester 1.

BI602: Advanced Immunology

This module will provide students with a detailed understanding of the immune system, including the molecules and signalling pathways that mediate immune effector functions. Topics covered include: Innate Immunity, Pattern recognition receptor signalling, the Major Histocompatibility complex and its role in transplantation immunology, antigen processing and –presentation, T and B cell activation, Immune effector mechanisms, Cell migration and Inflammation, the immune response to viruses and viral immune evasion.

Course structure**:** 16 lecture hours, 4 tutorials, prescribed reading

Assessment**:** Total marks 100%. 70% for two hour written examination at the end of the semester 1, 30% continuous assessment (20% for MCQ and 10% for group assignment)

BI 603: Molecular Parasitology and Diseases of Poverty

The taught component of the module will begin with an introduction to protozoan parasites, namely *Plasmodium* species that cause malaria, African trypanosomes, South American trypanosomes and *Leishmania* species. The parasite-host interface will be covered in detail focusing on the mechanisms by which protozoan parasites establish and maintain infection and cause disease. Topics will include molecular mechanisms of antigenic variation and immune modulation by protozoan parasite, host responses and host resistance mechanisms both innate and acquired. The application of parasite and host genomics to develop vaccines and other control options for these diseases will be covered. The course will also examine emerging and re-emerging infectious diseases of poverty, climate change and global travel to include HIV, TB, Dengue and West Nile Virus. Finally the interaction between nutritional status and disease susceptibility will be explored. Lecture material will be supplemented by dedicated tutorials that will be in the form of a journal club and a presentation assignment where students research and present on an assigned topic. Students will undertake a 3 hour practical to expose them to methods for parasite identification and disease diagnosis.

Course structure: 18 lecture hours, 3 hours practical and 4 hours workshops/tutorials with a presentation assignment

Marks out of 100: 80 marks for 1.5 hour written examination at end of semester 1,
5 for the practical assignment and 15 for the presentation assignment.

BI 604: Bioethics, Biopharmaceuticals and Clinical Trials

Lecture topics will include: bioethics in relation to scientific research and drug development; the design and management of clinical trials; the production and global impact of biosimilar drugs; the regulatory issues facing the introduction of pharmaceuticals. The module will also involve seminars from senior individuals in start-up, SME and multinational biopharmaceutical companies based in Ireland, including descriptions of R&D activities and commercialisation issues. Workshops on commercialisation of research and bioethics will support the lecture material.

Course structure: 16 lectures

Marks out of 100: Assignments: 100%

GY606: Geography of Health and Health Care

Module objective: To understand current interpretations of geographies of health and critically evaluate the geographical dimensions of research and policy in a global health context.
Module content: The module will explain and illustrate, through case studies and examples, the important role of geography in explaining the global burden of disease, health inequalities, and linkages between the physical environment and health.

***Course structure*:** 18 lecture/workshop hours; 6 seminar hours.

Marks out of 100: Continuous Assessment 100%. One essay 66⅔%; one group project 33⅓%.

BI 605: Clinical Immunology

Module Content: Introduction to immunopathology and mechanisms of tissue injury. Diagnostic techniques. Normal defences against infection. Primary and secondary immunodeficiency with emphasis on how understanding of primary immunodeficiencies contributes to our understanding of the human immune system. Allergy. Mechanisms of autoimmunity. Organ-specific autoimmune disease. Non-organ specific autoimmune disease. Leukaemias and lymphomas. Abnormal immunoglobulins. Paraneoplastic syndromes. Infection related immunopathology. Haemopoietic stem cell transplantation. Solid organ transplantation. Active and passive immunisation. Therapeutic use of immunoglobulins and monoclonal antibodies. Immunosuppression. Evolving areas in clinical practice. Continuous assessment will based on two literature based case studies.

Course structure: 16 lectures, 1 site visit, 2 case studies (literature based)

Marks out of 100: 40 marks for one 1.5 hour examination – short question format and 60 marks for two case study literature reviews (2 x 30)

BI 606: Applied and Molecular Immunology

Module Content: The course will focus on the high-end immunology technologies, beginning with an introduction to modern molecular techniques and comprising a comprehensive overview of

DNA-, RNA-, protein- and organism-based scientific techniques. Through a series of lectures students will learn the underlying principles behind technologies such as cloning, DNA footprinting, EMSA, CHIP, reporter gene assays, northern blotting, RT-PCR, real-time PCR, flow cytometry, imaging, immunohistochemistry, immunoprecipitation and the generation of transgenic animals. In addition, applications of these technologies in the field of immunology, as well as limitations of the techniques, will be described. The course will be supported by practical demonstrations for MSc students of flow cytometry and other technologies.

Course structure: 16 lecture hours, 9 hours practical workshops on cell separation, flow cytometry and animal husbandry.

Marks out of 100: 100 marks for a two hour written examination at the end of semester 2.

BI 607: Introduction to Bioinformatics

***Module Content*:** The course will provide a practical approach to familiarise students with a number of bioinformatic approaches through lectures and workshops. In addition students will be given an introduction to the principals behind database queries, structure, tree construction etc. Lectures will be supported by tutorials with specific assignments designed to reinforce lecture material.

Course structure: 12 lectures and 3 (x 3 hour) workshops

Marks out of 100: 70 marks for a 1.5 written examination, 30 marks for continuous Assessment.

BI 608: Vaccines and adjuvants

This course will examine adjuvant use (3 lectures), building on concepts delivered in modules covering innate immunology. One lecture will survey the use of vaccines in a historical context (Jenner and prior to 1890) and in traditional folk medicines from around the work. The bulk of the course will survey the rational design of vaccines. This will begin with the history of poliovaccines (2 lectures) comparing the Salk v Sabin vaccines, the lesser known failed vaccines of the 1930s and the Cutter incident. The course will then survey all vaccines in common use and examine the particular challenges of protecting the neonate in the developing world. Finally the course (4 lectures) will examine the prospects for novel vaccines against the three major infectious diseases of poverty (TB, HIV malaria). Students will be expected to perform considerable reading of current literature in vaccinology and prepare a dissertation on a vaccination challenge specific to a resource poor region.

Course structure: 16 lectures, 4 tutorials, 1 dissertation, prescribed extra reading

Marks out of 100: 100 marks for a dissertation

BI611: Seminars in Advanced Immunology and Global Health

Module Objective:
The objective of the module is to develop critical thinking and interpretation skills at an advanced level. Specifically, students are expected to be able to assess recent research findings in the area of Immunology and Global Health and convey such developments to both specialist and non-specialist audiences.

Learning Outcomes

- On successful completion of the module, students should be able to:
- Critically assess and discuss current research findings in Immunology.
- Appraise recent activity in Global health research.
- Interpret scholarly activity in Immunology and Global health for a non-specialist audience.
- Formulate a summary suitable for a specialist academic group.

Teaching & Learning methods
Students will attend two research seminars in the Institute of Immunology per month during semester 1 and 2. During these seminars, talks in the areas of Immunology and Global Health will be presented by specialists in their field. An attendance level of 70% is required to pass this module and students are expected to engage actively with the topic of the talk and the speaker. To this end, reading material will be provided beforehand and a question and answer session with the speaker takes place after each talk. For each talk, 2 students will be assigned the tasks of introducing the speaker and chairing the Q&A session, respectively. At the end of each semester, students have to submit a written assignment based on one of the seminars given during this semester. The assignment consists of two parts: 1. An article written for a lay audience (e.g. a newspaper article or a blog), 1000 words 2. An academic summary of the research presented during the seminar, 1000 words. For both parts of the assignment, the student is expected to consult and incorporate appropriate additional sources of information (e.g. research papers, news articles, position papers, interview with the speaker)

Assessment
Continuous Assessment, 100%

AN615A: Global Health

This is an anthropology/social science *seminar* on problems of global health. We take a two-pronged approach to a vast, and vastly complex, field. First, we examine and critique an influential argument about the relationship between perduring systems of domination (such as poverty, racism, and sexism) and disease. Second, we examine the ways in which this knowledge and its attendant morality mobilizes global concern and types of intervention. In seeking solutions to problems of global health and human suffering, we are attentive to the hierarchies, and the unforeseen consequences, that can emerge when powerful global institutions seek to improve the lives of the putatively powerless. Thus, we consider the role social science *in* global health plays, alongside the social science *of* global health.

Assignments:

(a) One collaborative seminar presentation on an area of focus identified in readings (e.g., definitions of 'global health,' colonial medical history, humanitarianism, and so on).
(b) One approx. 4,000 word collaborative research report. Because we approach both (1) health problems and (2) quandaries of institutional response, your essay should choose one on-going health problem in the developing world (e.g., AIDS, malaria, obesity, civil emergencies) and describe the 'biosocial' character of the problem ('the disease,' 'disability,' or 'disaster') *within the context* of a particular institutional response (whether led by public, private, or public-private institutions). Your essay could, for example, be about PEPFAR, the WHO Global Malaria Program, the Drugs for Neglected Diseases Initiative, Partners in Health, or Doctors without Borders. Throughout this seminar, and in your essay, you are encouraged to think as a 'double agent': imagine yourself as someone both *inside* and *outside* 'the system.' (Y)our aim should be to gain knowledge of some concrete specifics of global health institutions while also advancing (y)our ability to think abstractly and critically about them.

We will experiment with a collaborative format for producing the final report; minimally, these reports will be written and assembled by teams of students from both anthropology and immunology. Reports are due May 15 and should be returned to the Department of Anthropology office in Rowan House.

This is a hybrid seminar-lecture. I may do some contextualising lectures designed to expand upon readings and to provoke discussion amongst students. However, the seminar works best when students actively engage in the required readings, coming to class prepared to discuss and debate them. *Attendance is required.*

Text: Mark Nichter, *Global Health: Why Cultural Perceptions, Social Representations, and Biopolitics Matter*. 2008. Tucson: University of Arizona Press.

BI 609: Immunology Masters Research Project

Students undertake a 12-week research project under the guidance of a supervisor. Students may be provided with a reading list but are expected to perform a literature search to familiarise themselves with the topic assigned. Over the period of the project students must become competent in the techniques and equipment relevant to the project. Students will also contribute to the academic programme of their laboratory by attending regular seminars and laboratory meetings. All students provide a poster of their research findings, as part of a day long showcase of the Masters student's work. On completion of the project students must submit a thesis outlining their research.

Course structure: 12-week full time research project (supervised) between June and September. A Masters research showcase day. Students may be based in NUIM or elsewhere.

Marks out of 600: 420 marks for a thesis, 120 marks for laboratory work, 60 marks for poster

Assessment and marking

The course consists of 12 modules, each attracting a mark of 100 (total 1200 marks) and one research project attracting 600 marks. The total marks are 1800.

Assessment is by examinations in January and May, by continuous assessment and on the research project.

Students must achieve an overall minimum of 40% (720 marks) for the award of MSc.
In addition it is obligatory to pass modules BI601, BI602 (minimum 40 marks each) and the research project module BI609 (240 marks).

There are no repeat examinations.

Penalties: *(for late submission of Course/Project Work etc.)*
Late submission of continuous assessment accepted with penalty (up to 3 days 10%, more than 3 days 25%), in the absence of extenuating circumstances.

Guidelines for project assignments

Literature assignments are aimed at researching the literature in the area and discussing the topic under consideration, including reference to opposing views on the subject where appropriate. The thesis should not be simply a reproduction of information from review articles or book chapters, but should include your interpretation of the subject, organised to develop the reader's understanding as you think appropriate and written with authority, by one who understands the evidence and issues. The assignment should be broken into sections which should have a General Introduction, Discussion (should be broken into subsections with appropriate subheadings for sections dealing with different topics), Conclusions and References. The Conclusions should draw together the discussion points made during the discussion. At the end of the assignment you should understand your topic fully and be capable of presenting the findings and defending your conclusions at a seminar on your thesis topic.

Understand the major points you wish to make order them logically and build towards each with evidence. Do not include empty material that is not helpful to the reader or part of your case building, no matter how impressive it looks.

DO NOT EXCEED THE WORD LIMIT OF THE LITERATURE PROJECT, WHICH INCLUDES REFERENCES

Quotations. In general, use direct quotations only where the wording matters to your case.

Reference Material. Familiarize yourself with the background literature relating to the project. You are expected to do a literature search using computers linked to the Internet. Your supervisor may provide you with additional reprints which may not be available in the library. However it is your task to research the literature and ask for specific references if available. Reference material that is not available from the library or from your supervisor can be obtained on inter-library loan through the Library. However there can be long delays in receiving these, so students are advised to make these requests early in the first term.

Referencing. It must be possible to identify the source of all material which is not your own.

- References are easier to revise and more informative if given in the form:
  According to Jennings (1978) -----
  Jennings (1978) stated that -----
- All references should be given fully, and in alphabetical order, in the reference list at the end of the literature survey. Follow the format described for the laboratory project thesis.

Diagrams. Should be made whenever possible. Where based in published illustrations/data these should be re-drawn by you to demonstrate the point you wish to make. The legend should contain a credit e.g. "Re-drawn from Stairs (1989)", and of course Stairs will appear in the reference list at the end. If, for instance, your point concerns a few chemical groupings on a large molecule, you might consider using lines to pick out all or part of the overall shape of the molecule and draw in more fully the few groups that are essential to your discourse.

Material beyond your competence. Where your presentation carries you into e.g. advanced mathematics or chemistry that you cannot reasonably be expected to master; deal only with the conclusions as set out by the author.

Complex original ideas. Some topics allow you to develop ideas of your own. You may like to discuss them with your Supervisor before incorporating them in your essay.

Typing. It is preferable to use a word-processing package so that you can easily rearrange sections. You should run a spell-checker. Recommended font is Times New Roman (size 12). The thesis should be double-spaced.

Reprints. Where you order literature (on Inter Library Loan) that is not available at Maynooth, you should show (returnable book) or give a copy of it (paper) to your Supervisor. This will aid appreciation of how well you have done and contribute to the reference collections of the laboratories.

You must submit an identical copy of your written thesis as an MS Word document on CD. Label the CD with your name, student number and thesis title.

Guidelines for laboratory projects

Your project will provide you with an opportunity to get involved in real research, usually on some aspect of the research already ongoing in your supervisor's laboratory. Your project also gives the examiners and future employers an indication of your ability and your initiative.

A. Choosing your project.

Try to choose a laboratory which interests you and which suits your scientific background and your general lab skills.

B. Project organisation. Initial steps.

- Familiarise yourself with the background literature relating to the project. Your supervisor may provide you with a reading list or key review articles papers directly relevant to the project. However you are expected to do a literature searches using computers linked to the Internet, either in the Library or in certain cases in your supervisor's laboratory.
- Become familiar with the equipment and experimental techniques that you will require for your project. It is essential that you become competent in all the research techniques to be used before you start proper experiments and make sure you understand the basis of the techniques.

C. Project organization. Lab work.

- Plan experiments carefully following discussion with your supervisor. Make sure suitable controls are included and sufficient replicates of the experiments are carried out.
- Use booking sheets for the equipment in high demand.
- Check time scale of experiments and make sure it fits in with your permitted working hours in the laboratory.
- Make note of all the experimental procedure, including calculations for making up solutions etc.
- Never rely on your memory. Write your results into your notebook immediately; preferably a hardbound notebook not on pieces of paper.
- Analyse your results as you get them. Draw graphs, etc. now while the material is fresh in your mind and while you are not under too much pressure.
- Record the results from all experiments, even ones which did not appear to work.
- See all experiments through to the end.
- Show courtesy to other workers in your laboratory. Keep your work area clean and tidy; wash glassware and return reagents to shelves, fridges or freezers immediately after use; respect other people's laboratory property: glassware, stock solutions, media, etc. You will also be expected to take part in maintenance rotas during your time in the lab.

D. Writing up your results.

No matter how carefully you conducted and carried out your experiments and how excellent your results are, your overall mark can be pulled down considerably by a poor write-up. Therefore, it is important to leave sufficient time for writing up the thesis.

Typing. It is preferable to use a word-processing package so that you can easily rearrange sections. You should run a spell-checker. Recommended font is Times New Roman (size 12). The thesis should be double-spaced.

A research thesis should be organised under the following sections:-

Title page.

Brief accurate title with scientific names of any organisms used
Statement that the thesis is submitted in fulfillment of the requirements for the degree.
Your name
Address of the Department
Date

Acknowledgments page.

Optional

Declaration.

Certification of originality.

Table of Contents.

All pages should be numbered and the Table of contents should have a list of all sections and subsections. You should also use a separate numbering system to denote each section and subsection as follows: 1. Introduction; 2. Materials and Methods 3. Results; 4. Discussion and 5. References.
e.g. the first subsection within Materials and Methods would be numbered 2.1, with the appropriate page number in the right hand side.

Abstract.

This should be a maximum of one page and should briefly summarize the aims of the project, how the problem was tackled and the key findings from the research. This should have the basic content of the thesis without extensive experimental details.

Introduction.

This section covers the scientific background to your project and the rationale for the study. The Introduction should supply sufficient background information from your literature survey to allow the reader to understand and evaluate the findings of the study.

Materials and Methods.

A clear and concise description of the techniques you used in the project. This should include sufficient information to allow the experiments to be repeated.

Results.

The data is presented in this section in the form of Figures (graphs, histograms), Tables and drawings or photographs as appropriate, and a suitable text which should summarize the significant experimental observations and briefly explain the findings; reserve extensive interpretation of the results for the Discussion section. Each results sub-section should begin with text giving a brief description of the rationale and design of the experiments (not the methods as these will have already been covered under Materials and Methods) followed by details of the findings, referring to all the Figures and Tables.

Figures must have a legend underneath with the Figure number and title; followed by a short description of the Figure to make the information displayed understandable without frequent reference to the text. Tables must have the Table number and title above the Table with the Legend underneath. (See examples of finished Figure and Table which follow).

Discussion.

The Discussion should provide an explanation and interpretation of your results and the presentation of evidence (from your own project work and from the literature) which justify the explanations proposed. The significance of your findings should be discussed in the context of published work and should not contain extensive repetition of the Results section or reiteration of the Introduction.

References.

The reference section must contain all relevant sources (original articles from scientific journals, review articles and chapters from books). You must always reference original articles for techniques or statements of fact; reference to general textbooks and reviews can only be used when you are summarizing points in the Introduction and Discussion. All listed references must be cited in the text in parentheses after the relevant section of text. You should give the name of the first Author and *et al*. if more than two authors and the one or two name(s) if only one or two authors, followed by the year of publication (e.g. Smith *et al.*, 1995 or Smith & Jones, 1995). In the reference section arrange the citations in alphabetical order by first author and in chronological order if there are more than one article by an identical list of authors. The authors name(s) should be followed by initials (not first names in full), followed by the year of publication, the title of the article, the name of the Journal, the volume and the inclusive page numbers of the articles. You must give the complete title of the article or book chapter, but you can use standard abbreviated titles of journals. Examples below; note the reference to a book or book chapter differs in format from the reference to a periodical.

Mahon, B.P., Katrak, K. and Mills, K.H.G. 1992. Poliovirus-specific murine $CD4^+$ T cell clones recognise serotype specific epitopes on VP1 and VP3 and cross reactive epitopes on VP4. J. Virol. 66, 1479-1481.

Mills, K.H.G. 1996. Induction and detection of T cell responses. In: Vaccine Protocols. Methods in Molecular Biology. (Eds. Robinson, A., Farrar, G.H. and Wiblin, C.N.) Humana Press Inc., NJ, USA. pp. 197-221.

Roughgarden, J. 1979. Theory of Population Genetics and Evolutionary Ecology: An Introduction. Macmillan, New York.

Internet websites can be used as references, however, these are not peer-reviewed and should be avoided/minimised where possible

At the start of your project you should devise a filing system (cards, files of reprints or computer programme) for references which will make it easy for you to collate them in alphabetical order in the final reference section.

Appendix Tables

These are optional and can be used to tabulate raw data which was used to generate the contents of Figures and Tables of analysed data in the results section.

Lab projects vary greatly in the degree of difficulty of the techniques and the ease with which data are obtained. This is taken into consideration by the examiners. So there is no need to be anxious and upset if some of your colleagues are amassing large quantities of data and despite your best efforts, your project appears to be moving very slowly. Keep in contact with your supervisor and if your supervisor is satisfied with your rate of progress, then you shouldn't worry too much

about the progress of your colleagues' research. Most people get great satisfaction from doing project work. It is our hope in the Biology Department that you too will enjoy the intellectual challenge of your project and that it will give you some valuable first hand experience of the procedures used in original research.
Chapter 8 in Wedgewood, M.E. "Tackling Biology Projects", Macmillan (1987) gives some very valuable advice on the writing of a project report.

You must submit two bound hard copies of your written thesis and an electronic copy as an MS Word document on CD. Label the CD with your name, student number and thesis title.

Plagiarism

This notice is an adapted summary of the NUIM policy on academic plagiarism relevant to Biology students. For a fuller explanation please read the University Calendar.

Guidance

Plagiarism is a form of theft. It is the passing off of another person's work as your own. It includes copying without acknowledgement from a published source (print or electronic), or from unpublished sources (e.g. another student's essay or notes). Plagiarism occurs when material is copied word for word, but not only in that circumstance. Plagiarism also occurs when the substance or argument of a text is copied even with some verbal alterations, such as in paraphrase without acknowledgement. Plagiarism includes using material from books or periodicals, from the internet, from grind tutors, or from other students, without full acknowledgement of the sources. When the University confers a degree to a student it signifies that the individual has attained a certain standard of academic skill and performance, thus plagiarism is not only theft of the ideas and work of others, it is also an attack on the standard and reputation of the other Maynooth graduates.

Copying (when a student copies work from a peer, with or without consent) and collusion (when students collaborate to present work as if it were individual and original) are forms of plagiarism. *In instances where two or more purportedly original assignments show clearly derivative similarities that are unacknowledged, they shall both or all be treated as plagiarism unless the contrary can be demonstrated.* Plagiarism in any form of assignment contributing to marks or a grade for a course is a serious offence. It is a form of cheating on several counts: the perpetrator is attempting to obtain credit for work not done, and is also attempting to benefit from work done by somebody else. Plagiarism undercuts the whole thrust of scholarly enquiry that is the essence of your education.

Disciplinary Consequences

Plagiarism is a form of academic dishonesty and will be treated with the utmost seriousness wherever discovered. Your examiners, tutors and markers are required to report instances of suspected plagiarism to the relevant Head of Department concerned. Any student submitting written work for continuous assessment can be asked by the marker or the department to take a further test. This may take the form of an oral examination on the assignment in question and related issues, or the writing of a test paper in controlled conditions. Requiring a student to take such a test does not necessarily imply that plagiarism is suspected. In addition, students should be aware that a percentage of submitted written work will be selected at random for scrutiny using software designed to detect plagiarism.

In instances where an element forming part of an assignment is found to be plagiarised, marks will be deducted for that assignment, there will be no possibility of submitting a "make-up" assignment, and previous and subsequent work submitted in connection with the course may be subject to particular scrutiny. If more extensive plagiarism is detected, zero marks may be awarded for that assignment, furthermore the plagiarism may be reported to the Supervisor of Examinations and the Committee of Discipline. Penalties imposed may involve educative classes, suspension or expulsion from the course.

Plagiarism & the research thesis

Your thesis will inevitably draw on the work of others. The effective use and evaluation of existing material are among the skills that you are expected to develop. In all cases, when you

build on the work of others you must cite the source of the material (an idea or opinion, a quote, data, diagrams etc). It must be acknowledged in a standard form of referencing.

Your research project (literature or laboratory) is a work of scholarship. You are required to submit an identical copy of your written thesis as an MS Word document on CD for the same deadline. This document may be scrutinised for plagiarism using specialised software.

Details of the referencing format are given later on, but here are some practical tips to help you:

- You must present a work of scholarship in your own words and diagrams.
- If you state a fact or rely on data from another source, you must acknowledge that source in the form of a citation in the text. Citations must be listed in a bibliography/reference list.
- If you use a diagram or figure from another persons work, you must cite this in the legend and the bibliography.
- If the exact words used by someone else are important to your argument, then you may use these within quotation marks and must cite the source.
- If you have paraphrased someone else's argument, data or conclusions, then this must be acknowledged by citation.
- Paraphrasing that dominates your work, does not include your own intellectual input or is simply a rewrite of another persons effort is still plagiarism, even if you do use citations. You must provide an intellectual input that adds to the existing material. This point is particularly relevant to students wishing to follow postgraduate study.

In summary, your work will rely on the work of others. You should understand that material and think about it. Use your own words to describe the essential point that is relevant to your thesis, and cite your source in the text as well as the reference/bibliography section. If you are worried about what constitutes plagiarism, contact your project supervisor.

Remember, you must submit an identical copy of your written thesis as an MS Word document on CD. Label the CD with your name, student number and thesis title.

Examination assessment scale

Letter Grade	*Descriptive Heading*	*Representative %*	*Class*
A++	Answer which could not be bettered.	100	I
A+	Exceptional answer displaying unexpected insight.	90	I
A	Undoubtedly first class, flawless answer, demonstrating originality.	80	I
A-	Almost flawless answer demonstrating some originality	70	I
B+	Extremely high competence, perhaps displaying limited originality or technical flaws or minor errors	68	II-1
B	Fundamentally correct and demonstrating overall competence.	65	II-1
B-	Competent performance, substantially correct answer but possibly containing minor flaws or omissions.	60	II-1
C+	Awarded on the basis of the answer being somewhat better than a C but below a B-.	58	II-2
C	Basically correct, answer with minor errors or one major error/omission.	55	II-2
C-	Awarded on the basis of the answer being somewhat below a C but better than a D+.	50	II-2
D+	No more than adequate answer.	48	III
D	Adequate answer with serious errors or omissions.	45	III
D-	Lowest passing grade, barely deserving to pass.	40	P
E+	The answer is inadequate and does not deserve to pass.	38	F
E	The answer fails to address the question properly but displays some knowledge of the material.	35	F
E-	Fails to address the question.	30	F
F+	Little relevant or correct material but some evidence of engagement with question.	20	F
F	Very little relevant or correct material.	10	F
F-	Totally irrelevant answer.	0	F

Laboratory safety

For the protection of yourself and others please read the following notes carefully and obey the instructions implicitly.

FIRE:
You should be aware of the positions of emergency exits.
Specific instructions will be given in the event of evacuation.
Your assembly point is Fire Assembly Point C (see map - inside front cover).

PERSONAL PROTECTION:
Smoking, eating, drinking, chewing gum are prohibited in the laboratory. Storage of food and drink and food is prohibited by law in all laboratories (with the exception of computer laboratories)

You are required to wear a white laboratory coat at all times. Failure to do so will result in exclusion from that laboratory session. Laboratory coats are not available for loan from the Biology Department.

Laboratory coats must be worn fastened at all times.

Gloves are also provided for personal protection. Unfortunately they only protect the wearer and can easily contaminate surfaces. Remove all gloves before leaving the laboratory, even if for a brief period. Remove gloves while using laboratory equipment unless there are specific hazards present. Do not wear gloves when using Bunsen burners unless specifically instructed by the lecturer in charge.

Remove gloves and lab coat before leaving the laboratory. If you need to transfer samples or equipment to another laboratory, remove one glove and used the ungloved hand to open doors etc.

Other protective equipment such as safety glasses will be provided, by the department as required.

Long hair must be tied back.

You must wash your hands immediately at the end of the practical.

PERSONAL INJURY:
Cuts or grazes must be covered with a plaster. Please inform your demonstrator. First aid cabinets are supplied in all teaching laboratories.

Any accident or injury however trivial must be reported to a demonstrator.

If a particular practical has specific hazards or disposal methods, these will be explained to you and will be displayed on the board in the teaching laboratory. You must follow these instructions carefully.

GENERAL SAFETY:
In accordance with university regulations, you will be expelled from the practical session if you do not conduct yourself in an orderly manner.

Students are normally allowed in the teaching laboratory only for timetabled laboratory sessions. You may not use the laboratory at other times unless permission has been obtained in writing from the technician in charge.

Undergraduate students should not enter the preparation laboratory, research laboratories, growth rooms, storerooms etc. without permission.

Proper regard to the correct use of equipment is required from all staff and students. Intentional interference with safety signs and safety features of any equipment is a criminal offence.

Students are expected to leave their bench place, including sink, clean and tidy.

It is particularly important that microscopes are put away correctly:

- slides must be removed
- a check must be made that a low power lens is in the viewing position
- all lenses must be cleaned with lens tissue
- the microscope must be unplugged and the flexes wound neatly, but not tightly.
- the microscope must be covered

You should be aware that chemicals and biological materials are frequently transported around the department, therefore it is very important that you walk slowly and carefully in the corridors.

N.B. The instruction of your demonstrator must be followed at all times. Please check with your demonstrator if you have any doubts or questions in relation to safety.

Absences and medical conditions

A lecturer takes a register in some lectures and all practicals. It is extremely important that you do not miss lectures or practicals except when it is unavoidable because of serious circumstances.

If you do not attend a lecture or practical you must record this. Any illness or other circumstances, which might adversely affect your performance, should be noted. Provision of false information will be viewed very seriously.

If it is necessary for you to consult a doctor or the College nurse you should obtain a medical certificate.

Unavoidable absences will be taken into account when your practical mark is compiled.
It is essential also that you inform one of your course leaders of ongoing difficulties or illnesses which are liable to affect your work during the year.

Factors which might affect your theory examination performance should be reported.
If possible this should be done before you sit the examination.

Information provided later than 3 days after an examination will not normally be taken into account.

Where appropriate you should provide medical certificates.