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Foreword

Welcome to Dublin, to Trinity and to a busy year which we hope will be exciting, challenging and rewarding for all of you. With the help of our colleagues and friends from across the campus and from other institutes, in Ireland and abroad, we have been working hard to put together a comprehensive Immunology programme, which we have designed to stimulate, entertain and inform. We hope that you will all graduate from this course with a deep understanding and love for immunology and immunological research, which will open doors on to exciting new career options. This M.Sc. in Immunology is already internationally renowned and our graduates are undertaking PhDs in the UK, Germany and Russia as well as Ireland, are doing medicine or are employed as science communicators, medical laboratory scientists or in pharmaceutical companies. Upon graduation you will be our ambassadors in leading universities, hospitals and pharmaceutical companies across the globe. Enjoy yourselves, work hard and make great discoveries.

Cliona O'Farrelly, Ph.D.  
Professor of Comparative Immunology,  
Co-Director, M.Sc. Immunology Course

Nigel Stevenson, Ph.D.  
Assistant Professor  
Co-Director, M.Sc. Immunology Course
Module Co-Ordinators and Academic Staff

Cliona O’Farrelly (Co-Director) is Professor of Comparative Immunology in the School of Biochemistry and Immunology and the School of Medicine at TCD. She graduated with a BA Moderatorship in Microbiology from TCD in 1977 and a PhD in Immunology, also from TCD in 1982. Cliona and her Comparative Immunology research group use combinations of in silico, molecular and cellular technologies to discover and examine new genes, proteins and cells of innate and adaptive immune systems from different species and in different organs, particularly the liver and uterus. The influence of these immune components on the hosts’ susceptibility to pathogens, especially Hepatitis C virus, is a major focus. Cliona has extensive experience in graduate training, having graduated 32 Ph.D., 7 M.D. and 5 M.Ch. students and developed this MSc in Immunology, together with her colleagues, Nigel Stevenson and Andrew Lloyd. A recipient of the Irish Research Scientists’ Association Gold Medal, the Graves Medal, the Conway Medal and the Isla Hasliday Award, Cliona was President of the Irish Society of Immunology from 2000-2007 and was awarded the Nature Mentoring Award in 2014. Email: cliona.ofarrelly@TCD.ie

Nigel Stevenson (Co-Director) is Assistant Professor in the School of Biochemistry and Immunology at TCD. In 2000 Dr. Stevenson graduated from Queen's University of Belfast (QUB) with an Honours Degree in Biomedical Science, before joining Randox Laboratory's research and development team in 2001. Under the supervision of Prof. Jim Johnston at QUB, Nigel carried out Ph.D. studies investigating the novel regulation of immune cell migration by intracellular SOCS proteins. After post-doctoral research in the Centre of Infection and Immunity, QUB, in 2007 Dr. Stevenson joined the Liver Research Programme at St. Vincent’s University Hospital, Dublin. In 2008 the Irish Health Research Board awarded Nigel with a Fellowship to investigate the mechanisms by which Hepatitis C Virus blocks innate anti-viral immunity. Dr. Stevenson’s Intracellular Immunology group at TCD investigate the effects of viruses upon innate immune signalling pathways and translate these novel discoveries towards the development of novel therapeutics. Email: N.Stevenson@TCD.ie

Andrew Bowie is currently Head of Immunology in the School of Biochemistry and Immunology, TCD. He obtained his Ph.D. in Biochemistry from TCD in 1997, and was appointed to his current post in 2001. He was elected a Fellow of TCD in 2008. His research interests focus on how viruses are detected by the innate immune system, leading to the activation of transcription factors such as NF-kappaB and IRF3, and to the induction of cytokines and interferons. In particular, he is interested in DNA sensing by the innate immune system. He also has a strong interest in how viruses evade detection, and has published some seminal reviews and opinion articles on this emerging area, as well as speaking at numerous international conferences, workshops and seminars on the topic. Recently, he has published research papers and reviews as senior author in leading international journals including Nature.
Rachel McLoughlin completed her Ph.D. at the Institute of Nephrology at Cardiff University, UK. Following post-doctoral positions at Cardiff University and Brigham and Women’s Hospital, Boston Rachel obtained an Assistant Professor position at Brigham and Women’s Hospital/Harvard Medical School where she began to establish my independent research group. In 2010 Rachel was awarded a Wellcome Trust Career Development Fellowship, which facilitated her move to the School for Biochemistry and Immunology at TCD, where she established the *Host Pathogen Interaction* research group. Since 2011 Dr. McLoughlin has held the position of Usher Lecturer in Immunology. Rachel’s research centres on understanding the interaction of bacteria and the molecules they express, with the host's immune system and is primarily focused on understanding the immune response elicited by the gram-positive bacterium *Staphylococcus aureus*, in the context of infection, and through exposure to this organism as a commensal. Email: mclougrm@tcd.ie

Derek Nolan is a Lecturer in biochemistry and cell biology and head of the confocal facility in the School of Biochemistry and Immunology. Derek is also Director of Postgraduate Teaching and Learning and Director of the Centre for Microscopy and Analysis. Dr. Nolan’s research interests in African trypanosomes began as a postgraduate student in Paul Voorheis’ laboratory at the Dept. Biochemistry, TCD and continued at postdoctoral level when, following the award of a long term fellowship from EMBO. Derek moved to Etienne Pays’ group at the Universite Libre De Bruxelles (ULB) to investigate surface proteins in trypanosomes (1992). Subsequently, through Marie Curie and PIA Belgium fellowship awards he continued to work on the cell biology and biochemistry of trypanosomes at the ULB in Brussels. Following the award of a Wellcome Trust Senior Fellowship in basic biomedical sciences, Derek returned to Trinity to establish an independent research group focused on providing a better understanding of how these parasites survive in their mammalian hosts in order to develop new, improved therapies against African trypanosomes. Email: DENOLAN@tcd.ie

Derek Doherty completed his Ph.D. studies at King’s College, School of Medicine and Dentistry, London and postdoctoral research in the University of Washington, Seattle and University College Dublin before holding lecturing positions at the National University of Ireland, Maynooth and subsequently TCD. Derek is interested in the mechanisms by which cells of the innate immune system control adaptive immune responses and how they can be exploited for the design of improved vaccines and therapies. His group is currently investigating how human natural killer cells, natural killer T cells and γδ T cells influence the functions of dendritic cells, B cells and conventional T cells and how they contribute to immunity against hepatitis B, C and HIV and the pathogenesis of autoimmune disease, obesity and cancer. Email: dohertde@tcd.ie
Eleanor Wallace is Chief Medical Scientist in the Department Immunology in St. Vincent’s University Hospital, and Lecturer in Immunology in the Department of Clinical Immunology in St James's Hospital & Trinity College Dublin. She graduated from Dublin University, Trinity College in 1988 with a B.A. Mod (Biochemistry). In 1994 she was awarded a Ph.D in Immunology (TCD) for her research in C1-Inhibitor proteinase interactions and implications for inflammatory processes. Eleanor has held senior scientist posts in the Departments of Immunology in Beaumont Hospital and St. James's Hospital, Dublin and has significant experience in the clinical laboratory accreditation process. Together with Dr.s Mary Keogan and Paula O’Leary, Eleanor has published the course text book on clinical immunology, *Concise Clinical Immunology for Healthcare Professionals* (2007). Mary Therese Keogan, Eleanor M. Wallace, Paula O’Leary. Routledge, London. Dr. Wallace’s research interests include investigation of the molecular mechanisms causing common variable immunodeficiency (CVID); collection and analysis of data on primary immunodeficiency states for the European Society of Immunodeficiency (ESID) Online Registry project; Lymphocyte changes in HIV+ pregnant women and Mannan Binding Lectin (MBL) deficiency.

Email: E.Wallace3@st-vincents.ie

Joanne Lysaght graduated with a Science degree from N.U.I Maynooth in 2001. She then went on to complete a Ph.D. in 2005, in the Department of Biochemistry and Immunology in TCD under the supervision of Prof. Kingston Mills studying the modulation of innate and adaptive anti-tumour immune responses. Joanne then took up a role as a clinical scientist in the Cancer Molecular Diagnostic Laboratory in St. James’s Hospital, Dublin and post-doctoral positions in the Department of Haematology/Oncology and the Department of Surgery at St. James's Hospital. In 2009, Dr. Lysaght was awarded a HRB Post-Doctoral Fellowship for her work in the area of obesity and tumour immunity. In 2011, she was appointed Ussher Lecturer in Molecular Oncology and Assistant Professor in the School of Medicine in 2015. She is currently the course co-ordinator for the M.Sc. in Translational Oncology. Dr. Lysaght’s research focuses on the impact of obesity on anti-tumour lymphocyte responses in gastrointestinal cancer patients, combination immunotherapy with chemoradiation, T cell trafficking, cellular immunotherapy and inflammatory driven co-morbidities of cancer.

Email: JLYSAGHT@tcd.ie

Kieran Meade is Senior Research Officer in Animal Health at Teagasc, Ireland's Agricultural Research Institute. He did his undergraduate degree in Animal Science and a Ph.D. in Molecular Genetics in UCD. In the International Livestock Research Institute (ILRI), Kenya (2004), Kieran took part in cutting edge bovine trypanosomiasis research. Kieran then took up a post-doctoral research position with the Comparative Immunology Group first based at St. Vincent’s University Hospital, and subsequently to the School of Biochemistry and Immunology, TCD. Kieran’s research programme encompasses functional genomics and immunogenetics toward building a strong national research platform in bovine Immunology. Kieran has a passion...
for basic research in animal bioscience, and is also intent on the translation of this research into applied benefits for Irish agriculture, animal and human health. Email: Kieran.Meade@teagasc.ie

Luke O’Neill was appointed to the Chair of Biochemistry at TCD in 2008, where he also leads the Inflammation Research Group. He was Academic Director of the Trinity Biomedical Sciences Institute from 2011-2014. He has a Ph.D. in Pharmacology from the University of London and carried out Post-Doctoral research at the Strangeways Laboratory in Cambridge. He has won numerous awards for his research, notably the Royal Irish Academy Medal for Biochemistry, The Irish Society for Immunology medal, the Royal Dublin Society/ Irish Times Boyle medal for Scientific Excellence, the Science Foundation Ireland Researcher of the Year Award 2009 and the 2014 EFIS Medal. He was elected a member of EMBO in 2005. He is a co-founder and director of Opsona Therapeutics. In 2008 he was appointed Chair of the Immunity and Infection panel of the European Research Council. His research is in the area of the molecular basis to inflammatory diseases, with a particular interest in pro-inflammatory cytokines and Toll-like receptors. He has published over 200 papers and reviews on his research, in journals such as Nature, Science, Cell, Nature Immunology, Nature Medicine, Nature Genetics and PNAS. He is on the editorial boards of 6 journals, including the Journal of Biological Chemistry and Trends in Immunology. He is also on the Board of Reviewing Editors for Science, covering Innate Immunity. Email: LAONEILL@tcd.ie

Kingston Mills is Professor of Experimental Immunology, School of Biochemistry and Immunology, TCD. He is also Director of the Immunology Research Centre in The Trinity Biomedical Sciences Institute. He is a graduate of Trinity College and trained at as a Postdoctoral Fellow at University College London and the National Institute for Medical Research, Mill Hill, London, before joining the Scientific Staff of the National Institute for Biological Standards and Control in Herts, UK. He returned to Ireland in 1993 to take up an academic position at National University of Ireland, Maynooth. He was appointed to a Personal Chair at TCD in 2001 and was Head of the School of Biochemistry and Immunology form 2008-2011. He heads an active research team of around 20 scientists focusing on immunity to infection, autoimmunity and cancer. He is co-founder of Opsona Therapeutics and TriMod Therapeutics, drug development companies focusing on the development of immunotherapeutics for inflammatory diseases and cancer. Email: mills.k@tcd.ie
Course Objectives

On successful completion of the M.Sc. in Immunology students should be able to:

1. Demonstrate in-depth knowledge of the cellular and molecular basis of innate and adaptive immunity
2. Describe the key cells, organs and molecules of the innate and adaptive immune systems and how they function
3. Describe the biological basis of major immunologically mediated diseases
4. Discuss evolutionary and genetic influences on the immune system
5. Discuss innate and adaptive immunological involvement in viral, bacterial and parasitic infections
6. Discuss the role of the tumour microenvironment and the immune system in the development of cancer and in cancer therapeutics.
7. Demonstrate practical laboratory skills and expertise in selected methodologies used to study the immune system
8. Identify the scientific and clinical challenges pertinent to treatment and management of immunological diseases
9. Discuss the principles of immunotherapy discovery from target identification, to validation and commercialisation
10. Critically appraise research protocols and manuscripts, statistically evaluate data and write research reports
11. Demonstrate knowledge of key techniques used to answer research questions in Immunology
12. Describe how immunological research approaches might direct a research project or research-related career
13. Assess research hypothesis, design experimental studies and conduct quality scientific research in an ethical manner and communicate research findings in an appropriate scholarly manner to specialist and non-specialist audiences
14. Interpret experimental findings and evaluate in relation to study hypothesis and existing research
15. Critically analyse research findings in terms of experimental design and outcomes
16. Analyse and present data
17. Write clear and accurate scientific essays and reports
## Course Structure

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<th>Module Coordinator</th>
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<td>Prof. Cliona O’Farrelly &amp; Dr. Nigel Stevenson</td>
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<td>Michaelmas</td>
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<td>Immunological Technologies</td>
<td>Dr. Rachel McLoughlin</td>
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<td>Michaelmas</td>
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<td>Communicating Science &amp; Critical Analysis</td>
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<td>Microbe Detection &amp; Evasion</td>
<td>Dr. Andrew Bowie &amp; Dr. Nigel Stevenson</td>
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<td>Hilary</td>
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<tr>
<td>Clinical Immunology</td>
<td>Dr. Eleanor Wallace &amp; Dr. Nigel Stevenson</td>
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<td>Parasite Immunology</td>
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<tr>
<td>Immunotherapeutics &amp; Product Development</td>
<td>Dr. Nigel Stevenson</td>
<td>5</td>
<td>Hilary</td>
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<tr>
<td>Research Project</td>
<td>Dr. Nigel Stevenson</td>
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<td>Hilary</td>
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<td><strong>Total</strong></td>
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Modules

Basic Immunology (IM7101)

Term: Michaelmas
Credit weighting: 10 ECTS
Module co-ordinator: Cliona O’Farrelly and Nigel Stevenson

Module Overview:
This module aims to give a general and comprehensive introduction of immunology to students who have had little formal prior exposure to immunology. Basic terms and concepts of innate and adaptive immunity will be presented in a logical and accessible fashion. Students will be familiarised with immunological terms and introduced to the functions of the principle organs, cells, molecules and genes involved in initiating and mediating successful immune responses. By the end of the module, students should be able to explain fundamental immunological concepts and discuss the roles of functional components of the immune system including haematopoietic cells, acute phase proteins, pathogen recognition receptors, complement, TCRs, immunoglobulins and cytokines. They should also understand some basic concepts of immunological dysregulation seen in inflammatory and autoimmune diseases, allergy, malignancy and immunopathogenesis. Lectures will be supplemented with tutorials, where lecture topics will be discussed and each student will help present and explain research articles chosen from scientific review articles thereby further relating the module topics with course material.

Learning Outcomes:
Having completed this module students will be able to:
- Describe fundamental concepts in immunology
- Describe the role of immunological dysfunction in the pathogenesis of certain diseases
- Describe how manipulating the immune system can be used to treat disease
- Analyse recent developments in immunology
- List the application of key immunological techniques in research
- Read, interpret and critically analyse primary immunological literature
- Discuss immunological topics in group situations

Lectures:
1. Introductory Overview  Cliona O’Farrelly
2. Cells and Organs of the Immune System  Cliona O’Farrelly
3. Introduction to Research Projects  Cliona O’Farrelly
4. Introduction to Immunological Techniques  Brian Keogh
5. Inflammation  Louise Glover
6. Cytokines  
Nigel Stevenson

7. Natural Killer Cells  
Clair Gardiner

8. Tissue Resident and Myeloid Cells of the Immune System  
Cliona O’Farrelly

9. CD3+ TCR Structure and Function  
Cliona O’Farrelly

10. ‘Antigen Processing and Presentation’  
Laura Madrigal

11. Cellular and Molecular Components of Adaptive Immunity II:  
Kingston Mills

12. Antibody Structure and Function I  
Jerrard Hayes

13. Antibody Structure and Function II  
Jerrard Hayes

14. Antibody Structure and Function III  
Jerrard Hayes

15. Complement  
Michael Carty

16. Lymphocyte Development  
Cliona O’Farrelly

17. Review of MCQ  
Cliona O’Farrelly

18. Lymphocyte Development II  
Cliona O’Farrelly

19. Immunological Mechanisms in Action  
Derek Doherty

20. Immunometabolism I  
Dave Finlay

21. Immunometabolism II  
Luke O’Neill

22. Vaccines and Immunisation  
Ed Lavelle

23. Auto- Immune Diseases and Immunotherapies  
Jean Fletcher

24. Review  
Cliona O’Farrelly

Tutorials:
6 tutorial sessions will accompany the lectures; relevant reviews will be discussed at each session. The aim of these tutorials will be to use recent reviews to explore the material presented at lectures in more depth and to clear up any misunderstandings or misconceptions. Students will be expected to contribute, ask questions and engage in discussion at each tutorial. These contributions will be assessed.

Tutorial Leaders:
Brian Keogh; bkeogh@opsona.com
Michael Armstrong; michelle.armstrong@tcd.ie
Lydia Dyck; LDYCK@tcd.ie
Kyle Cunningham; CUNINKY@tcd.ie
Roisin Loftus; LOFTUSRO@tcd.ie

Assessment:
3 x MCQs (70%)
Tutorial assignment (30%)

Reading/Learning Resources:


Reviews to be covered in tutorials will be given out at the beginning of the course.
Immunological Technologies (IM7102)

Term: Michaelmas
Credit weighting: 10 ECTS
Module co-ordinator: Rachel McLoughlin

Overview:
This course will introduce the theory and practice of basic technologies used in immunological research. Specifically, students will learn how to dissect and section immunological organs and tissues; they will culture and analyse cells of the immune system; they will become proficient with flow cytometry and microscopy. They will learn how to identify and quantify specific genes by Polymerase Chain Reaction (PCR) and proteins using a range of assays including ELISAs and Western Blotting. At the end of this module, students will be proficient in the techniques required for their research projects, as well as understanding the underpinning science.

Learning Outcomes:
Having completed this module students will be able to:
- Describe key immunological technologies
- Perform each immunological technique described
- Apply technologies to specific research questions

Lectures:
- Animal models in research
  Peter Nolan
- Introduction to antibody technology-western blotting, ELISA
  Annie Curtis
- Introduction to Flow cytometry
  Jean Fletcher & Barry Moran
- Introduction to PCR
  Nigel Stevenson

Practicals:
- Cells and Organs of the Immune System
  Stephen Lalor
- Activation & assessment of cellular inflammatory responses
  Annie Curtis
- ELISA Assay
  Rachel McLoughlin
- Flow Cytometry
  Jean Fletcher & Barry Moran
- PCR
  Nigel Stevenson

Assessment:
- Practical write-ups x 5 (80%)
- MCQ (20%)
**Reading/Learning Resources:**


**Lab coat and spectacles:**

Specific “TCD designed” Howie style lab coats (designed by the College Safety Office to conform to the appropriate NISO standards) and safety spectacles must be worn during all practicals and should be purchased in advance by each student (from Student Union shops on the TCD campus).
Communicating Science and Critical Analysis (IM7103)

Term: Michaelmas and Hilary
Credit weighting: 5 ECTS
Module co-ordinator: Nigel Stevenson

Overview:
Students will attend research seminars organised by the Biochemistry Society during both the Michaelmas and Hilary Terms. During these seminars talks in the areas of Immunology will be presented by specialists in their field. Students are expected to engage actively with the topic of the talk and the speaker. Students will be allocated a speaker and will be asked to:

A. Write a short biographical summary on the scientist and list 3 of their key scientific publications. The summary and list of publications (Title, author list, journal details and abstract) should be emailed to the entire M.Sc. class 48 hours before the seminar.

B. Each student will prepare a written assignment based on their allocated seminar the following week. The assignment consists of two parts:
   1. An article written for a lay audience (e.g. a newspaper article or a blog), 200-300 words.
   2. An academic summary of the research presented during the seminar, 200-300 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).

C. The week after the scientific talk the student will present their written summary and the class will discuss each article.

To help students prepare these pieces, a series of lectures on general issues of importance in science communication will be presented including presenting scientific principles to the layman, ethical issues in scientific research and critical thinking.

Learning outcomes:
Having completed this module students will be able to:
- Critically assess and discuss current research findings in Immunology
- Interpret scholarly activity in Immunology for a non-specialist audience
- Formulate a summary suitable for a specialist academic group

Lectures:
Series of Biochemistry Society Immunology lectures  
Scientific communication and critical analysis  
Science Communication  
Translating science to the layman: Science Gallery Tour  
Communication Techniques  
Plagiarism  
Thesis Writing  

Visiting Lecturers  
Nigel Stevenson  
Joseph Roche  
Science Gallery staff  
Tamara O'Connor  
James Murray  
Kingston Mills

Assessment:
Two articles based on a seminar attended by the student
1. one written for a lay audience (50%)
2. one written for a scientific audience (50%)

Reading/Learning Resources:
The Elements of Style. Strunk and White (1999)
Tumour Immunology (IM7109)

Term: Michaelmas  
Credit weighting: 5 ECTS  
Module co-ordinator: Joanne Lysaght

Module overview  
The aim of this module is to provide a fundamental understanding of important immunological concepts and how they apply to the field of tumour immunology. The module will explore how both the innate and adaptive immune system recognises and eliminates cancerous cells and how immune cells can be hijacked by the tumour to support cancer development. This module will also incorporate lectures on the exciting and rapidly progressing field of cancer immunotherapy. Both new and emerging immunotherapies will be discussed.

Learning Outcomes:  
On successful completion of this module students will be able to:

- Describe how the innate and adaptive immune systems identify and respond to malignant cells.
- Describe how the tumour microenvironment and cancer treatments impact anti-tumour immunity.
- Outline the mechanisms by which the tumour can evade or subvert the immune system in order to support the tumourigenic process.
- Analyse current strategies being employed clinically to combat malignant disease and the associated challenges

Lectures:
1. Tumour immunosurveillance Joanne Lysaght
2. Inflammation and innate immune responses in cancer Fred Sheedy
3. Dendritic cells and cancer Ed Lavelle
4. Tumour associated macrophages and MDSC Fred Sheedy
5. Innate lymphocytes; new players in cancer immunity Derek Doherty
6. Innate lymphocytes (cntd) and B cells and cancer Derek Doherty
7. Effector T cells in anti-tumour immunity Joanne Lysaght
8. Regulatory T cells cancer Jean Fletcher
9. Tumour microenvironment and immunity Melissa Conroy
10. Infection and cancer Derek Doherty
11. Immunometabolism Melissa Conroy
12. Chemotaxis and cancer Melissa Conroy
13. Effects of cancer treatment on immunity Joanne Lysaght
Assessment:
100% module will be a written assignment; The student will write a 2000 word report on a given cancer type and this report will have to cover the following topics: - A short introduction to the cancer type (to include for example incidence rates, survival rates, epidemiology) - What is known about the role of the immune system in that cancer type -What are the current immunotherapies in that cancer type -What are the future immunotherapies in clinical trials for that cancer type. -Can you suggest an immunotherapy for this cancer type that is currently not in clinical trials and why,

The written assignment is due by 5pm on the 3rd December (email to jlysaght@tcd.ie).

Lecture locations (will be communicated by Dr. Lysaght during term):

1. William Fetherson Montgomery Lecture Theatre (WMLT), Ground floor, Trinity Centre at SJH
2. Robert Smith Lecture Theatre (RSLT), Ground floor, Trinity Centre at SJH
3. Durkan Lecture theatre (DLT), Institute of Molecular Medicine at SJH
4. Dorothy Stopfort Price Seminar Room (DSSR), Trinity Centre at SJH

Reading and Learning Resources:
Selected original and review articles
Immunogenetics (IM7105)

Term: Michaelmas
Credit weighting: 5 ECTS
Module Coordinators: Kieran Meade and Nigel Stevenson

Overview:

Immunological responses are controlled by the genes that code for contributing proteins and other molecules. Many immune genes are highly conserved and thus most human immune genes have homologues in other mammalian species. However, there are important differences in the numbers and sequences of some of these genes, which account for differences in immune responses both between species and individuals. Similarly, variation in the copy numbers of immune genes or in their sequences can have major impact on their function in immunity (DNA, RNA and protein levels), thus accounting for the significant inter-individual variation seen in all immune responses.

The aim of this module will be to provide sufficient background in basic genetics, genomics and epigenetics in order to better understand immunogenetics in different species. Species-specific immune responses will also be explored and genetic variation that predisposes individuals to disease will be discussed. An important aim of this module is to familiarise students with key immunological studies in diverse species. Finally, the threat of zoonotic infections to human health will be introduced. With the sequencing of genomes becoming quicker and cheaper, it is now possible to explore the immunomes of many species by bioinformatic analyses and to identify the genes linked to disease susceptibility using advanced technologies such as Genome-Wide Association Studies (GWAS). This module will introduce students to high-throughput and systems biology approaches used to investigate the immune response at a systems level.

Learning Outcomes:

Having completed this module students will be able to:

- Describe the structure of the genome – genes, promoter regions, non-coding regions, copy number variation, alternative splicing and miRNA.
- Understand the multiple levels of control of the immune response - local and systemic, including epigenetics.
- Appreciate the tools and technologies (and their limitations) available to scientists to uncover genetic associations with complex traits, such as immunity and inflammation
- Describe genome-wide association studies
- Understand the effects of specific genes and polymorphisms on the outcome of the immune response.
• Understand the main differences in the immune response between man, model and non-model organisms
• Critically evaluate and analyse species-specific information from immunological studies
• Describe the basic concepts of systems biology

Lectures/workshops:
2. Comparative Immunology and epigenetics Kieran Meade
3. Zoonoses and human health Kieran Meade
4. Bioinformatics and systems biology Kieran Meade

Round table discussion
Discussion of the consequences of the failure to appreciate species-specific differences in human drug design; CASE STUDY: The calm after the cytokine storm: lessons from the TGN1412 trial.

One Health team presentation:
At the beginning of the module, students are split into three teams to work on a major bacterial/viral/protozoan zoonotic disease of their choice. Appropriate terms of reference are discussed – and centre around comparative immunology between host and pathogen, challenges to eradication, recent developments in treatment, prospects for future treatment. Students will agree on a relevant review beforehand and that will focus their group research activity. During the last two lectures in the module, each group will present their findings to the class. Questions are also tabled by other group members.

Assessment:
Examination (80%)
Presentation (20%)

Reading/Learning Resources
Immunology of Infection, 3rd Edition. Kaufmann & Kabelit; 2010
Primer to the Immune Response. Tak Mak 2011.
Lewin's Genes X. Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick
Microbe Detection and Evasion (IM7106)

Term: Hilary
Credit weighting: 5 ECTS
Module co-ordinators: Andrew Bowie and Nigel Stevenson

Overview:
This module will be a research-led course covering pathogen detection by the innate immune system leading to effective pro-inflammatory and anti-pathogenic signalling responses. The module will explore mechanisms of pathogenic immune evasion and subversion and will also focus on the role of the immune response in health and disease. The past decade has seen huge progress in the discovery and characterisation of pattern recognition receptors (PRRs) such as Toll-like receptors, RNA helicases, DNA sensors and NOD-like receptors, which are now known to be responsible for the sensing of pathogens. This module will describe the pathogen detection and recognition receptor function, and include lectures and workshops by experts in this field, who have made significant contributions to our current understanding of innate immunity.

Learning outcomes:
Having completed this module students will be able to:
- Explain viral and bacterial infection at a molecular and pathogenic level
- Describe the concept and examples of pathogenic detection
- Describe proinflammatory and anti-pathogenic responses at a molecular and cellular level
- Describe key immune evasion strategies of viruses and bacteria

Lecture/workshop sessions:
1. Overview of pathogen detection Nigel Stevenson
2. PRRs for viruses: TLRs and cytosolic detection pathways Andrew Bowie
3. Role of inflammasomes in innate detection of pathogens and PRRs for bacteria: TLRs and NOD-like receptors Luke O’Neill
4. Anti-viral interferon response Nigel Stevenson
5. Viral Immune evasion of innate immunity I Andrew Bowie
6. Viral Immune evasion of innate immunity II Andrew Bowie
7. Bacterial Immune evasion Rachel McLoughlin

Assessment:
MCQ (25%)
3000-word literature review (75%)
Reading/Learning Resources:

**Cellular & Molecular Immunology.** Abbas, Lichtman, Pillai 8th Edition (2014)

Clinical Immunology (IM7107)

Term: Hilary
Credit weighting: 5 ECTS
Module co-ordinators: Eleanor Wallace and Nigel Stevenson

Overview:
The Departments of Clinical Immunology at St. James’s Hospital and St.Vincent’s University Hospital are involved in the investigation and treatment of patients with a range of different immunological disorders including allergy, autoimmunity, immunodeficiency and malignancy. They have particular experience and expertise in diagnosis and management of patients with immunodeficiency, vasculitis and autoimmune diseases. The Department of Clinical Immunology at St. Vincent’s University Hospital has a key role in providing diagnostic services for the leading National Referral Centre for Rheumatology and musculoskeletal disease. In addition, the Department supports the National Liver Transplant Programme providing services for the diagnosis of liver disease and a regional service for monitoring patients post-liver transplant. An overview of clinical immunology will be presented. The immunotechniques used in these laboratories to investigate common immunological clinical problems will also be presented and explored. Students will be given real life case histories to discuss; the class will decide on tests should be done; results will be presented and analysed; treatments and alternative strategies will be discussed.

Learning outcomes:
On successful completion of this module students should be able to:

- Outline the range of medical clues that lead to the possible diagnosis of immunodeficiency
- Discuss the molecular processes and genetic influences that can result in primary immunodeficiency disorders
- Explain the nature of inflammatory events leading to many diseases
- Describe mechanisms of autoimmunity and various common autoimmune disorders
- Explain the mechanisms of hypersensitivity reactions
- Describe the clinical manifestations of atopy and allergic inflammation
- Describe the investigation, diagnosis and management of conditions within paediatric allergy and immunology.
- Describe liver immunology, pathology & transplantation
- Discuss the rationale for a range of immunotherapies
- Describe the range of tests that help specifically diagnose immunological disorders including immunodeficiency, autoimmunity, allergy and transplant
Lectures/workshops:
1. Immunodeficiency
   Eleanor Wallace
2. Immunodeficiency: Case Studies
   Con Feighery
   Jacinta Kelly
3. Autoimmunity
   Eleanor Wallace
4. Autoimmunity: Case Studies
   Con Feighery
   Jacinta Kelly
5. New approaches to diagnosis and treatment of autoimmune disease: Case studies I
   Jean Fletcher
6. New approaches to diagnosis and treatment of autoimmune disease: Case studies II
   Jean Fletcher
7. Liver Immunology, Pathology & Transplantation
   TBC
8. Liver Immunology, Pathology & Transplantation: Case Studies
   TBC
9. Allergy
   Eleanor Wallace
   Niall Conlon
   Eleanor Molloy
   Lynn Kelly
10. Allergy: Case studies
11. Paediatric Immunology

Assessment:
Written examination (100%)

Reading/Learning Resources:
Parasite Immunology (IM7108)

Term: Hilary
Credit weighting: 5 ECTS
Module co-ordinator: Derek Nolan

Overview:
The parasitic mode of life is a major biological success story, evidenced by the fact that there is no major taxonomic grouping that does not have parasitism associated with it. This module will introduce parasite immunology and consider why parasites so successfully infect humans and evade immune mechanisms. Using selected parasites of major human and veterinary health importance as exemplar, the focus of this module will be on the strategies employed by parasites to allow them to overcome or otherwise ameliorate their host’s immune defenses. Interactions between parasites and host that potentiate the parasite’s prime objective of life cycle completion will also be considered. Research programmes dedicated to the discovery and analysis of parasite derived immunomodulatory molecules will also be explored.

Learning outcomes:
On successful completion of this module students will be able to:
- Describe basic mechanisms of parasite induced immunopathology and immunity against parasite infection
- Explore the pros and cons of using animal models for studying parasite infection
- Discuss approaches to control of parasite infection including vaccination options
- Identify the challenges in researching parasite immunology
- Define the strategies that African Trypanosomes employ to evade the mammalian humoral immune response and also how they overcome human innate defences
- Describe the basic features of malaria and discuss the contributions of different immune mechanisms to (i) immunity to and (ii) immunopathology of this infection
- Describe the life cycle, epidemiology and impact of Ascaris in Humans and delineate the immunological response to Ascaris
- Describe how Schistosomes alter the host immune response

3 Introductory Lectures
1. Innate mechanisms underpinning basic parasite immunology
2. Adaptive mechanisms underpinning basic parasite immunology
3. Vaccination against parasitic disease
Workshops:

1. Strategies used by African Trypanosomes to evade the mammalian humoral immune response and also how they overcome human innate defences  
   Derek Nolan

2. Life cycle, epidemiology and impact of Ascaris in Humans and delineate the immunological response to Ascaris  
   Celia Holland

3. Basic mechanisms of parasite induced immunopathology and how they might be manipulated using Schistosomes as a model  
   Padraic Fallon

4. Malaria and the immune response  
   Marian Brennan

Assessment:

Written examination (100%)

Reading/Learning Resources:

Up to date reading lists of primary research papers and reviews in the field of parasite immunology, of human innate and adaptive immunity to parasite infection and vaccination against parasite infection.
Global Infectious Diseases (IM7110)

Term: Hilary
Credit weighting: 5 ECTS
Module co-ordinator: Derek Doherty

Overview:
This module aims to give an in-depth overview of the interactions that take place between viruses and bacteria and the host, focusing on the most important global infectious diseases in humans. Students will be familiarised with the mechanisms by which the immune system senses, contains and eliminates harmful bacteria and viruses while tolerating harmless commensal organisms. The mechanisms by which infecting organisms subvert host immune responses, leading to pathology, will be examined in detail. Students will also learn about how infectious diseases spread, leading to epidemics and progress towards immunisation, treatment and eradication of infectious diseases. By the end of the module, students should have an understanding of the biology, pathology and current challenges that we face in the fight against global infectious diseases such tuberculosis, HIV/AIDS, hepatitis, influenza and respiratory infections, Salmonella and diarrhoeal disease.

Learning outcomes:
On successful completion of this module students will be able to:
- Describe how the immune system deals with infectious viruses and bacteria
- Describe the biology of the most important global infectious diseases in humans and the interactions between the causative pathogens and the host immune system
- Analyse current strategies being employed to combat global infectious disease and the associated challenges
- Read, interpret and critically analyse primary literature on the immunology of global infectious disease

Lectures/workshops:
1. Overview of global infectious disease challenges, vaccine-preventable diseases and progress in eliminating infectious pathogens.
   Derek Doherty
2. Mechanisms of antiviral and antibacterial immunity, including mucosal immunity and evasion and subversion of the immune system by pathogens.
   Derek Doherty
3. Commensal bacteria and Staphylococcal infections.
   Rachel McLoughlin
   Catherine Comiskey
5. Biology and immunology of tuberculosis.
   Joe Keane
6. Human immunodeficiency virus and AIDS
   Derek Doherty

7. Hepatitis viruses
   Derek Doherty

   Nigel Stevenson

8. Oral presentations of literature assignments
   Derek Doherty

9. Oral presentations of literature assignments
   Derek Doherty

10. The pathogenesis of diarrheal disease in developing nations
    Derek Doherty

**Assessment:**
Examination (70%)
Presentation (30%)

**Reading/Learning Resources:**

**Cellular & Molecular Immunology.** Abbas, Lichtman, Pillai 8th Edition (2014)


**Cellular & Molecular Immunology.** Abbas, Lichtman, Pillai 8th Edition (2014)

Selected Review articles
Immunotherapeutics and Product Development (IM7111)

Term: Hilary  
Credit weighting: 5 ECTS  
Module co-ordinator: Nigel Stevenson

Overview:
Research in the field of immunology has led to the generation of effective vaccines against a number of infectious diseases and also anti-inflammatory biologics that are routinely used for the treatment of autoimmune disorders such as rheumatoid arthritis, inflammatory bowel disease and multiple sclerosis. This module will give a detailed overview of drugs targeting both innate and adaptive immune responses and will describe in detail the drug development process from bench to bedside with particular focus being placed on vaccine adjuvants, cancer immunotherapeutics and treatments for autoimmune disease. In addition, the module will offer workshops detailing the intellectual property/technology transfer process as well as matters relating to regulatory affairs and clinical trial design.

Learning outcomes:
On successful completion of this module students will be able to:

- Describe how agents that target innate/adaptive immune pathways can modulate immune responses and provide therapy for immunological disorders.
- In addition students will have a clear understanding of the drug development process from bench to bedside.

Workshops:
1. Pre-clinical Development workshop: Road to a successful product  
   - Brian Keogh and Peter Nowlan
2. Intellectual property/Technology transfer workshop  
   - Emily Vereker
3. Clinical Trial design workshop  
   - Peter McGuirk
4. Regulatory Affairs workshop  
   - David Murray
5. Pharmaceutical Marketing  
   - TBC
6. Finance of Product Development  
   - Kingston Mills
7. Case Study – Trimod  
   - Jeremy Skillington

Lectures:
1. Introduction  
   - Nigel Stevenson
2. Infectious disease vaccines and adjuvants - innate immune activators  
   - Ed Lavelle
3. Immunotherapeutics for cancer – TLR agonist and Treg cell inhibitors  
   - Kingston Mills
4. Immunotherapeutics for autoimmunity – Inhibitors of pro-inflammatory cytokines
   Kingston Mills

5. Therapeutic strategies that modulate the immune system
   James Murray

Assessment:

*Group assignment*: Groups of students will be asked to identify/predict a new immunological therapeutic target, invent a ‘virtual’ therapeutic, carry out patent searches on existing products to ensure novelty and pitch their product to experts in product development, asking for realistic financial investment. The groups should pitch their therapeutic at the stage between pre-clinical and clinical development. Students will be assessed on their background knowledge from a scientific and intellectual property point of view, as well as their overall ability to market the product to potential investors (70%). A written summary of each project (with each student’s contribution/section clearly outlined) must also be submitted 48 hours prior to the group presentation (30%).

**Immunotherapeutics & Product Development (IM7111) Judging marks sheet for presentations**

<table>
<thead>
<tr>
<th>Marking Topics</th>
<th>Comments</th>
<th>Mark out of 10</th>
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<tbody>
<tr>
<td>Presentation skills, Quality of slides &amp; overall innovation</td>
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<tr>
<td>Target identification (novelty, patent checks, product/solution value (national &amp; global)</td>
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<tr>
<td>Pre-clinical development (appropriate in vitro assays, animal trials etc)</td>
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<tr>
<td>Clinical Development (Clinical trials, subject selection, blinding etc)</td>
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<tr>
<td>Product Patenting &amp; Licencing</td>
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<tr>
<td><strong>Product marketing</strong></td>
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<tr>
<td><strong>Understanding of development costs, financial returns and financial impact of this solution</strong></td>
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<td></td>
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<tr>
<td><strong>Ability to answer questions</strong></td>
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<tr>
<td><strong>Total (out of 80)</strong></td>
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**Reading/Learning Resources:**
Reviews and research papers as directed in lectures
Research Project (IM7112)

Term: Hilary
Credit weighting: 30 ECTS
Module co-ordinators: Nigel Stevenson & Cliona O’Farrelly

Overview:
This module is a key element of the course where the theoretical and technical aspects of immunology which have been presented, analysed and discussed in other modules are brought into practical and innovative focus on specific research questions. Each student will be expected to engage in a piece of original research to reveal novel aspects of immune activity or function. Emphasis will be placed on generating publishable and/or patentable data. A list of project titles will be made available in December. Students will rank their choices 1-5. Should more than one student choose any single project allocation, MCQ results from IM7101 will be used to provide guidance. Students will then meet with their project supervisor who will discuss the project and help plan a 3000 word literature review on a title based around the topic of their project. After the research project, students will submit a 10,000 word dissertation based on the results obtained during their research project. All students will also be required to present the findings of their research project at the M.Sc. in Immunology poster session.

Learning outcomes:
On successful completion of this module students should be able to:

- Identify an area of research interest and formulate a project proposal: outlining the hypothesis behind the project, identifying the specific aims and objectives and designing a work plan that will ensure the project is achieved in a suitable time frame.
- Prepare a comprehensive literature review, evaluating previous studies carried out in the specific research area.
- Identify suitable research methods to carry out the experimental plan.
- Formulate a coherent hypothesis that draws on engagement with, and critical appraisal of, existing knowledge relevant to their research project.
- Carry out experimental work that addresses the hypothesis.
- Assemble and analyse the data collected in an efficient and logical manner, using appropriate statistical software (e.g. Excel, Prism, SPSS).
- Evaluate potential solutions for experiments that are not working or where unexpected results are obtained.
- Interpret the research findings and draw appropriate conclusions based on research outcomes and how this relates to the peer-reviewed literature.
- Write a substantial research dissertation in a clear and concise manner with respect to both data illustration and text in accordance with scientific conventions.
Module supervision:
The 12 week laboratory-based research project will be carried out in relevant laboratories under the supervision of principal investigators within the School of Biochemistry and Immunology, within other TCD schools or external to TCD.

The literature review will be submitted in January (2 hard copies to be submitted to the School Office. The literature review must also be submitted online via Turnitin and a Turnitin report attached to the front of the hard copies.

The 12 week research project will start in March and finish in June.

The final thesis will be submitted 2 weeks after the end of the project and the following week students will present the findings of their research project during a poster session.

(Exact dates will be communicated in the Hilary term)

NB: Literature review and Thesis must be printed double-sided.

Module assessment:
IM7112 will make up 33% of the overall marks of the entire M.Sc. broken down as follows:
Literature review: 10%
Final 10,000 word thesis based on a laboratory research project: 85%
Poster presentation: 5%
Extra Information

Examinations
Details of timing and examinations are indicated. If these dates change, the class will be informed by email in advance.

Assessment Summary
The nature of the assessments will vary from one module to another. Individual teaching staff will give more details of assessment procedures at the beginning of each module.

Basic Immunology (IM7101) 10 ECTS:
3 x MCQs (70%)
Tutorial assignment (30%)

Immunological Technologies (IM7102) 10 ECTS:
Practical write-ups x 5 (80%)
MCQ (20%)

Communicating Science and Critical Analysis (IM7103) 5 ECTS:
Two articles based on a seminar attended by the student,
1. one written for a lay audience (50%)
2. one written for a scientific audience (50%)

Tumour Immunology (IM7109) 5 ECTS:
Written assignment (100%)

Immunogenetics (IM7105) 5 ECTS:
Written examination (80%)
Presentation (20%)

Microbe Detection and Evasion (IM7106) 5 ECTS:
MCQ (25%)
3000-word literature review (75%)

Clinical Immunology (IM7107) 5 ECTS:
Written examination (100%)

Parasite Immunology (IM7108) 5 ECTS:
Written examination (100%)
**Global Infectious Diseases (IM7110) 5 ECTS:**
Written Examination (70%)
Presentation (30%)

**Immunotherapeutics and Product Development (IM7111) 5 ECTS:**
Group assignment and presentation (70%)
Written summary (30%)

**Research Project (IM7112) 30 ECTS:**
Literature review (10%)
Final 10,000 word thesis based on a laboratory research project (85%)
Poster presentation (5%)

**Submission deadlines**
For each item of coursework there will be a submission deadline. Students are expected to meet ALL deadlines.

**Deadline penalties**
- A 1% mark penalty per day past the deadline will be applied
- Extensions will only be granted in exceptional circumstances
- Cases for special circumstances must be made to the course co-ordinator and director.

**Attendance**
Attendance will be monitored in all components of the M.Sc. course. Full attendance at all classes is considered a measure of professional behaviour expected of all students. All activities are considered to be core and lack of attendance may affect student progression. All absences must be reported to both the course directors in advance of the class.

**Word Limitations**
All course assessments must comply with the stated word limit (+/- 10%).

**Scheme for marking of projects**
The 10,000 word thesis (85%) mark is comprised of the supervisor's mark and co-ordinator/director marks for the project thesis. The supervisor’s mark will be based on the student's performance within the laboratory (technical ability, understanding of the project and literature pertaining to it, critical evaluation of results, demonstration of initiative and independent thought) and on the content of the thesis. The supervisor will also make the other
examiner of the project dissertation aware of any unforeseen difficulties that arose during the course of the project.

<table>
<thead>
<tr>
<th>Class</th>
<th>Mark Range</th>
<th>Criteria</th>
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<tbody>
<tr>
<td>I</td>
<td>85-100</td>
<td>Exceptional project report showing broad understanding of the project area and excellent knowledge of the relevant literature. Exemplary presentation and analysis of results, logical organisation and ability to critically evaluate and discuss results coupled with insight and originality.</td>
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<tr>
<td></td>
<td>70-84</td>
<td>A very good project report showing evidence of wide reading, with clear presentation and thorough analysis of results and an ability to critically evaluate and discuss research findings. Clear indication of some insight and originality. A very competent and well presented report overall but falling short of excellence in each and every aspect.</td>
</tr>
<tr>
<td>II-1</td>
<td>60-69</td>
<td>A good project report which shows a reasonably good understanding of the problem and some knowledge of the relevant literature. Mostly sound presentation and analysis of results but with occasional lapses. Some relevant interpretation and critical evaluation of results, though somewhat limited in scope. General standard of presentation and organisation adequate to good.</td>
</tr>
<tr>
<td>II-2</td>
<td>50-59</td>
<td>A moderately good project report which shows some understanding of the problem but limited knowledge and appreciation of the relevant literature. Presentation, analysis and interpretation of the results at a basic level and showing little or no originality or critical evaluation. Insufficient attention to organization and presentation of the report.</td>
</tr>
<tr>
<td>III</td>
<td>40-49</td>
<td>A weak project report showing only limited understanding of the problem and superficial knowledge of the relevant literature. Results presented in a confused or inappropriate manner and incomplete or erroneous analysis. Discussion and interpretation of result severely limited, including some basic misapprehensions, and lacking any originality or critical evaluation. General standard of presentation poor.</td>
</tr>
<tr>
<td>Fail</td>
<td>20-39</td>
<td>An unsatisfactory project containing substantial errors and omissions. Very limited understanding, or in some cases misunderstanding of the problem and very restricted and superficial appreciation of the relevant literature. Very poor, confused and, in some cases, incomplete presentation of the results and limited analysis of the results including some serious errors. Severely limited discussion and interpretation of the results revealing little or no ability to relate experimental results to the existing literature. Very poor overall standard of presentation.</td>
</tr>
</tbody>
</table>
A very poor project report containing every conceivable error and fault. Showing virtually no real understanding or appreciation of the problem and of the literature pertaining to it. Chaotic presentation of results, and in some cases incompletely presented and virtually non-existent or inappropriate or plainly wrong analysis. Discussion and interpretation seriously confused or wholly erroneous revealing basic misapprehensions.

### Plagiarism

To ensure that you have a clear understanding of what plagiarism is, how Trinity deals with cases of plagiarism, and how to avoid it, you will find a repository of information at [http://tcd-ie.libguides.com/plagiarism](http://tcd-ie.libguides.com/plagiarism).

We ask you to take the following steps:

(i) Visit the online resources to inform yourself about how Trinity deals with plagiarism and how you can avoid it at [http://tcd-ie.libguides.com/plagiarism](http://tcd-ie.libguides.com/plagiarism). You should also familiarize yourself with the Calendar entry on plagiarism located on this website and the sanctions which are applied;


(iii) Familiarise yourself with the declaration that you will be asked to sign when submitting course work at [http://tcd-ie.libguides.com/plagiarism/declaration](http://tcd-ie.libguides.com/plagiarism/declaration);

(iv) Contact your College Tutor, your Course Director, or your Lecturer if you are unsure about any aspect of plagiarism.

### Submitting the IM7106 Essay, IM7112 Literature Review & IM7112 Thesis

As well as submitting hard copies to the school office, the IM7106 essay and IM7112 literature review and thesis must be submitted to plagiarism detecting software. You will do this via Blackboard. The software is SafeAssign and your work is automatically routed through SafeAssign when you submit. Your document must be saved in one of the following formats: doc, .docx, odt, .txt, .rtf, .pdf or .html. Go to the Module Code (IM7106 or IM7112) in Blackboard. You will see the Submission Link (left hand menu). Follow the instructions within that link. You are allowed a single “trial run” submission and will receive a plagiarism report. An overall identity score of less than 30% is acceptable, as this will take into account references and commonly used terms picked up by the software.
If your score is in excess of 30% you should consider rewording the highlighted passages and resubmitting. If you have any queries contact Glynis Robinson (robinso@tcd.ie). All submissions must be printed double-sided.

**Examination rules**

**General**

- The onus lies on each student to establish the dates, times and venues of their own examinations. No timetable or reminder will be sent to individual students by any office.
- You are expected to familiarise yourself with the location of every examination venue to which you have been assigned.
- Mobile phones, or other electronic or communication devices, are not permitted in examination venues - if a phone rings or an alarm on a phone is heard, or it is discovered in any other way in the venue it will be confiscated.
- Students must follow the instructions given by the invigilators in a co-operative and respectful manner.

**Before entering an examination venue**

- Leave your personal belongings, including bags, coats, hats, etc at the designated place within your examination venue as directed by the invigilator.
- You will not be admitted to the examination after the first half-hour, and will not be allowed to leave during the last half-hour. If you arrive after the first half-hour, contact the module coordinator and course coordinator as a matter of urgency.

**While in an examination venue**

- Once you have entered a venue, complete SILENCE must be maintained at all times.
- Each student must be in possession of their student ID card for each examination session. You should place your student ID card on the right-hand side of your desk for the duration of each examination.
- A ‘Clean Desk’ policy applies for all examinations. In addition to pens, pencils, rulers, student ID card, etc. only materials permitted for an examination may be placed on the desk. Invigilators will be instructed to request students to remove any non-permitted items from their desk. Pencil cases and calculator covers are not permitted. Students are advised that random pocket searches may be conducted during an examination session. Upon request, students should remove all items from their pockets for scrutiny by an invigilator. Failure to empty pockets when requested is considered a disciplinary offence and will be referred to the Junior Dean.

**During an examination**
You should check the title of the paper on your desk to ensure that it is the correct examination paper for your course, and read carefully all the instructions given.

You are not allowed to start your examination until instructed to do so by the invigilators. Please use any spare time at the start to fill in your answerbook cover(s), remembering to complete the section at the bottom right-hand corner as requested before sealing the flap on every anonymous booklet used. Write legibly in ink – pencils are only allowed for MCQ forms.

You will be advised of the time thirty minutes and ten minutes before the end of the examination.

If you wish to leave the examination venue at any stage during the examination you must be escorted by an Invigilator. If necessary you will be accompanied to a bathroom by an Invigilator.

If you wish to leave before the end of the examination you must hand your booklet(s) to an Invigilator and ensure you hand up everything you wish to have marked.

If you are taken ill just before an examination and are unable to sit it, immediately contact your module coordinator and course coordinator. If you feel unwell during your examination, please inform an Invigilator - you will be asked if you wish to go to the College Health Centre and will be accompanied by an Invigilator.

Smoking breaks are not allowed during examination sessions.

Dictionaries and Programmable calculators are not permitted at examinations.

**On completion of an examination session**

You will be advised that:

- you must immediately stop writing and hand up your booklets when instructed to do so by an Invigilator;
- you should ensure that all of your answerbooks are labelled correctly with your examination number (where appropriate) and all other required information;
- it is your responsibility to hand in everything you wish to have marked by ensuring all materials are fastened securely with a treasury tag;
- you must remain in your seat until all scripts have been collected;
- you must not remove from the examination venue answer books, rough work, or other materials supplied.
- While every effort will be made to give due notice of major changes, the College reserves the right to amend the examination timetable.

College regulations and further information can be found on the TCD website and at the following web addresses:

[https://www.tcd.ie/academicregistry/exams/](https://www.tcd.ie/academicregistry/exams/)
[https://www.tcd.ie/academicregistry/exams/assets/local/guideexam.pdf](https://www.tcd.ie/academicregistry/exams/assets/local/guideexam.pdf)
Any further information or queries can be made to the course director, coordinator or graduate studies (contact details on page 3).

**Student conduct for examinations**

Students are forbidden during an examination to do or to attempt to do, any of the following: to have in their possession or consult or use any books, papers, notes, memoranda, mobile phones or written or electronic material of any nature, or to copy from or exchange information with other persons, or in any way to make use of any information improperly obtained.

Where the examination is of such a nature that materials are provided to the candidates, or where the candidates are allowed by the rules of that examination to have materials in their possession, then candidates may of course make use of such materials, but only of such materials, and the general prohibition above continues to apply in respect of any and all other materials.

Where candidates have the prior written permission of the examiner(s), of the Senior Lecturer, or of the Disability Officer, to have materials in their possession during an examination, then candidates may of course make use of such materials, but only of such materials, and the general prohibition above continues to apply in respect of any and all other materials.

Where candidates are allowed to bring personal belongings into the examination venues upon condition that such belongings are stored in an area – such as the back of the venue – away from the area in which the candidates are sitting their examinations, then candidates may bring personal belongings into the hall, provided that they are placed in the indicated area and are not returned to by the candidates until they have finished their examinations and are leaving the hall.

**Any breach of this regulation is regarded as a major offence for which a student may be expelled from the University.**

Students must not leave the hall before the time specified for the examination has elapsed, except by leave of the invigilator.

Examinations or other exercises which are part of continuous assessment are subject to the same rules as other College examinations. Where submitted work is part of a procedure of assessment, plagiarism is similarly regarded as a major offence and is liable to similar penalties.

**Pass/Fail**

a) Each module must be passed at a minimum of 50%. The final module mark will be calculated using the weighted assessment components. Students must pass 10 of the 11 modules (but must pass module IM7112) in order to be awarded a M.Sc. in Immunology.

b) Failure of modules
(i) In cases where students fail to achieve a minimum of 50% in a module, a repeat of a written exam or written assignment will be permitted during the appropriate repeat periods. Only one repeat will be allowed. Please note: due to the nature of IM7102, practicals cannot be repeated.

c) Failure of a module.
(i) Students must pass term 1 modules before they can progress to term 2.
(ii) Term 2 modules will be assessed at their end. Any students failing any of the term 2 modules (apart from module IM7112) will be able to repeat.
(iii) Failure of more than one module, on the second attempt, indicates failure of the whole course, requiring exit from the course.

d) Compensation.
Students who fail a module (apart from module IM7112), but obtain 45% or more in that module, may compensate from marks awarded for the other modules, as appropriate, up to a total of 5%.

e) IM7112:
To begin the research project, students must have completed and passed 9 out of 10 previous modules. Module IM7112 must be passed in order for the student to be considered for an award of Masters degree. Compensation is not possible for module IM7112; neither can module IM7112 be used to compensate for any of the taught modules. Module IM7112 will make up 33% of the overall marks in the final evaluation of the awarding of the M.Sc. degree. Students must achieve 50% in module IM7112 to fulfil criteria for the award of the M.Sc. course.

f) Progression
i) All students register on the Masters programme.
ii) Students who have successfully passed the ten taught modules of the course and accumulated 60 ECTS, but who do not wish to proceed to the module IM7112 stage, or if they have submitted, but then failed the IM7112, will be considered for a Postgraduate Diploma in Immunology (exit award).
(iii) Students who have successfully passed all the taught modules and module IM7112 and accumulated 90 ECTS will be considered for a Masters degree. Students must achieve at least 50% in IM7112 and in 9 of the 10 taught modules (IM7101-7111) to fulfil criteria for the award of the M.Sc.
iv) The award of a Masters with Distinction shall require the achievement of at least 70% for module IM7112 and an average of at least 70% (which is weighted on the ECTS credits for each module) in all taught modules (IM7101-IM7111). A distinction cannot be awarded if a candidate has failed any module during the period of study.

Course Feedback
A Feedback Form will be given out at the end of each module. These anonymous forms are a mechanism whereby students can make comments and suggestions that will help us to maintain and indeed improve the quality of the teaching offered.

Please note that aspects of this handbook and timetable are subject to change during the year.
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Opening Hours
During term: 9.30am - 5.00pm, Monday - Friday
Out of Term: 9.30am - 12.30pm & 2.15 - 5.00pm, Monday - Friday