



**UNIVERSITY OF
CAMBRIDGE**

Institute of Continuing Education

Undergraduate Certificate in Immunology

2022-2023

Course code: 2223CCR212

COURSE GUIDE

Welcome to the **Undergraduate Certificate in Immunology**, a University of Cambridge award offered by the Institute of Continuing Education (ICE). The Certificate is taught and awarded at FHEQ level 4 (i.e. first-year undergraduate level) and attracts 60 credits. The award is completed in one academic year. For further information about academic credit please see our website: <http://www.ice.cam.ac.uk/studying-with-us/information-for-students/qualifications-that-we-offer>.

The **Undergraduate Certificate in Immunology** is taught using remote methods. There will be no face-to-face teaching on the course. Teaching is via asynchronous, self-paced approaches facilitated by the course Virtual Learning Environment (VLE) along with scheduled synchronous delivery using remote learning platforms such as Zoom. You are encouraged to attend synchronous sessions to maximise your learning. However, as this may not always be possible we will record these sessions where possible and place them in the VLE.

Examples of asynchronous teaching approaches on the course include, but are not limited to: structured reading within the VLE and through external recommended sources; utilisation of podcasts or videos; engagement with virtual practical and laboratory resources; quizzes and activities in the VLE; pre-recorded lectures and seminars; online discussion forums; and your own self-directed learning. Synchronous teaching may include: delivery of lectures, seminars and their associated discussion; group-based activities; journal clubs; debates; discussions based around pre-reading; and practical demonstrations.

There will be 12 hours of synchronous teaching during each unit of the course. These are split over 4 sessions for unit 1, 2 sessions for unit 2, and 3 sessions for unit 3. The date and times of the sessions are on the final page of this document. Indicative timetables for each session are confirmed, via the VLE, in advance. This allows the teaching staff to maximise the effectiveness of the synchronous sessions for the material they are covering.

The majority of the course teaching, both in terms of material and content, occurs through asynchronous approaches via the VLE ahead of and between the synchronous sessions. Most material is released at the start of a unit to allow you to structure your learning journey and self-directed study, but sometimes additional material may be added as a unit progresses.

Course Overview

The **Undergraduate Certificate in Immunology** focuses on providing you with a broad introduction to the core principles of immunology. The course is split into three distinct units each of which introduces different areas of immunology. The first unit covers the function of the innate and adaptive immune system and introduces the major processes in these essential responses. The second unit considers how the immune system functions in the maintenance of health and in the contribution to disease. The final unit focuses on cancer immunology and the potential utilisation of the immune system to combat this disease. Each unit is split into four separate “blocks” of study, the contents of which are briefly outlined later in this course guide.

This broad overview will be complemented and enhanced by the inclusion of specific case studies and detailed examples that will enable you to engage more deeply with the course material. You will be encouraged to consider and discuss the historical and current understanding of the immune system.

The majority of the course is delivered through material provided on the dedicated course VLE. This will consist of a range of learning activities that may include guided reading, pre-recorded lectures and videos, exercises, activities, quizzes, short question and answers, alongside suggestions for further self-directed learning. The material in the VLE will introduce and explain theoretical and practical elements of the study of immunology. 12 hours of synchronous teaching sessions each term complement and support the material provided in the VLE. Synchronous sessions will be recorded where possible and added to the VLE and will contain additional teaching materials and guidance on course assignments.

Recommended Readings

Engagement with a wide range of reading material and additional resources will enhance and improve your understanding of the subjects you are studying and help you have a more comprehensive and satisfactory learning experience.

Many textbooks exist that cover the broad topics of immunology and/or the more specific areas around immune functions and the role of the immune response in disease. The majority of these provide excellent introductions to the topics taught in the course and you may wish to familiarise yourself with some of the content in these. A detailed online reading list will be provided on the course VLE at the outset of the programme. This will use a system called Leganto and books accessible online via the University using your Raven credentials.

For some texts older editions still contain the relevant information and students are welcome to discuss this, and other reading options, with the Tutors or Course Director. Background reading will greatly increase your appreciation of the course.

Course Aims and Learning Outcomes

Overall, the course aims to:

- enable students to develop a rigorous approach to the acquisition of a broad knowledge base in immunology;
- provide experience and competence in basic experimental techniques relevant to the study of immunology;
- provide detailed knowledge of the immune system;
- encourage students to take responsibility for the quality of personal and group outputs;
- identify conceptual frameworks and core principles in immunity and to identify their strengths and weaknesses.

Within the overall aims of the course the following learning outcomes will be delivered through the taught material and assessed via the unit assignments.

Knowledge and understanding:

- Describe and appreciate the ongoing changes in our understanding of immune function
- Explain how diseases come about, how they can be treated, and why this doesn't always work
- Describe how vaccination works at the molecular level, at the level of the individual, and at the population level
- Understand the importance of human factors in the spread and control of illness and disease

Skills and other attributes:

Intellectual skills:

- Identify the key principles through which the immune system contributes to both health and disease
- To effectively communicate scientific context and ideas to peers
- To demonstrate a degree of critical awareness of the reliability of different sources on information
- Explain the impact on society of diseases related to immunological factors

Practical skills:

- To demonstrate competence in appropriate practical techniques relevant to the study of immunology
- To record data accurately, and perform basic manipulations of data with guidance

Transferable skills for further study and employability

In addition to academic skills and knowledge you will gain a broad range of widely applicable skills. These include:

- The capacity for independent thought and judgement
- The development of independent learning, study and time management skills
- The deployment of skills in critical reasoning
- The development of competence in using IT to support one's work
- The ability to work with others, productively and equitably
- The qualities necessary for employment requiring the exercise of some personal responsibility and the demonstration of high levels of motivation and personal commitment through part-time study
- The ability to reference sources of information to support one's reasoning
- An awareness of ethical issues and the ability to discuss these rationally
- To adapt interpersonal and communications skills to clarify tasks.

Course Assessment

Successful completion of all course assignments is required to pass the course and receive the 60 CATS credits available. The pass mark for each assignment is 40% and further details of the Institutes marking, assessment and resubmission policies are available in the student handbook.

Course Assessments:

Assessment for the **Certificate in Immunology** consists of the following:

- 1) Three compulsory assessments, one from each unit, together totalling 50% of the final course mark. Submitted at the end of each unit.
- 2) A portfolio of 3 assignments, of 1,500-2,000 words or the equivalent, together totalling 50% of the final course mark. Assignments to be chosen from a list provided in each unit and no more than 2 of the 3 portfolio pieces to be from the same unit. One portfolio assignment is submitted at the end of unit 2 and the other two portfolio pieces at the end of unit 3.

Assessment details:

Compulsory Assessments:

One summative assignment for each unit equivalent to 1,500-2,000 words that will consist of:

- i) 6 structured questions assessing core knowledge and understanding and/or data handling skills. Each question worth 10 marks for a total of 60 marks.
- ii) 8 short answer questions assessing core knowledge and understanding. Each question worth 5 marks for a total of 40 marks.

The compulsory assessment questions are released on the VLE no later than 1 month before the submission deadline for the unit or by the date of the last synchronous teaching session, whichever is soonest.

Portfolio Assignments:

We provide a list of permitted portfolio assignments no later than at the start of each unit. The list consists of 4-6 assessment activities each of which is the equivalent to 1,500-2,000 words. Activities may include, but are not limited to: essays, data handling questions, computational activities, case studies, problem based learning questions, the production of infographics, fact sheets, podcasts, videos or presentations.

Unit 1 Submission Date: 12 noon (GMT) 04/01/2023

Unit 2 Submission Date: 12 noon (GMT) 22/03/2023

Unit 3 Submission Date: 12 noon (BST) 09/06/2023

Study hours

The award of academic credit is a means of quantifying and recognising learning, and within the UK, one credit notionally represents 10 hours of learning¹. Each of the units in this course attracts 20 credits so students should expect to need to study for approximately 200 hours in total to complete each unit successfully. However, it is recognised that student study at different paces and use a variety of approaches, so this is a recommendation, rather than a hard-and-fast calculation.

¹ 'Academic credit in higher education in England – an introduction'. The Quality Assurance Agency for Higher Education, 2009

Teaching staff

A range of academic experts teach on the course. This gives you access to and involvement with people who have extensive subject knowledge and who are, in many cases, actively involved in research in immunology and its related disciplines. Further details of the teaching staff are on the course website. The overall Academic Director is Dr Tom Monie, who has a PhD in Molecular Virology and ran a research group investigating the innate immune response to infection. He is Deputy Director of Academic Centres at the Institute of Continuing Education. Tom is a firm believer that learning should be fun, that learner participation is central to this process, and that successful teaching requires responsiveness to the needs of the learners.

For a list of tutors who teach on the biological science programmes, please see the Biological and life sciences subject page on the Institute's website (<http://www.ice.cam.ac.uk/courses/courses-subject/biological-and-life-sciences>).

Administrative staff

Arts and Sciences Enquiries
e. artscience@ice.cam.ac.uk

Syllabus for Unit 1

Michaelmas term 2022

The Innate and Adaptive Immune System

Start date	15 th October 2022	End date	3 rd December 2022
Dates	Session 1 15/10/2022 2-5pm	No of meetings	4 Remote: Zoom-based synchronous meetings
	Session 2 29/10/2022 2-5pm		
	Session 3 19/11/2022 2-5pm		
	Session 4 03/12/2022 2-5pm		

Summary

This unit provides an overview of the innate and adaptive immune systems, the key cells involved and the effector molecules activated. The processes of inflammation, pattern recognition, complement activation, B cell and T cell activation, antibody production, tolerance, hypersensitivity and autoimmunity will be introduced. Changes in perception of the functional connections between the innate and adaptive immune system will be discussed.

Content

What happens when a pathogen is detected? How does our body respond? How and what does the immune system remember from before? These are just some of the questions considered throughout this unit. You will study the sequential steps involved in producing a protective immune response, learn how the immune response differentiates between harmful and benign threats, explore the generation of immune memory and the production of a protective antibody response and be introduced to a wide range of immunological molecules and processes.

The unit will focus on understanding the core mechanisms, processes and molecules involved in the innate and adaptive immune systems. You will learn about the independent functions of these systems as well as the specific and essential manner in which they interact with one another to ensure effective and comprehensive immune protection. Examples will be drawn predominantly, but not exclusively, from the human immune response.

Provisional unit structure

This unit is structured around broad topics, all of which will feature in the assessments.

Topic	Indicative content for synchronous and asynchronous delivery
Inflammation	A basic overview of the innate immune system, its constituents, the timescales over which it works, and the different ways that it can detect and respond to internal and external threats and dangers. Consideration will be given to the historical aspects of research into the innate immune response.
Pattern Recognition Receptors	This topic will expand your knowledge of the way that pattern recognition works in the immune system. By studying receptors such as those from the Toll-like receptor family and the inflammasome-forming proteins you will learn how these molecules detect threats, how they activate cellular signalling pathways and how these lead to inflammatory, or other, immune effects.
B cells, T cells and their effector functions	The third topic of this unit presents a chance to study the functions of the adaptive immune system. Particular consideration will be given to the role, importance, and interplay of T cells and B cells. This will lead into discussion of the generation of antibody diversity, the different types of antibody and their mechanisms of action, and their importance for the development and maintenance of immune memory.
Hypersensitivity and Autoimmunity	The unit ends by exploring two important examples of the immune response responding in a less than helpful manner, namely the processes of autoimmunity and hypersensitivity. We will look at how these situations arise and the diseases and conditions that they can result in.

Student assessment

For full details of the assessment of this course please see page 5. The deadline for submission of the core assignment associated with this unit will be 12 noon on Wednesday 4th January 2023 (GMT*). Students are expected to submit their assignments online and feedback on assignments is delivered online.

*Greenwich Mean Time

Syllabus for Unit 2

Lent term 2023

The Immune System in Health and Disease

Start date	28 th January 2023	End date	18 th February 2023
Dates	Session 1 28/01/2023 10am - 4pm	No of meetings	2 Remote: Zoom-based synchronous meetings
	Session 2 18/02/2023 10am - 4pm		

Summary

The second unit puts the immune system into a functional perspective and considers how it contributes to the maintenance of health and the development of disease. Case studies will cover issues such as allergic responses and anaphylaxis, sepsis, the mechanisms behind vaccination and protective immunity, immunopathology, and the contribution of the immune response to chronic conditions such as diabetes, rheumatoid arthritis and Crohn's Disease.

Content

Building on the knowledge laid down in the previous unit the four topics covered will use a case study based approach to provide in depth and detailed engagement with the pathophysiological consequences of immune activation. Case studies will be drawn from common and well know conditions including asthma, diabetes, septicaemia, Crohn's Disease and arthritis. Upon completion of the unit you will have a clear understanding of how the immune system both protects and damages and how we can manipulate the immune system to provide protection via vaccination.

Provisional unit structure

This unit is structured around broad topics, all of which will feature in the assessments.

Topic	Indicative content for synchronous and asynchronous delivery
Allergy	This topic looks at the different types of allergic response. Particular attention will be given to the immunological basis of allergy, types of allergens, mast cells, basophils and eosinophils, and the importance of molecules such as leukotrienes and histamine.
Acute inflammation	Expanding the understanding from unit 1 about inflammation, case studies from acute infections and conditions such as sepsis introduce the pathological basis of acute inflammation. Consideration will be given to the natural process of resolution, the development of severe and life-threatening acute inflammation, and the transition from acute to chronic inflammatory states.

Vaccination	What makes a good vaccine? Why do some vaccines provide complete and long-lasting protection whilst others are less effective? This topic explores the generation of an immune response through vaccination, the different types of vaccine that exist, and the importance of both the innate and adaptive immune responses in responding to vaccines.
Chronic inflammation	A selection of case studies relevant to chronic inflammation that may include conditions such as Crohn's Disease, rheumatoid arthritis, obesity and type 2 diabetes. The role of the immune response in the generation and maintenance of an inflammatory state will be studied from a mechanistic and a pathological perspective. The use of immunomodulatory molecules to treat these conditions will be discussed.

Student assessment

For full details of the assessment of this course please see page 5. The deadline for submission of the core assignment associated with this unit will be 12 noon on Wednesday 22nd March 2023 (GMT*). Students are expected to submit their assignments online and feedback on assignments is delivered online.

*Greenwich Mean Time

Syllabus for Unit 3

Easter term 2023

Cancer Immunology

Start date	15 th April 2023	End date	20 th May 2023
Dates	Session 1 15/04/2023 10am - 4pm	No of meetings	3 Remote: Zoom-based synchronous meetings
	Session 2 06/05/2023 2-5pm		
	Session 3 20/05/2023 2-5pm		

Summary

The final unit delves into a rapidly developing area of immunology to explore the relationship between cancer cells and the immune system along with consideration of the immunotherapy as a current and future therapeutic approach.

Content

Cancer is something of an immune enigma. Understanding how the immune system recognises, interacts with and destroys cancer cells has entertained immunologists for many years. Ultimately, the immune system appears unable to keep cancer cells in check. However, modulation of the immune system to more effectively inhibit cancers and actively destroy cancer cells remains an appealing prospect with many benefits over conventional cancer treatments.

Within this unit we will cover the broad elements of cancer and its interplay with the host immune system. We will begin by discussing how cancers arise and what the Hallmarks of cancer are and what they mean. The process of cancer immune-surveillance will be introduced alongside consideration of the mechanisms by which cancer cells can evade or subvert the immune response. We will end by considering the benefits and disadvantages of both current and future options for use immunotherapies to treat cancers.

Provisional unit structure

This unit is structured around four broad topics, all of which will feature in the assessments.

Topic	Indicative content for synchronous and asynchronous delivery
What is cancer?	The first part of this unit will introduce cancer from a molecular basis. How does a cell become cancerous, what changes does it undergo

	and what risk factors affect this? The Hallmarks of Cancer will be introduced and discussed.
Cancer and the immune system	The unit will continue by addressing the interaction of cancer cells and the immune system. What is cancer immuno-surveillance? Are cancer cells recognised as an immune target? How do cancer cells disrupt normal immune signalling pathways and processes? Can the immune system be stimulated to effectively target tumours and cancer cells?
Current cancer immunotherapies	Building on the ideas introduced in the previous topic we will discuss current cancer therapies, paying close attention to those that interact with and modulate the immune system. This will include discussion of immune checkpoint blockade, adoptive cellular therapies and cancer vaccines.
The future of cancer immunotherapy	The unit, and course, will end with a look to the future of cancer treatment from an immunological perspective. This will include discussion about the applicability of combination therapies, the production of new immune checkpoint blockades, and the modulation and regulation of T cell activity.

Student assessment

For full details of the assessment of this course please see page 5. The deadline for submission of the core assignment associated with this unit will be 12 noon on Friday 9th June 2023 (BST*). Students are expected to submit their assignments online and feedback on assignments is delivered online.

*British Summer Time

SYNCHRONOUS SESSION TIMETABLE

Michaelmas 2022

The Innate and Adaptive Immune System

Session 1	15/10/2022 2-5pm
Session 2	29/10/2022 2-5pm
Session 3	19/11/2022 2-5pm
Session 4	03/12/2022 2-5pm

Lent 2023

The Immune System in Health and Disease

Session 1	28/01/2023 10am - 4pm
Session 2	18/02/2023 10am - 4pm

Easter 2023

Cancer Immunology

Session 1	15/04/2023 10am - 4pm
Session 2	06/05/2023 2-5pm
Session 3	20/05/2023 2-5pm

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Whilst every effort is made to avoid changes to this programme, published details may be altered without notice at any time. The Institute reserves the right to withdraw or amend any part of this programme without prior notice.

Information correct as of 01/08/2022