



**UNIVERSITY OF  
CAMBRIDGE**

Institute of Continuing Education

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**Undergraduate Certificate in  
Immunology**

**2021-2022**

**Course code: 2122CCR212**

**COURSE GUIDE**

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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>.

### Important information for the 2020-2021 Academic Year

During the 2021-2022 Academic Year 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 and place them in the Virtual Learning Environment.

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 two synchronous teaching sessions during each unit of the course. These take place during a time window as outlined in the provisional unit structure. Exactly when teaching occurs in this window varies from session to session and is 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. For example, it might consist of 4 separate sessions each of 45 minutes in length; or a 30 minute seminar, followed by discussion, group work, group feedback and another seminar.

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. This material appears progressively over the unit to help guide and structure your learning journey and self-directed study.

## Course Overview

The **Undergraduate Certificate in Immunology** focuses on providing you with an introduction to the core principles of immunology. The course is split into three distinct units each of which introduces distinct areas of immunology. The first unit covers the function of the innate and adaptive immune system and introduces the major functional 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.

The focus of the course will be to offer a broad introduction to the subject of immunology. 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. Two synchronous teaching sessions each term complement and support the material provided in the VLE. Synchronous sessions will be recorded and added to the VLE and will contain additional teaching materials and guidance on course assignments.

The three course units are each split into four separate “blocks” of study, the contents of which are briefly outlined later in this course guide, along with a broad reading list. Throughout the year additional readings and resources are put on the course VLE.

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.

## Learning Outcomes

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. Submitted on the 10<sup>th</sup> June 2022 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.

We provide you with the compulsory assessment questions no later than 1 month before the submission deadline for the unit or the date of the last synchronous teaching session, whichever is soonest.

#### *Portfolio Assignments:*

We provide a list of permitted portfolio assignments 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.

## 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 learning<sup>1</sup>. 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 students study at different paces and use a variety of approaches, so this is a recommendation, rather than a hard-and-fast calculation.

<sup>1</sup> '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

<b>Arts and Sciences Enquiries</b>
e. <a href="mailto:artscience@ice.cam.ac.uk">artscience@ice.cam.ac.uk</a> t. 01223 746418 / 746236

## Venue

The Institute of Continuing Education's administrative headquarters are at Madingley Hall, an elegant country house built in the 16th century and set in gardens of about seven acres, designed in the 18th century by Capability Brown. Please visit [www.ice.cam.ac.uk](http://www.ice.cam.ac.uk) and [www.madingleyhall.co.uk](http://www.madingleyhall.co.uk) for further information.

**The course is being taught entirely remotely during the 2021-22 Academic Year.**

## Contact details of ICE

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T: 01223 746222  
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*Please also refer to the 'information for students' section on ICE's website [www.ice.cam.ac.uk/studying-with-us/information-for-students](http://www.ice.cam.ac.uk/studying-with-us/information-for-students) and the 2019/20 Student Handbook for award-bearing courses for further information and guidance relating to all aspects of the course including study skills, assignments, assessment and moderation. The Course Information and Help and Guidance section of the ICE Virtual Learning Environment (VLE) will also contain valuable information specific to your course.*

*Information correct as at 17 February 2021*

# The innate and adaptive immune system

<b>Start date</b>	8 October 2021	<b>End date</b>	15 December 2021
<b>Synchronous Sessions</b>	Saturday 30 October 2021 10:00 – 16:00 (GMT)  Saturday 27 November 2021 10:00 – 16:00 (GMT)		
<b>Delivery</b>	Remote: Zoom-based synchronous and online VLE- based asynchronous teaching	<b>No of synchronous meetings</b>	2

## Summary

This unit will provide an overview of the history of the innate and adaptive immune systems, the key cells involved in each and the effector molecules that are activated in each system. 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	The unit will start with 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.

These topics are supported by two synchronous teaching sessions on the **30<sup>th</sup> October 2021** and the **27<sup>th</sup> November 2021**. Teaching on these dates will provide additional details, material and information around the topics covered. Full details of the precise content and timings of these sessions is provided in advance on the course VLE.

## Learning outcomes

As a result of the unit, within the constraints of the time available, students should be able to:

## 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 5<sup>th</sup> January 2022 (GMT\*)**. Students are expected to submit their assignments online and feedback on assignments is delivered online.

*\*Greenwich Mean Time*



## Syllabus for second unit

Lent term 2022

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# The immune system in health and disease

<b>Start date</b>	10 January 2022	<b>End date</b>	23 March 2022
<b>Synchronous Sessions</b>	Saturday 29 January 2022 10:00 – 16:00 (GMT) Saturday 19 February 2022 10:00 – 16:00 (GMT)		
<b>Delivery</b>	Remote: Zoom-based synchronous and online VLE-based asynchronous teaching	<b>No of synchronous meetings</b>	2

### Summary

The second unit of this Certificate puts the immune system into a functional perspective and considers how it contributes to both the maintenance of health and the development of disease. Case studies will enable the exploration of 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

This unit is about case studies. Building on the knowledge laid down in the previous unit the four topics covered will use a case study based approach to provide a more in depth and detailed engagement with the pathophysiological consequences of immune activation. Case studies will be chosen to highlight normal effective immune function alongside examples of conditions and diseases in which the immune response contributes significantly, or even entirely, to morbidity.

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	Following on from the end of unit one this topic takes a more in depth look at the different types of allergic response that occur. Particular attention will be given to the immunological basis of allergy, types of allergens, the role of mast cells, basophils and eosinophils, and the importance of molecules such as leukotrienes and histamines.
Acute inflammation	This topic expands the understanding from unit 1 about inflammation. Using case studies from acute infections and conditions such as sepsis the pathological basis of acute inflammation will be discussed. Consideration will be given to the natural process of resolution, the potential 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 and initiate shorter lived protection? This part of the unit 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. Examples of highly successful vaccines will be used and alongside discussion of some of the broader misconceptions and ethical considerations about vaccination.
Chronic inflammation	The unit will end with a selection of case studies relevant to chronic inflammation. These 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.

These topics are supported by two synchronous teaching sessions on the **29<sup>th</sup> January 2022** and the **19<sup>th</sup> February 2022**. Teaching on these dates will provide additional details, material and information around the topics covered. Full details of the precise content and timings of these sessions is provided in advance on the course VLE.

## Learning outcomes

As a result of the unit, within the constraints of the time available, students should be able to:

## 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 23<sup>rd</sup> March 2022 (GMT\*)**. Students are expected to submit their assignments online and feedback on assignments is delivered online.

\* Greenwich Mean Time

# Syllabus for third unit

Easter term 2022

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## Cancer Immunology

<b>Start date</b>	28 March 2022	<b>End date</b>	10 June 2022
<b>Synchronous Sessions</b>	Saturday 23 April 2022 10:00 – 16:00 (BST) Saturday 14 May 2022 10:00 – 16:00 (BST)		
<b>Delivery</b>	Remote: Zoom-based synchronous and online VLE-based asynchronous teaching	<b>No of synchronous meetings</b>	2

### 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.

These topics are supported by two synchronous teaching sessions on the **23<sup>rd</sup> April 2022** and the **14<sup>th</sup> May 2022**. Teaching on these dates will provide additional details, material and information around the topics covered. Full details of the precise content and timings of these sessions is provided in advance on the course VLE.

## Learning outcomes

As a result of the unit, within the constraints of the time available, students should be able to:

## 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 10<sup>th</sup> June 2022 (BST\*)**. Students are expected to submit their assignments online and feedback on assignments is delivered online.

*\*British Summer Time*

## 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. The texts and resources listed below are an indication of the sorts of reading material that will benefit your learning. They are a mix of textbooks and popular science books. Where possible the textbooks are available electronically through the University library and can be accessed using your Raven credentials.

Throughout the course you are given specific readings as part of the teaching. Information about, and links to, these appear in the VLE as necessary.

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.

<b>AUTHOR</b>	<b>TITLE</b>	<b>PUBLISHER</b>
Cooper LNJ, Mittendorf EA, Moyes J and Prabhakaran S	Immunotherapy in translational cancer research	John Wiley and Sons 2018
Coico R and Sunshine G	Immunology: A short course	John Wiley and Sons 2012
Delves PJ, Martin SJ, Burton DR and Roitt IM	Roitt's Essential Immunology	John Wiley and Sons 2011
Davies DM	The Beautiful Cure: The Revolution in Immunology and What It Means for Your Health	University of Chicago Press 2018
Erridge C	Undergraduate Immunology: A textbook for tablets and other mobile devices 2 <sup>nd</sup> edition	Kindle 2020
Graeber C	The Breakthrough: Immunotherapy and the Race to Cure Cancer	Scribe UK 2018
Murphy K and Weaver C	Janeway's Immunobiology, 9 <sup>th</sup> edition	Garland Science 2016
Paul WE	Fundamental Immunology	Wolters Kluwer 2012
Playfair JHL and Chain BM	Immunology at a Glance	John Wiley and Sons 2012
Sompayrac LM	How the immune system works	John Wiley and Sons 2015
Strober W, Gottesman SR, Coico R and Sunshine G	Immunology: Clinical Case Studies and Disease Pathophysiology	John Wiley and Sons 2009

## SYNCHRONOUS SESSION TIMETABLE

Michaelmas 2021

### **The Innate and Adaptive Immune System**

Session 1 30/10/2021

Session 2 27/11/2021

Lent 2022

### **The Immune System in Health and Disease**

Session 1 29/01/2022

Session 2 19/02/2022

Easter 2022

### **Cancer Immunology**

Session 1 23/04/2022

Session 2 14/05/2022

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