



**UNIVERSITY OF  
CAMBRIDGE**

Institute of Continuing Education

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**Undergraduate Certificate in  
Infectious Diseases**

**2022-2023**

**Course code:2223CCR213**

**COURSE GUIDE**

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Welcome to the **Undergraduate Certificate in Infectious Diseases**, 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: [www.ice.cam.ac.uk/info/academic-credits-cats-points](http://www.ice.cam.ac.uk/info/academic-credits-cats-points)

#### Important information for the 2022 – 2023 Academic Year

During the 2022-2023 Academic Year the **Undergraduate Certificate in Infectious Diseases** 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 Infectious Diseases** focuses on providing you with an introduction to the major types of infectious pathogen: viruses, bacteria, parasites and fungi. The course explores the mechanisms by which major pathogens replicate, how they cause disease and what current and future treatment options are available.

The course will offer a broad introduction to the subject of infectious diseases. 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 infections.

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 infectious diseases. 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 course consists of three discrete units, focusing on viruses, bacteria, and parasites and fungi respectively. Each of these units is split into 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 infectious diseases;
- provide experience and competence in basic experimental techniques relevant to the study of infection;
- provide detailed knowledge of the major types of pathogen
- encourage students to take responsibility for the quality of personal and group outputs
- identify conceptual frameworks and core principles in infection 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:

- Explain the core elements of pathogen replication and pathogenesis
- 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 infection

#### Practical skills:

- To demonstrate competence in appropriate practical techniques relevant to the study of infectious diseases
- To record data accurately, and perform basic manipulations of data with guidance
- To understand the relevance of using computational approaches to understand pathogen and infection behaviour

## 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 Infectious Diseases** 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 9<sup>th</sup> June 2023 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 infectious diseases 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.

The Course Director is Dr Hazel Stewart, an experienced postdoctoral scientist working on applying molecular virology to a range of important pathogens that cause chronic infection and disease in both humans and animals. Hazel's projects focus upon how viruses such as polio expand their coding potential by using novel RNA regulatory elements hidden in their genomes (for example, ribosomal frameshifting and transcriptional slippage). She is currently applying this to SARS-CoV-2, the causative agent of the COVID-19 pandemic, to identify novel regulatory elements. Hazel's previous research involved elucidating the role of novel RNA secondary structures in selective genome packaging for human pathogens responsible for chronic disease, such as hepatitis C virus and Chikungunya virus. She also has experience working with novel emerging viruses, such as equine hepaciviruses, and of investigating the transmission of gammaretroviruses in animal pathogens such as feline retroviruses and koala retrovirus. In 2018 she was awarded the qualification of Fellow of the Higher Education Academy in recognition of her teaching and supervisory experience.

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](mailto:artscience@ice.cam.ac.uk)

t. 01223 746418 / 746236

## Institute of Continuing Education

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.

## Contact details of ICE

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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 2022-23 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 VLE will also contain valuable information specific to your course.*

*Information correct as at 31 May 2022*

Syllabus for first unit  
Michaelmas term 2022

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# Viruses

<b>Start date</b>	7 October 2022	<b>End date</b>	7 December 2022
	Saturday 22 October 2022		
<b>Synchronous Sessions</b>	10:00 – 16:00 (GMT)		
	Saturday 12 November 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

This unit will provide a broad understanding of virus biology and pathogenesis. It will investigate topics such as: viral replication strategies, antiviral therapy and vaccination, commensal viruses, bacteriophage, emerging viral infections, and viruses and cancer.

## Content

Viruses are all around us. The current pandemic caused by the coronavirus SARS-CoV-2 highlights the impact viruses can have on human life. This is not however, the first time, nor will it be the last, that viruses have had a profound impact on the human race. Human Immunodeficiency Virus (HIV) has been a global pandemic for close to 40 years and infections such as smallpox and influenza have caused millions of deaths through history.

The unit will provide a broad overview of viral biology and pathogenesis. You will explore different replication strategies and learn how this influences pathogenesis, transmission and treatment. You will touch on the basics of the immune response to viral infection. Throughout the unit a wide range of viruses will be introduced to highlight specific details relevant to the learning outcomes. These will be supported by more in depth examples and case studies from viruses such as influenza, HIV and herpes simplex virus. Information about experimental approaches to the study of viruses and viral infection will be provided as part of the unit.



## 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
RNA Viruses	RNA viruses include some of the major viral pathogens such as influenza virus, SARS-CoV-2, poliovirus and measles. Retroviruses, including HIV, are also explored in this section. In this topic you will cover how these viruses replicate, how they are transmitted and how they cause disease.
DNA Viruses	Following a similar approach to the topic on RNA viruses this part of the unit will introduce the core molecular virology and pathogenesis of viruses that use DNA as their genetic material. A variety of examples and case studies, including members of the herpesviridae, smallpox, papillomaviruses and polyomaviruses will be used to explore viral biology and pathogenesis.
Evolution of Viral Pathogens	This part of the unit will focus upon the varied mechanisms by which viral pathogens mutate and evolve. The influence of vaccines, antiviral treatments and host immune responses upon viral evolution will be considered.
Diagnosing and treating viral infections	The unit will include close consideration of the methods available to diagnose and treat viral infections. Case studies will introduce the use and application of antiviral drugs, vaccination and educational strategies in controlling and treating virus-based infections. Consideration will be given to challenges, successes and an outlook for the future.

These topics are supported by two synchronous teaching sessions on the 22<sup>nd</sup> **October 2022** and the 12<sup>th</sup> **November 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

This unit will contribute to delivery of all the learning outcomes detailed on page 4 of the course guide.

## 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 4<sup>th</sup> January 2023(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 2023

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## Bacteria

<b>Start date</b>	2 January 2023	<b>End date</b>	3 March 2023
<b>Synchronous Sessions</b>	Saturday 21 January 2023 10:00 – 16:00 (GMT) Saturday 11 February 2023 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 introduce the different types of bacteria, how they are classified and what this means for how they live, and how they are targeted therapeutically. It will also cover topics such as: bacterial replication; antibiotics and antibiotic resistance; bacterial epidemiology; commensal bacteria and the microbiome. Case studies will be used to support learning and enable the collection of information from a variety of authoritative sources.

### Content

As free living organisms bacteria represent a very different type of pathogen to viruses. Our commensal bacterial flora plays a critical role in maintaining homeostatic balance, provides vital biochemical functions and helps protect against infection. However, not all bacteria are helpful, or indeed harmless. Bacterial infections are common place and the largest ever global pandemic, the Black Death, was caused by a bacteria, *Yersinia pestis*.

Within this unit you will be introduced to the basic biology of a wide range of pathogenic bacteria and some commensals. This will cover their replication, their unique characteristics, how they cause disease, the production of toxins and their treatment. Consideration will be given to the epidemiology and transmission of bacterial infections. Close consideration of the treatment of bacterial infections will be provided along with exploration of some of the broader issues regarding the global problems of antibiotic resistance.

## 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
Gram positive bacteria	The biology, pathogenesis and epidemiology of Gram positive bacteria will be discussed. Examples will be drawn from major pathogens such <i>Staphylococcus</i> and <i>Streptococcus spp</i> and <i>Clostridium spp</i> .
Gram negative bacteria	The biology, pathogenesis and epidemiology of Gram negative bacteria will be discussed. Examples will be drawn from major pathogens such as <i>E. coli</i> , <i>Salmonella spp</i> , <i>Vibrio cholerae</i> , <i>Yersinia pestis</i> and <i>Helicobacter pylori</i> .
Bacterial identification and diagnostics	This unit will focus on providing an understanding of the different experimental approaches available to aid bacterial identification in a diagnostic setting. This will include elements such as the use of chemical tests and stains (including the Gram stain), analytical profile indexing and the use of sequence-based information.
Treatment of bacterial infection	The unit will include a closer consideration of the methods available to treat bacterial infections. The primary focus will be on the use of antibiotics. This will consider their mechanism of action and the increasing problem of antibiotic resistance. Case studies will be used to introduce wider topics such as vaccination and the use of educational strategies to control bacterial infection.

These topics are supported by two synchronous teaching sessions on the **21<sup>st</sup> January 2023** and the **11<sup>th</sup> February 2023**. 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

This unit will contribute to delivery of all the learning outcomes detailed on page 4 of the course guide.

## 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 22<sup>nd</sup> March 2023(BST\*)**. Students are expected to submit their assignments online and feedback on assignments is delivered online.

*\*British Summer Time*

## Syllabus for third unit

Easter term 2023

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# Parasite and Fungi

<b>Start date</b>	27 March 2023	<b>End date</b>	31 May 2023
	Saturday 22 April 2023		
<b>Synchronous Sessions</b>	10:00 – 16:00 (BST)		
	Saturday 13 May 2023		
	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

This unit will explore the major types of parasitic and fungal pathogens. It will introduce the different classes of parasite and fungi and consider the implications for replication and control of their distinct life cycles. A strong focus will be given to case studies from both human and veterinary parasitic and fungal infections. The epidemiology of infection will be considered in the context of control and human induced environmental changes.

### Content

Parasites take advantage of their host, gaining food and resource at the expense of their host. Parasitic infections are a major global threat, especially in low income countries. Infections such as malaria result in hundreds of thousands of deaths on an annual basis. Others, including many worm infections result in lower levels of mortality but carry very large burdens of morbidity on the affected populations. However, parasitic and fungal infections receive significantly less coverage and funding than their viral and bacterial counterparts.

This unit will utilise a case study based approach to develop your understanding of the basic biology of parasites and pathogenic fungi. The focus will be on major pathogenic parasites and fungi. This will be related to their pathogenesis, transmission and life cycles and potential treatment options.

## 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
Protozoan parasites	The biology, pathogenesis and epidemiology of protozoan parasites will be discussed. Examples will be drawn from major parasitic diseases including malaria and leishmaniosis. The importance of vectors in the parasitic life cycle and the transmission cycle will be covered.
Helminths	Helminth means worm. They can be classified as roundworms, tapeworms and flukes (flatworms). This unit will look at major parasitic helminths and through the use of case studies such as hookworms, schistosomes and ascaris we will explore the biology, pathogenesis and epidemiology of helminth infections.
Fungal infections	This topic will provide a brief overview of common fungal infections such as ringworm and thrush, as well as investigating less well known infections like those caused by <i>Cryptococcus</i> and <i>Coccidioides</i> . The impact of fungal infections on people with weakened immune systems will be introduced.
Treatment of parasitic and fungal infections	The unit will end with a closer consideration of the methods available to treat both parasitic and fungal infections. This will include public health and epidemiological approaches, drug-based treatments, vaccination and educational strategies. The relative success of different approaches will be considered as will the potential for eradication of some parasitic infections and the challenges faced in trying to achieve this.

These topics are supported by two synchronous teaching sessions on the **22nd April 2023** and the **13<sup>th</sup> May 2023**. 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

This unit will contribute to delivery of all the learning outcomes detailed on page 4 of the course guide.

## 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 9<sup>th</sup> June 2023(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 infectious disease, microbiology and the more specific areas around individual classes and types of pathogen. 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.

It is recommended, but not essential, that students have a basic understanding of biology, equivalent to GCSE level, prior to starting this course. Students who have not completed GCSE Biology are encouraged to contact the Course Director (Dr Hazel Stewart, [hs623@cam.ac.uk](mailto:hs623@cam.ac.uk)) for a list of additional background recommended readings prior to the course starting date.

<b>AUTHOR</b>	<b>TITLE</b>	<b>PUBLISHER</b>
Dimmock NJ, Easton AJ and Leppard KN	Introduction to Modern Virology	John Wiley and Sons 2016
Healey J	Fighting Infectious Diseases	The Spinney Press 2017
Hogg S	Essential Microbiology	John Wiley and Sons 2013
Goering R, Dockrell H, Zuckerman M and Chiodini P	Mims' Medical Microbiology and Immunology, 6 <sup>th</sup> edition	Elsevier 2018
Nash AA, Dalziel RG, Fitzgerald JR	MIM's Pathogenesis of Infectious Disease, 6 <sup>th</sup> edition	Academic Press 2015
Pommerville JC	Alcamo's Fundamentals of Microbiology, 8 <sup>th</sup> edition	Jones & Bartlett Learning 2006
Tortora GJ, Funke BR and Case GL	Microbiology: an introduction	Pearson 2018
Willey J, Sherwood L and Woolverton CJ	Prescott's Microbiology, 10 <sup>th</sup> edition	McGraw-Hill Education 2016
Wilson BA, Winkler M and Ho BT	Bacterial Pathogenesis : A Molecular Approach, 4 <sup>th</sup> edition	ASM Press, 2019
Yong E	I Contain Multitudes: The Microbes Within Us and a Grander View of Life	Vintage 2017
Zimmer C	A planet of viruses	Barnes and Noble 2015

## SYNCHRONOUS SESSION TIMETABLE

Michaelmas 2022

### Viruses

Session 1 22/10/2022

Session 2 12/11/2022

Lent 2023

### Bacteria

Session 1 21/01/2023

Session 2 11/02/2023

Easter 2023

### Parasites and Fungi

Session 1 22/04/2023

Session 2 13/05/2023

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