MODULE SPECIFICATION

Academic Year (student cohort covered by specification)	2021-22
Module Code	3460
Module Title	Pathogen Genomics
Module Organiser(s)	Professor David Conway & Professor Martin Hibberd
Faculty	Infectious & Tropical Diseases
FHEQ Level	Level 7
Credit Value	**CATS:** 15 **ECTS:** 7.5
HECoS Code	100948
Term of Delivery	Term 3
Mode of Delivery	This module is delivered online. Teaching will comprise a combination of live and interactive activities (synchronous learning) as well as recorded or self-directed study (asynchronous learning).
Mode of Study	Full-time
Language of Study	English
Pre-Requisites	Robust understanding of basic principles of molecular biology and genetics. This would be equivalent to that which would be gained from study of at least 2 of the following modules in Molecular Biology during Term 2: • Molecular Biology & Recombinant DNA Techniques; • Advanced Training in Molecular Biology; • Molecular Research in Infectious Diseases. Taking of these earlier modules is not mandatory if students can demonstrate sufficient background knowledge gained from study elsewhere. No laboratory experience is required, but rather an interest in understanding genomic data.
Accreditation by Professional Statutory and Regulatory Body	Not currently accredited by any other body
Module Cap (Indicative number of students)	24 (numbers may be capped due to limitations in facilities or staffing)
Target Audience	This module is suitable for students studying: MSc Medical Microbiology,

	MSc Medical Parasitology, MSc Control of Infectious Diseases, MSc Tropical Medicine and International Health, and potentially also suitable for research degree students.
Module Description	This module is for students with an interest in the biology or epidemiology of infectious disease agents, to gain a state-of-the-art understanding of their genomics. The module will enable students to use powerful approaches to data analysis, and to interpretations relevant to current genetic research priorities, surveillance and control.
Duration	5 weeks at 2.5 days per week
Timetabling slot	Slot E.
Last Revised (e.g. year changes approved)	August 2021

Programme(s) This module is linked to the following programme(s)	**Status**
MSc Medical Microbiology	Recommended Option
MSc Medical Parasitology	Recommended Option

Module Aim and Intended Learning Outcomes

Overall aim of the module
The overall module aim is to: • give participants a critical understanding of current methods and interpretations of pathogen genomics as a preparation for future research or translation of findings.

Module Intended Learning Outcomes
Upon successful completion of the module a student will be able to: 1. Analyse pathogen genome sequence data accessed from diverse sources to produce descriptive summaries; 2. Apply freely available bioinformatic tools for relating genome sequence data to the biology of particular pathogens; 3. Identify methods to analyse genome sequences from population samples of pathogen isolates to address epidemiological issues; 4. Demonstrate how detailed information on individual genes and their functions relates to large genome-scale analyses of pathogens; 5. Assess how local data fit into globally accessible genome databases to give a stronger understanding of pathogens.

Indicative Syllabus

Session Content
The module is expected to cover the following topics: • **Pathogen genome structure and annotation** (includes: genome content and chromosomal arrangements; generating and assembling genome sequences; browsing and analysing genome sequences; principles of comparative genomics). • **Functional genomics and transcriptomics of pathogens** (includes: methods for quantitative transcriptome analysis in experimental and clinical studies; genomic perspectives on mutagenesis or gene silencing studies). • **Population and evolutionary genomics of pathogens** (includes: population structure and epidemiological history; phylogenomics; recombination and lateral gene transfer; signatures and causes of natural selection). • **Centralised genomic and bioinformatic research and resources** (includes: primary genome databases; derived genome databases and community resources; overview of facilities and pathogen research programmes at Wellcome Trust Sanger Institute). • **Computer practicals** will relate to the above subjects and include use of freely available software for genome sequence data analysis and for interpretation and integration of transcript and phenotypic data at the genomic scale.

Teaching and Learning

Notional Learning Hours

Type of Learning Time	Number of Hours	Expressed as Percentage (%)
Contact time	70	47
Directed self-study	20	13
Self-directed learning	30	20
Assessment, review and revision	30	20
Total	**150**	**100**

Student contact time refers to the tutor-mediated time allocated to teaching, provision of guidance and feedback to students. This time includes activities that take place in face-to-face contexts such as lectures, seminars, demonstrations, tutorials, supervised laboratory workshops, practical classes, project supervision as well as where tutors are available for one-to-one discussions and interaction by email. Student contact time also includes tutor-mediated activities that take place in online environments, which may be synchronous (using real-time digital tools such as Zoom or Blackboard Collaborate Ultra) or asynchronous (using digital tools such as tutor-moderated discussion forums or blogs often delivered through the School's virtual learning environment, Moodle).

The division of notional learning hours listed above is indicative and is designed to inform students as to the relative split between interactive (online or on-campus) and self-directed study.

Teaching and Learning Strategy
• Lectures – online • Live discussion sessions - online • Computer practicals – online and potential on-campus option for selected sessions • Online and potential option for on-campus visit to Wellcome Genome Campus (1 full day) • Private study – reading • Private study – computer data browsing and software practice

Assessment

Assessment Strategy
The assessment for this module has been designed to measure student learning against the module intended learning outcomes (ILOs) as listed above. The grade for summative assessment(s) only will go towards the overall award GPA. The assessment for this module will be online. A computer practical assessment will involve some data analysis and interpretation of short applied research problems, based on ideas and processes that have been learned during the module. This will be conducted during a two-hour session, and will comprise 50% of the assessment marks for the module. A written essay assessment will be conducted during personal study time during the final three weeks of the module. This will give students the opportunity to develop and expand on ideas introduced during the sessions, combined with reading and interpretation of the research literature. This will comprise 50% of the assessment marks for the module.

Summative Assessment

Assessment Type	**Assessment Length (i.e. Word Count, Length of presentation in minutes)**	**Weighting** (%)	**Intended Module Learning Outcomes Tested**
Essay	Approx. 1500-2000 words	50	All (with some options)
Short questions on analysis	2 hours	50	All (with some options)

Resitting assessment
Resits will accord with the LSHTM's Resits Policy The task will be the same as the original assessment.

Resources

Indicative reading list
Reading material will be indicated for each of the sessions. No set reading list is needed before the session, but any general reading on genetics and genomics of pathogens will be useful preparation - there is a large open-access literature that we encourage students to freely explore by internet searching.

Other resources
To help prepare for some of the computer practical sessions, previous familiarisation with command-line computing would be useful, and introduction to use of the R program for bioinformatics would be particularly worthwhile. The following free resources may be useful for background:
https://bioinfotraining.bio.cam.ac.uk/postgraduate/programming/bioinfo-introRbio
https://a-little-book-of-r-for-bioinformatics.readthedocs.io/en/latest/

Teaching for Disabilities and Learning Differences

The module-specific site on Moodle gives students access to lecture notes and copies of the slides used during the lecture. Where appropriate, lectures are recorded and made available on Moodle. All materials posted on Moodle, including computer-based sessions, have been made accessible where possible.

LSHTM Moodle is accessible to the widest possible audience, regardless of specific needs or disabilities. More detail can be found in the Moodle Accessibility Statement which can also be found within the footer of the Moodle pages. All students have access to "SensusAccess" software which allows conversion of files into alternative formats.

Student Support Services can arrange learning or assessment adjustments for students where needed. Details and how to request support can be found on the LSHTM Disability Support pages.