Liverpool John Moores University

Title:	Genes and Genomes
Status:	Definitive
Code:	**5501YAUZOO** (127816)
Version Start Date:	01-08-2021
Owning School/Faculty:	Biological and Environmental Sciences
Teaching School/Faculty:	Biological and Environmental Sciences

Team	Leader
Craig Wilding	Y

Academic Level:	FHEQ5	**Credit Value:**	20	**Total Delivered Hours:**	58
Total Learning Hours:	200	**Private Study:**	142		

Delivery Options
Course typically offered: Semester 1

Component	Contact Hours
Lecture	36
Practical	18

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	Exam	Written exam covering lecture material for Genome sequencing and sequencing technologies	34	2
Presentation	Poster	Written exam covering lecture material for Genomics in Health and Disease	32	
Exam	Exam	Poster presentation on model organisms	34	2

Aims

The aim of this module is for individuals to understand how human, animal, plant and other organismal genomes are sequenced. Students will learn the underlying

techniques and principles of genome sequencing and be introduced to the latest technologies (Illumina sequencing, PacBio sequencing, Oxford Nanopore) and how they work. These will be compared and contrasted to traditional Sanger sequencing techniques. Genomics is receiving widespread application in both human and veterinary medicine. This module will also examine the resources available for this, and look into how genomic approaches such as Genome Wide Association Studies are used to understand the underlying genetic basis of phenotypes, particularly disease. Model organisms are species that are widely utilized in genetics, usually because they are easy to maintain and breed in a laboratory setting and have particular experimental advantages which allow them to be manipulated and experimented upon. They are particularly important for the study of gene function using, for example, reverse genetics and transgenic approaches. Students will be introduced to the key model organisms: mouse, roundworm, fruitfly, Arabidopsis and the genomic resources and techniques available for their study. The aim of this module is for individuals to develop an understanding of the role of model organisms in genetic research and how forward genetics, reverse genetics and transgenic approaches are used to understand phenotypes and disease states.

Learning Outcomes

After completing the module the student should be able to:

1	Describe and understand the experimental methodology that is used to sequence genomes and transcriptomes and discuss how genome sequencing techniques can be used in zoology.
2	Compare the advantages and disadvantages of first-, second-, and third-generation sequencing methods.
3	Understand both the potential of, and restrictions, of personalised genomics for health and disease research and understand how genomic approaches such as Genome-Wide association studies are used in understanding the genetic basis of disease states.
4	Understand the role of model organisms in genetic research and describe the genetic and genomic resources available for the key model organisms (Drosophila, C. elegans, Mus musculus, Danio rerio, Arabidopsis thaliana).
5	Use online resources (e.g. www.ensembl.org) to explore the genome of the key model organism and a chi-squared test for association on genetic data from a non-complex hereditary condition.
6	Describe how forward and reverse genetics, and transgenic approaches can be used to understand the genetic control of phenotypes.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Written exam	1	2	6
Poster presentation	3	6	5
Written exam	4	6	5

Outline Syllabus

Methodological approaches to genome and transcriptome sequencing including first, second- and third-generation sequencing techniques. Mendelian and complex genetic traits. Personalised medicine. Genome-wide association studies of human and animal traits. Chi-squared tests of association. An understanding of the role of model organisms in genetic research. Knowledge of the genetic and genomic resources for the key model organisms (mouse, fruitfly, roundworm, Arabidopsis). An understanding of genetic approaches applicable to model organisms – forward genetics, reverse genetics and transgenic techniques.

Learning Activities

The module content will be delivered through lectures, computer-workshop activities and practical activities. Theoretical lectures will provide appropriate subject knowledge to support the practical application.

Notes

This module is for individuals to develop an understanding of the role of genome sequencing in genetics and genomic research and how genome sequencing techniques work. Individuals will also develop an understanding of how modern genetic and genomic techniques and resources are being used to understand health and disease states in humans, animals and plants. The role of model organisms in genetic and genomic research with relevance to human and animal phenotypes and diseases will also be included. Individuals will also develop basic practical skills appropriate for handling model organisms.