NST PART II GENETICS

NST PART II BBS (GENETICS)

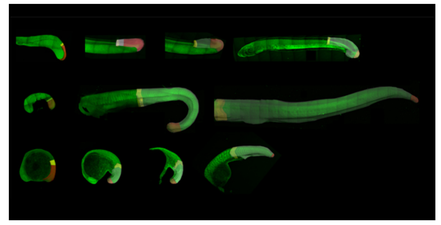
HOW THE PART II COURSE IS ORGANISED

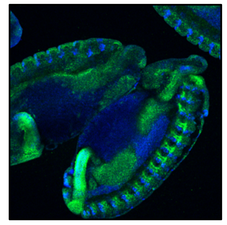
MICHAELMAS TERM	**LECTURES** Module 1 Module 2	Journal Sessions Problem Sessions Social Aspects of Genetics [SAG] Research Seminars	**LITERATURE REVIEW** submitted at start of LT
LENT TERM	**LECTURES** Module 3 Module 4	Journal Sessions Problem Sessions Research Seminars	**PROJECT** [or BBS **DISSERTATION**]
EASTER TERM	Revision sessions		**EXAMS**

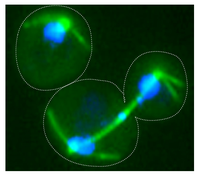
Students with Genetics as their BBS major subject will take all 4 modules (plus a minor subject from elsewhere) and participate in all the seminars – they have Genetics as their "home" department and have full access to all the facilities.

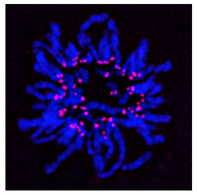
MODULE 3 : DEVELOPMENTAL GENETICS

This module will cover the field of developmental genetics with an emphasis on how genetics is used to uncover cellular and molecular mechanisms of development in a wide variety of organisms, including examples from *Drosophila*, *C.elegans*, zebrafish and the mouse. Topics will include: the establishment of body axes and cell fate determination, roles of small RNAs, the development of the germ line, properties of stem cells, advanced genetic tools to study development in mouse & human (including organoids), signalling mechanisms, transcription regulation, & gene regulatory networks in development.









MODULE 1 : GENOMES, CHROMOSOMES & THE CELL CYCLE

This module will focus on how genomes are organised. It covers prokaryotic genomes and the "floating genome" of bacterial species (comprised of mobile elements including plasmids, transposable elements, integrons and conjugative transposons), as well as eukaryotic chromosomes and their functional elements. It also examines eukaryotic control mechanisms (centred on key cell cycle protein kinases, protein phosphatases, and checkpoints) that promote correct cell cycle progression and the accurate segregation of genes and chromosomes into daughter cells at cell division.

EXAMPLES OF LENT TERM PROJECTS

The Department offers the choice of 'wet' or 'dry' projects, which are undertaken in the Lent Term. For example:

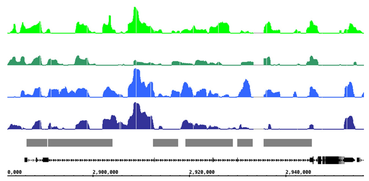
- Integrating ancient African Y-chromosome lineages into present-day phylogenies.
- CRISPR-mediated deletion of transposable elements.
- A new approach to the treatment of UTIs.
- Mechanisms regulating genomic stability during germline development.
- Evolutionary variation of the fine-scale recombination map in cichlid fish.
- Identifying cancer vulnerabilities.
- Mechanochemical signalling in aggregates of embryonic stem cells.
- Isolation & characterisation of mitochondrial mutants using targeted restriction enzymes in *Drosophila.*
- Engineering a synthetic light-controlled gene expression system for plants.
- Evolution of endogenous small RNAs across arthropods.
- Phenotypic and molecular analysis of mice carrying mutations in genes regulating epigenetic machinery during development.

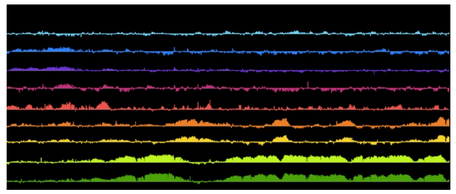
MODULE 4 : EVOLUTIONARY GENETICS & ADAPTATION

Modern evolutionary theory has its roots in the union of Mendelian genetics with Darwin's theory of evolution, two of the great unifying themes of biology. This module will consider the process of evolution, exploring the central topics of natural selection, adaptation and genetic drift, and combining a variety of empirical and theoretical approaches. The lectures will cover general principals in evolutionary genetics, and key topics such as speciation, the evolution of genomes, the genetics of adaptation, the evolution of sex and how experimental evolution can be used to understand the evolution and function of genomes.

MODULE 2 : HUMAN GENETICS, GENOMICS AND SYSTEMS BIOLOGY

This module will focus on human genetics, the genetic basis of human disease and the role of genomics in tackling it. Humans are a problem for the geneticist because, for all sorts of good reasons, we don't do experiments on ourselves. Human genetics has always needed to exploit technology to obtain answers to the problems it poses. The sequencing technologies that underpin our ability to analyse genomes will be examined, followed by the organisation of the human genome, the role of repetitive DNA, and genetic approaches (such as GWAS) aimed at characterising other aspects of human variation. The module will also explore mitochondrial genetics, the role of imprinting, and gene therapy. Finally, the genomics and proteomics approaches that underpin functional analysis of genomes will be introduced.





TOPICS DISCUSSED IN OUR SOCIAL ASPECTS OF GENETICS SESSIONS

- Scientific Fraud
- Genome Editing/ CRISPR-Cas
- Medical Ethics
- GMOs

WHY STUDY GENETICS?

- Genetics has always occupied a pivotal position in the biological sciences – it influences them and unites them.
- Genetics is a subject that is incredibly important in human affairs and is always in the news. It is likely to be THE driving science for the next 50 years.
- In this department the range of research interests is especially broad. This will not only ensure that you leave Cambridge with a wide knowledge base, but will help you discover where your interests lie – and you'll be making useful contacts.
- We attract a high level of grant funding for research at the frontiers of the subject.
- You'll find a wide range of job opportunities will be open to you. Genetics graduates are not only in demand – they find it easy to move between disciplines. And prospects will improve still further as a result of genome projects, the application of genetics to environmental problems, and advances in medical and agricultural genetics.
- Part II students always mention the friendly & informal atmosphere in the Genetics Department, with everyone joining together at break-time in the Tea Room, and at the Christmas and Summer Parties.
- With a class of ~20-30 students we can ensure that every Part II gets the support and guidance necessary to allow them to get the best out of the course.
- There is a separate Part II classroom and a subject-specialist library, so you can stay in the building 24 hours a day, 7 days a week, should you choose to!
- With your research project, undertaken in the Lent Term, you are conducting your own research, working alongside graduate students and post-doctoral scientists.
- The Part II research projects are real science – some of them have contributed new findings, developed into further research, or seen publication.

more info on our website – www.gen.cam.ac.uk