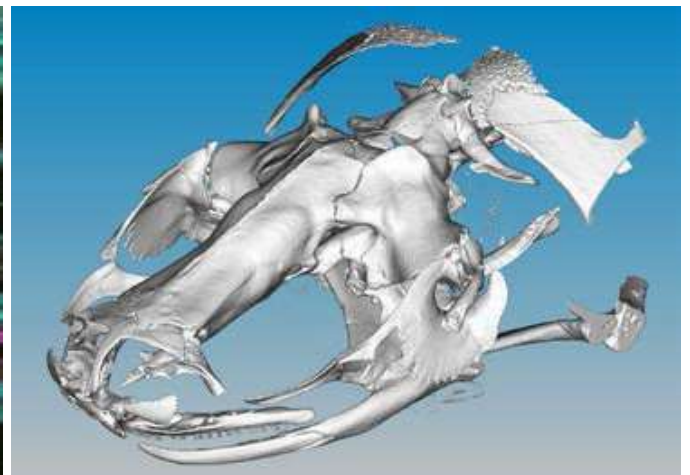
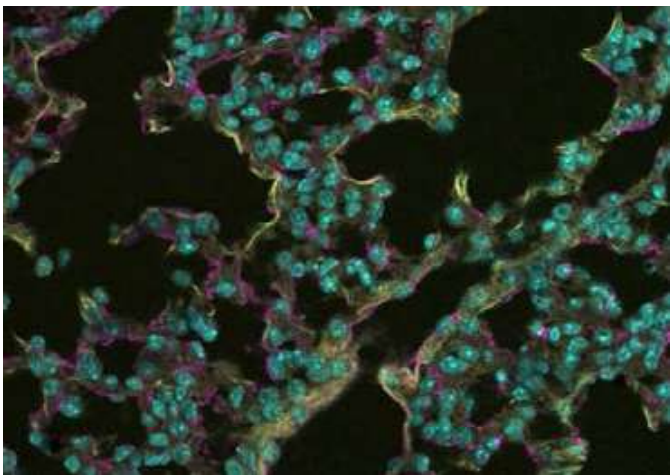
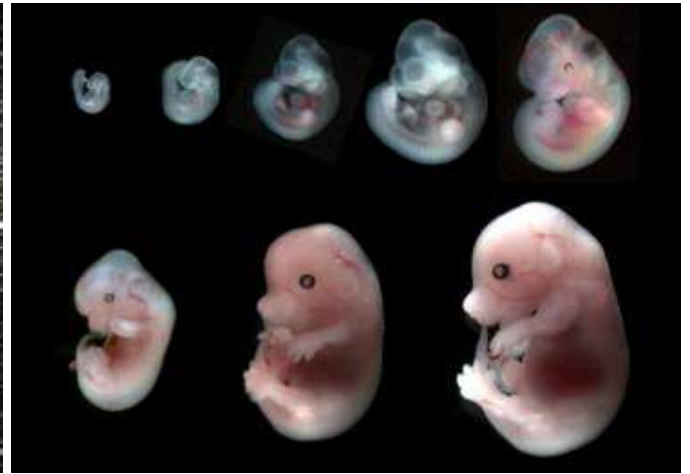
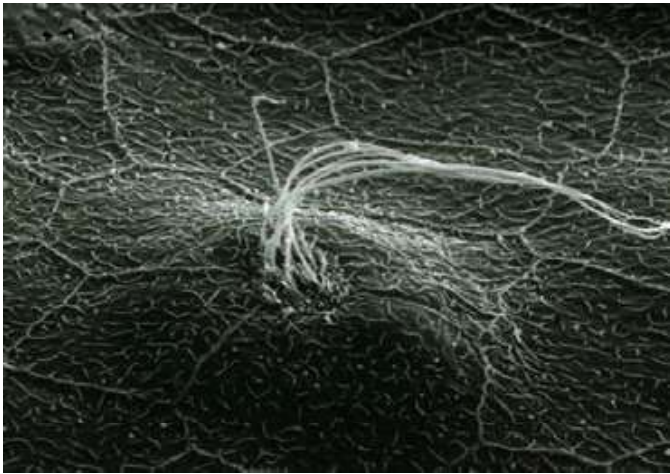




pdn part II

Department of Physiology,
Development and Neuroscience

2023 - 2024



UNIVERSITY OF
CAMBRIDGE

PART II PHYSIOLOGY, DEVELOPMENT AND NEUROSCIENCE 2023-2024

NST PART II PHYSIOLOGY, DEVELOPMENT AND NEUROSCIENCE

Course Organisers: Prof Amanda Sferruzzi-Perri & Dr Hannah Clarke (sabbatical cover TBC).

DEVELOPMENT AND REPRODUCTIVE BIOLOGY

Theme Organiser: Prof Nick Brown

INTEGRATIVE PHYSIOLOGY

Theme Organiser: Dr James Fraser

NEUROSCIENCE

Theme Organiser: Prof Angela Roberts

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<http://www.pdn.cam.ac.uk/>

Part II Physiology, Development and Neuroscience website:

<http://www.pdn.cam.ac.uk/teaching/part2/index.shtml>

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INTRODUCTION

Part II in Physiology, Development and Neuroscience offers a broad range of teaching and project opportunities covering the full spectrum of interests within the Department. Our Part II teaching is organised into modules to offer the greatest possible flexibility allowing students to design a course to match their own interests.

The Department of Physiology, Development and Neuroscience is concerned with material central to the life sciences. It addresses questions about the way that cells, tissues and organs develop and function in people and animals. Physiology, Development and Neuroscience are broad but interlinked subjects with many different areas of specialisation. A good grounding in these subjects opens the way to a wide variety of careers: these range from those where you use your knowledge directly, to those in which the understanding you will acquire of complex organisms is put to work less directly, such as in managing equally complex human organisations. The knowledge and skills gained on this Part II course will particularly provide a valuable basis for the practice of human and veterinary clinical medicine, where a critical understanding of scientific advances is essential in designing and evaluating new treatments. Many parts of the course concentrate on important research areas where recent discoveries have changed our perception of disease and have posed new questions to be answered. The fourteen modules are organised into three themes, allowing you to spend the whole of your third year studying in depth Development & Reproductive Biology, Integrative Physiology or Neuroscience. Alternatively, those of you seeking a broader overview can select to follow a more general course, combining modules across these themes.

One major benefit of studying Part II Physiology, Development and Neuroscience will be in gaining an in-depth knowledge of key core areas of the life sciences. You will also gain important knowledge and skills that graduates in any subject should these days have. These skills include:

- critically assessing information you read or hear
- keeping accurate records
- writing reports and reviews, and effectively presenting and communicating your ideas
- efficiently using libraries and information databases
- selecting appropriate statistical procedures to verify hypotheses
- using modern computer software

Teaching of the course involves most members of staff of the Department of Physiology, Development & Neuroscience and is supplemented by invited specialists from across the University, and from the Babraham Institute, Medical Research Council and Addenbrooke's and Papworth Hospitals. We also offer a growing number of modules taught in collaboration with other Departments, allowing us to call upon the broadest range of expertise within the University.

Taking Part II in Physiology, Development & Neuroscience gives you the many advantages of a home base on the Downing Site. You will immediately feel an important contributing part of the vibrant research community. The social cohesion with your fellow Part II students will be enjoyable and valuable throughout the year and your academic and other questions can be informally dealt with when you happen to meet members of staff about the Department. The Department has numerous resources available to you through the year, including a well-stocked library, where you will be able to find many of the books and journals you need in a single place. The Department also maintains computers and printers, which you will be able to access. The friendly and supportive Part II administrator will become well known to you and our tearoom, frequented by all members of the Department, further fosters cohesion.

The scope of the course

You will probably already have an overview of some or all of physiology, development and neuroscience from your Part I courses and we will therefore build upon these basics by offering an in-depth course in which we will not attempt to cover the whole of these subjects. We offer teaching on topics of current interest that we discuss to a much higher level than in Part I. This means that you can devote your time to those areas you find particularly interesting. While we expect that the majority will have done the Part IA and IB courses in physiology, neurobiology or developmental and/or reproductive biology, we will also welcome those who have done only one of these courses, as well as those who approach physiology, development and neuroscience from other directions, such as biochemistry, genetics or animal biology.

The organisation of the course

All students study 4 modules. The course offers a wide choice from fourteen modules that are described in the following pages. The modules are divided into three themes: Development & Reproductive Biology, Integrative Physiology and Neuroscience. Some students will want to study one theme; however, others enjoy the opportunity to follow a more general course, combining modules across themes. Guidance will be given by your Departmental Advisor, often a member of the staff whom you may know already as a member of your College. You will be asked to study four modules and you are given a free choice as to how you distribute those over the two terms (for example: two in Michaelmas and two in Lent or three in Michaelmas and one in Lent etc.) but be aware that some modules have restricted numbers, and some combinations are not possible (see module descriptions on page 10). In your detailed reading you will want to concentrate on the topics that particularly interest you. In the examination there will be one paper per module. Much of your formal teaching will take place during the morning, with the exception of some shared modules. Many modules also offer two or three-hour workshops, journal clubs or seminars in the afternoons. These give opportunities for a more interactive style of teaching that many students enjoy and find helpful in consolidating the lecture material. Most afternoons, during Michaelmas and Lent terms, are free for project work and private study. The Easter Term is kept largely free from formal commitments to allow time for reading and for discussion.

The Projects

All students do either an experimental research project or a theory-based project, under the supervision of an appropriate member of staff. Laboratory-based research projects are limited in number and allocation cannot be guaranteed to all students who wish to do these. The findings are written-up in the form of an 8,500-word report. You may choose the topic of your project from those provided by members of staff and will have the opportunity to discuss the projects with the relevant staff members before you submit your choices. You will also have the opportunity to present your progress to the Department as a poster presentation. The times that you work on your project can be negotiated with your supervisor to some extent so that you will have time available for other work and outside interests, but in general students are expected to spend about 16 hours a week on their project. The titles of a number of recent research projects are listed towards the end of this booklet, as are some of the publications arising from projects.

PART II PHYSIOLOGY, DEVELOPMENT AND NEUROSCIENCE: *A strategic analysis*

Our aims

- To provide a broad multidisciplinary course in Physiology, Development & Neuroscience.
- To teach you a variety of scientific skills that will equip you for future careers in a wide range of areas: health sciences (e.g., the pharmaceutical industry and environmental physiology), medicine and veterinary medicine, research in the life sciences and related disciplines, teaching, publishing and management.

How we expect to achieve them

- By offering a modular course of lectures, workshops, seminars, informal discussions and research projects, supplemented by personal contact with members of the academic staff.
- By training you in the use of practical and conceptual tools required in many sub-disciplines: from molecular biology, through membrane and cellular physiology, to the study of systems physiology and the disorders of physiology associated with disease.
- By providing constructive feedback on your progress through personal discussion and assessment of project work.

What you can expect by the end of the course

The ability to:

- Think and write critically and creatively about what you have read, learnt and discovered.
- Analyse, both qualitatively and quantitatively, data collected during research projects.
- Use available resources to conduct research into scientific problems, e.g., libraries and computer databases, together with academic and technical expertise.
- Assess and implement practical techniques necessary to solve a particular scientific problem.
- Communicate with expert and non-expert audiences through presentations, project reports and essays.

WHAT TO DO IF YOU ARE INTERESTED IN PART II PDN:

Two application forms must be completed:

1. **The Departmental Application:** If you want to take the Part II Physiology, Development and Neuroscience course it is essential that you complete an internal application form, via this Google Form: <https://forms.gle/gCSjUV6WCTeaGWKh6>
We cannot allocate a place if this form is not completed.
2. **The University Application:** Formal application to take the course must also be made to the NST Tripos Part II allocations team after consultation with your Director of Studies. Details of how to do this can be found on the Natural Sciences webpage: <https://www.natsci.tripos.cam.ac.uk/students/third/ii-subject-allocation>

You should make all Part II applications by 19th May 2023.

A copy of this brochure and the PDN application form link are also available on our Departmental website: <https://www.pdn.cam.ac.uk/undergraduate/part-ii-courses>

PART II PDN COMMON COURSES: FOR ALL PDN STUDENTS

There are some skills, which we think that everyone doing Part II PDN needs to acquire, regardless of their area of specialisation. For this reason, a number of teaching sessions open to all PDN students are offered.

Some of these sessions will be held during the orientation day before lectures begin and others will be held during the year.

Topics to be included:

- Reading and evaluating a scientific paper
- How to write a Part II essay
- Reference management
- Statistics and data analysis
- How to tackle experimental design questions
- Poster & figure making
- Project write-up guidance
- Information regarding the Part II PDN examinations

NOTE:

This booklet describing the Part II Physiology, Development and Neuroscience course was produced in late January. Some small details are likely to change. Some lecturers may change because of timetabling or leave commitments.

PART II BBS: OPTIONS IN PDN

The Part II BBS course is for students who want a course based entirely on lecture and library work, with no practical component. Students take a major subject (consisting of 4 modules) and a minor subject (1 module) and write a dissertation.

MAJOR SUBJECT 415: Physiology, Development and Neuroscience

Maximum 20 places

Course Organisers for PDN: Prof Amanda Sferruzzi-Perri (ans48@cam.ac.uk) & Dr Hannah Clarke (hfc23@cam.ac.uk) (sabbatical cover TBC)

BBS students must take 4 of the 14 PDN modules as their major subject, under the auspices of Part II PDN.

MINOR SUBJECTS

Many of the PDN modules are also offered as BBS minor subjects. Major subject 415 may be taken with any one of these minor subjects, provided that the student chooses 4 modules which are different to their minor subject, and they do not clash in the timetable.

111: Module N6 Higher Order Brain Function and Dysfunction (15 places)

138: Module N1 Developmental Neurobiology (5 places)

141: Module P1 Cellular Physiology (5 places)

142: Module P2 Development and Stem Cells (5 places)

143: Module P8 Systems and Clinical Physiology (5 places)

152: Module N3 Neuroscience: Circuits and Systems (5 places)

153: Module N4 Cellular and Molecular Neuroscience (5 places)

Major subject 415 may also be taken with:

128: Bioinformatics, run by Genetics but available as a PDN module (see pg 16 for module P5)

137: Surgical and Radiological Anatomy (SaRA), run by PDN but only as a minor BBS subject (see pg 18 for minor 137).

SUMMARY OF PART II PDN THEMES AND MODULES

Development and Reproductive Biology	Integrative Physiology	Neuroscience [§] (4 modules + Experimental approaches in brain research)
Michaelmas term		
N1 Developmental Neurobiology <i>(shared with Part II Zoology)</i> P3 Fetal and Placental Physiology P4 Early Development & Patterning: Genetic and Cellular Mechanisms <i>(shared with Part II Genetics and Zoology)</i> P9 Cell Assembly and Interactions <i>(shared with Part II Zoology)</i>	P1 Cellular Physiology P3 Fetal and Placental Physiology	N1 Developmental Neurobiology <i>(shared with Part II Zoology)</i> N3 Neuroscience: Circuits and Systems N4 Cellular and Molecular Neuroscience
Lent term		
P2 Development and Stem Cells P6 Development: Cell Differentiation & Organogenesis <i>(shared with Part II Zoology)</i> P7 Pathophysiology of Cancer	P2 Development and Stem Cells P5 Bioinformatics <i>(with Part II BBS Genetics)</i> P7 Pathophysiology of cancer P8 Systems and Clinical Physiology	N6 Higher Order Brain Function and Dysfunction N9 Modulation, Plasticity and Behaviour

§PART II PDN: THE NEUROSCIENCE THEME

Theme Organiser: Prof Angela Roberts (acr4@cam.ac.uk).

This PDN Neuroscience option is particularly designed for those students with a keen interest in research. It combines the study of specific topics in neuroscience with an exploration of the process of research itself. Acquaintance with the scientific method will not only be gained through hands on research experience in the form of a two-term research project but also through participation in a series of workshops on 'experimental approaches in brain research'. The aim is to introduce you to biomedical research (through the study of the brain) and to enable you to formulate and address your own questions about living systems from molecules to behaviour.

All Neuroscience Theme students must choose four neuroscience modules (from N1, N3-4, N6, and N9) within PDN; attend 4 out of a possible 8 workshops on experimental approaches in brain research and take a two-term lab-based project.

Neuroscience workshops: Experimental Approaches in Brain Research

These workshops have restricted numbers. All students registering for the Neuroscience Theme in Part II PDN must attend four of these workshops in addition to four modules chosen from N1, N3-4, N6, and N9. Any spaces left may be filled by students not registered for the Neuroscience theme.

Each workshop will be composed of a one-hour teaching session in which the advantages and limitations of different research techniques available to the neuroscientist will be discussed in the

context of specific neurobiological research topics (e.g. neuronal fate, information processing in neuronal networks, how the brain makes decisions, the use of optical imaging to understand cognitive maps in the hippocampus). Students will then be given the opportunity to work in groups to follow up particular questions arising from that teaching session and to present a summary and lead a discussion of the issues in student-led presentation sessions a week later. The questions may involve designing experiments (useful for answering such questions in the exam), critically reviewing a paper or comparing and contrasting research methods or results. These workshops are structured in such a way as to develop not only your intellectual abilities, but also your skills in communicating ideas effectively to others, both orally and in writing, and in working with others collaboratively. Thus, you will develop skills that are of value not only in biomedical research but in many other careers as well.

List of neuroscience workshops offered in 2022/23:

(Most of these will be repeated for the coming year)

Michaelmas Term:

Understanding neuronal networks: current progress and future promises

Dr David Parker

Understanding neuronal networks: current progress and future promises Dr David Parker
Neuronal networks (also known as circuits) assemble the cellular components needed to process sensory inputs, perform cognitive functions, and pattern motor outputs. However, despite their central role in the nervous system, our understanding of neuronal networks is limited at best. This workshop will examine the conceptual and experimental approaches to examining the organisation and function of neuronal networks, the claims of new experimental and analytical techniques, and highlighting the questions that are likely to remain given the nature of these networks.

Experimental approaches to axon guidance

Dr Geoff Cook

Experimental techniques used to characterize the mechanisms of axon guidance will be discussed and examples given of their application to specific biological systems. Those taking this workshop will be encouraged to consider the advantages and limitations of each of the experimental approaches.

Shedding light on brain function: Optogenetics and beyond

Prof Ole Paulsen

This workshop will explore new optogenetic approaches to the study of neurons and their circuit functions. We will describe the basic principles of cell-type-specific expression of light-activated channels, and how they can be used to activate or silence neurons. We will discuss the opportunities offered by this new technology, and also some possible problems and caveats.

Challenges for the social neuroscientist

Dr Simone Ferrari-Toniolo

This workshop will explore the distinct challenges that arise in neurophysiological studies of social behaviour and social cognition. In such studies, an individual animal's brain (or a neuron within that brain) is being investigated while the animal interacts with a conspecific. By looking at key papers, we will identify challenges that social experiments pose for experimental control and data

interpretation and discuss how these challenges can be overcome. We will identify novel research questions for social neuroscience and appropriate experimental designs to test them.

Lent Term:

Studying behaviour in translational neuroscience: the dos and don'ts

Dr Christian Wood & Dr Kevin Mulvihill

This workshop will consider a range of psychological tests that are available to the Behavioural Neuroscientist for studying the brain mechanisms that underlie cognition and emotion in animals. An intrinsic problem with all psychological tests is that they never just measure the one particular psychological process that you are interested in. So, how do you gain the specificity that you are looking for? Moreover, how relevant are the results in animals to our understanding of the brain mechanisms underlying human behaviour? This workshop will consider issues of specificity, sensitivity and translatability, focussing on fear and anxiety, cognitive flexibility and reward learning.

Discovering endophenotypes: the connection between genes and neuropsychiatric syndromes

Prof Jeff Dalley

This workshop will review the concept of endophenotypes in experimental Psychiatry. The notion that genes and environment combine to confer susceptibility to the development of complex, polygenic brain disorders such as schizophrenia, attention-deficit hyperactivity disorder (ADHD) and drug addiction was first proposed by Gottesman and Shields in 1973. We will explore the utility of measuring intermediate phenotypes (e.g., based on neurophysiological, biochemical, endocrinological, neuroanatomical and cognitive components) to the discovery of gene influences in brain syndromes and discuss how this approach can aid disease diagnosis and the development of animal models.

Designing behavioural neurophysiological studies

Prof Wolfram Schultz

This workshop will present a range of key experiments and consider the principal factors that go into a useful study. We will look at the constraints imposed by behaviour, electrophysiology and specific species and discuss example experiments in which these have been successfully taken into consideration. We will try to identify future appropriate research questions and techniques and assess how they differ from less promising ones.

Cutting edge tools for studying the hippocampal cognitive map

Dr Julija Krupic

This workshop will present how development of new tools such as optical imaging combined with navigation in virtual reality, specific viral targeting of individual brain regions or cell types, high density electrophysiological recordings and other techniques allows asking the most 'bold' questions in spatial cognition. As a case study we will identify 'an important research question', design an experiment and 'build' state-of-the-art experimental setups to solve it.

THE PDN COURSE MODULES

The themes to which individual modules belong are indicated as follows: (D) Development and Reproductive Biology, (P) Integrative Physiology, (N) Neuroscience.

Michaelmas Term Modules

Module N1: Developmental Neurobiology (D, N)

(Inter-departmental module with Zoology)

Module organiser: Prof. Clare Baker (cvhb1@cam.ac.uk)

This module addresses how the nervous system is assembled during embryonic development. Although we now understand a considerable amount about the processes involved, many fascinating questions remain.

We begin by discussing the formation of the vertebrate neural tube (future brain and spinal cord), and how this is patterned to generate distinct neuronal and glial cell fates in different regions, including the cerebral cortex. We also consider the evolution of the cerebral cortex. We discuss the formation of the peripheral nervous system from the migratory neural crest and cranial neurogenic placodes (good models for understanding the control of cell migration and fate-choice). Once neurons have formed, they extend axons to their targets to 'wire up' the nervous system: the process of axon guidance is considered in detail. We explore how axons make and refine the synapses that will generate functional neural circuits, and discuss how circuit designs lead to function.

This is an interdepartmental course (with Zoology), given by researchers in the Departments of PDN, Genetics, Zoology, and the MRC Laboratory of Molecular Biology.

It is best suited for students who have studied some neurobiology in Part IB, either in MedST/VetST or in NST, but others will be able to take it if they are prepared to do some background reading.

Module N3: Neuroscience: Circuits and Systems (N)

Module organiser: Dr David Parker (djp27@cam.ac.uk)

We know a lot about the brain in terms of its molecular and cellular properties, and of the role of different brain regions in behaviour. What we lack is insight into how the molecular and cellular properties interact to generate cognitive functions and behaviours. This is widely considered to be the major problem facing neuroscience, illustrated by the current billion Euro and billion Dollar projects that aim to address this question.

This module will consider this problem. It will begin by considering cellular interactions in neuronal circuits, before turning to consider how these circuits act in neural systems to generate cognitive functions and behaviours.

The module will focus on various aspects of conceptual and experimental approaches to circuit/system understanding. Lectures will start with an introduction to neural circuits/systems and their analysis. This will be followed by consideration of connectomic analyses of neural circuits underlying sensory and motor function in *Drosophila*. Lectures will then focus on neural circuits underlying reproductive functions in mammals and cerebellum circuits that influence

motor learning and behaviour. Neural systems will then be considered, with lectures on visual system pathways and the role of the vestibular system in perception and spatial navigation. The module will finish with an introduction to artificial neural networks and their role in system and circuit understanding.

The module will include interactive discussions on general features of circuit/system functions and their analysis. This will include the relative merits of experimental approaches (e.g., imaging compared to electrophysiology, will the 'photon replace the electron'; the relative merits of experimental and computational analyses; and ultimately how can we link neuronal, circuit, and system function.

This module complements any of the neuroscience modules. P1 provides complementary cellular detail, and P8 a complementary systems perspective.

Module N4: Cellular and Molecular Neuroscience (N)

Module organiser: Prof Ole Paulsen (op210@cam.ac.uk)

This module **cannot** be taken with Cellular Physiology (P1)

While many approaches can be used to study the structure and function of nervous systems, any deep mechanistic understanding must include an appreciation of the cellular properties of different types of neurons and glia, as well as their interactions and the molecules involved. This module aims to give students an understanding of important principles in contemporary neuroscience at cellular and molecular levels. The lectures will cover voltage-dependent ion channels and their role in electrical signalling, ligand-gated ion channels and their role in synaptic transmission, intracellular signalling in neuromodulation and synaptic plasticity, sensory transduction mechanisms, and cellular techniques applied to circuit neuroscience.

This module aims to provide insights that will be useful in the other PDN neuroscience modules. N4 compliments any of the other neuroscience Modules.

Module P1: Cellular Physiology (P)

Module organiser: Dr Christof Schwiening (cjs30@cam.ac.uk)

This module **cannot** be taken with Cellular and Molecular Neuroscience (N4) or Early Development & Patterning: Genetic and Cellular Mechanisms (P4).

Cells detect and respond to changes in their external environment through a cornucopia of signalling pathways. Many of the pathways involve complex biochemical reactions, but some are more amenable to study by the physiologist – in particular membrane potential, calcium and pH. Thus, in this module we look at cellular signalling from a Physiological viewpoint rather than 'stamp collecting' all of the signalling pathways. The three main signalling mechanisms we have selected here are used by both excitable and in-excitable cells to transmit information from the cell surface to effector systems. We start the module by looking at the basic ionic regulation mechanisms that allow signalling to exist including sodium and calcium regulation. We then move to looking at the ion channels that allow calcium into cells. This is followed by a series of lectures on intracellular calcium signalling.

This year we are including a lecture on endoplasmic reticulum interactions with the mitochondria which can sculpt calcium signals. The calcium signals also result in pH microdomains, which are also potential intracellular 'second' messengers. We then focus on the membrane and consider

how ligands can result in potential changes and how these potential changes can be modified by signalling pathways. We end the series of lectures by bringing together membrane potential changes and calcium signalling with lectures on skeletal muscle and meta plasticity.

The module contains a series of workshop/seminars on mathematical modelling, molecular techniques, fluorescence measurements and microelectrode techniques.

Module P3: Fetal and Placental Physiology (D, P)

Module organiser: Prof Dino Giussani (dag26@cam.ac.uk)

The study of the fetus and placenta is a unique aspect of physiology with relevance for basic and clinical sciences. This module will explore a wide range of topics, including the normal development of the fetus and placenta, adaptations to the intrauterine environment, responses to challenges in utero, mechanisms of parturition and the transition at birth. The scientific basis underlying the aetiology of miscarriage, preeclampsia and sudden infant death syndrome, and the consequences of prematurity, maternal obesity and intrauterine growth retardation will be discussed.

In addition, the course will give insight to current ideas on the developmental programming of health and disease.

Modules that compliment P3 are: P2 for a developmental focus, P4/ P6 for students interested in cellular/morphological changes and P7/P8 for a wider physiology or pathophysiology theme.

Module P4: Early Development & Patterning: Genetic and Cellular Mechanisms (D)

(Inter-departmental module with Genetics and Zoology)

Module organiser: Dr Richard Adams (rja46@cam.ac.uk)

This module **cannot** be taken with Cellular Physiology (P1).

This newly updated course is the first of two complementary modules (with P6), which can also be taken on their own. The module works well in combination with all other PDN modules.

This module will cover how the early embryo develops from a fertilized egg to form the body plan. It will focus on our understanding of how gene regulatory and signalling interactions drive cell fate decision making within cells and combine this with our understand of how dynamic cell behaviours drive the shaping of tissues through morphogenesis. You will therefore learn about the key principles of embryonic development, taking examples from a range of early developmental events such as cell fate determination, germline development, gastrulation, segmentation, and somitogenesis in both invertebrate and vertebrate systems. In doing so, you will also be introduced to a range of modern techniques applicable to the study of development including molecular, genetic and imaging technologies.

An emphasis across the module is in comparing the mechanisms across a broad range of experimental organisms and processes, in order to highlight the essential principles of developmental biology.

This interdepartmental course (with Genetics and Zoology) will consist of three lectures per week.

Module P9: Cell Assembly and Interactions (D)

(Inter-departmental module with Zoology)

Module organiser: Dr Milka Sarris (ms543@cam.ac.uk)

Cells are highly organised and dynamic structures. In this module we will explore how the architecture of the cell is constructed and how cells interact with each other and their environment in order to fulfil their myriad roles in animals. Our current knowledge of these vital topics will be presented in depth, with a focus on the molecular mechanisms that regulate cell behaviour. We examine how cells use basic cell biological mechanisms in their complex activities within animals, including cellular behaviour during development and how cellular activities provide key physiological functions in the adult.

We study how cells become polarized and adhere together to form higher order multicellular assemblies, how membrane compartments are constructed, and the dynamics of transfer between them. We will discuss current ideas about how cells were created during evolution, and how eukaryotic cells arose from prokaryotes. We will explore how cells sense and respond to the mechanical properties of their surroundings and the key role of the cytoskeleton in determining cell shape, organisation and movement.

We switch focus to the nucleus and how the genome architecture determines gene expression and discuss how cells maintain protein homeostasis, and the important process of autophagy in cellular physiology.

Thus, we provide a comprehensive picture of different fundamental cellular processes and introduce a broad range of techniques to visualise and study these processes in live cells, in vitro and in intact animals.

This is an interdepartmental course (with Zoology). In addition to lectures there are several interactive sessions (such as journal clubs) in which there will be discussions of key papers, experimental techniques and major concepts in the field. P9 works well with the other 'Developmental and Reproductive Biology ('D') Theme' modules.

Lent Term Modules

Module N6: Higher Order Function and Dysfunction (N)

Module organiser: Prof Angela Roberts (acr4@cam.ac.uk)

This module considers the neurobiological basis of a range of higher-order functions in the brain including (i) perception, recognition and decision making in the visual domain, (ii) spatial navigation, long term memory and cognitive map theory and (iii) positive and negative emotions and their regulation. These are the product primarily of the functioning of high-order association cortices found in the temporal and frontal lobes. They will be discussed in relation to findings from a range of experimental approaches in humans and animals including non-human primates and rodents.

Vision is a main source of information for primates, and our life greatly depends on the ability to recognise behaviourally relevant objects. This section will consider how a visual input is analysed to detect objects including faces, and how such information can be memorised and recalled to guide our behaviour. It will consider how the physical shape of an object is analysed along the ventral visual stream to create a neuronal representation of the object independent of angle and size in viewing; how memorised objects are represented by neurons in medial temporal lobe; how these memories can be recalled through local processing as well as global interaction of brain regions and how new information can be stored in the brain as detectable changes within specific neurons.

In considering navigation and long-term memory, a particular focus will be placed on the important role of the hippocampal formation. Evidence for the hippocampus as a cognitive map will be critically reviewed along with its role in encoding spatial and non-spatial representations. This section will finish by considering the crucial role of the hippocampus in Alzheimer's disease, which is the most common cause of dementia, causing the most profound deficits in long term memory.

Finally, the circuits involved in both the regulation and dysregulation of positive and negative emotion will be described. Emphasis will be placed on the contribution the prefrontal cortex makes to the top down regulation of subcortical circuits known to induce appetitive approach and negative avoidance behaviour. Throughout this module use of state-of-the-art technology to measure and intervene in brain function will be highlighted alongside the translational potential of studies in animals to inform our understanding of higher-order functions and dysfunctions in humans.

This Module works best when taken with any of the other neuroscience Modules.

Module N9: Modulation, Plasticity, and Behaviour (N)

Module organiser: Dr Sue Jones (sj251@cam.ac.uk)

This module **cannot** be taken with Systems and Clinical Physiology (P8)

A fascinating feature of the nervous system is neuronal plasticity: the ability for neurons and their connections to be modified in response to specific patterns of activity in an ever-changing external or internal environment. Alongside neuronal plasticity, the modulatory effects of neurochemicals provide additional flexibility in the response repertoire of neurons. In the mature mammalian brain,

neuronal plasticity and modulation enables complex neural networks to remain dynamic and adaptive.

Two key questions in modern neuroscience are: what are the mechanisms of neuronal plasticity, and how do neuronal plasticity and modulation contribute to behaviour? This module will focus on both of these questions, and will explore examples of plasticity and modulation in defined neuronal systems, ranging from endocrine modulation of hypothalamic circuits in the context of sexual maturation and behaviour, to the plasticity of neurons in brain reward pathways and how this is hijacked by drugs of abuse, and the neuronal plasticity in sensory, motor and cognitive networks. Contemporary as well as traditional research methods for investigating neuronal plasticity and modulation will be considered, including opto- and chemogenetic approaches, imaging and electrophysiology. The first lecture will include an introduction to different forms of cellular and synaptic plasticity and modulation.

This Module works best when taken with any of the other neuroscience Modules.

Module P2: Development and Stem Cells: Embryonic and Extra-embryonic Tissues (D, P)

Module organisers: Dr Erica Watson (edw23@cam.ac.uk) and Prof Magda Zernicka-Goetz (mz205@cam.ac.uk)

The transformation of a fertilised egg into a human embryo encompasses a series of fundamental cellular events. During this process the initial totipotent egg generates stem cells that, progressively become restricted to different fates. The first differentiation event is a separation between extra-embryonic trophoctoderm and the pluripotent inner cell mass, and the second, within the inner cell mass, between the embryonic epiblast and the extra-embryonic primitive endoderm. In this module we will explore how these cell fate decisions are taken and what stem cell niches, transcriptional networks, and epigenetic modifications reinforce them. We will explore how we can build embryo ourselves using stem cells growing in vitro. We will also consider subsequent formation and functions of the extra-embryonic lineages, and how interactions between the trophoctoderm and the maternal tissues and metabolism lead to implantation and establishment of a successful pregnancy.

The module will start by examining the development of cell polarisation and the effects of subsequent symmetrical and asymmetrical cell division and cell position in creating unique cell populations in the mouse and human embryos. The subsequent differentiation of the inner cell mass, the concept of embryonic stem cells and their therapeutic potential in regenerative medicine will then be explored, with comparisons being made between the mouse and human. We will then investigate how the extra-embryonic lineages interact with the maternal tissues to establish a human pregnancy. This will include consideration of endometrial receptivity, implantation, decidualisation and the factors that regulate trophoblast development, including interactions with the maternal immune system, metabolism, and microbiome. Correlates will be drawn between normal pregnancies and the common complications, including miscarriage and preeclampsia, in which extra-embryonic tissue formation and function is impaired.

The technologies that researchers use in the lab to study mammalian development will be touched upon including: stem cell derivation, synthetic embryos, organoids, epigenome analysis, and animal models. The module will involve a mix of lectures and journal clubs.

Useful combination modules include: P3 Fetal and placental physiology (M), P4 Early Development & Patterning: Genetic and Cellular Mechanisms (M), P6 Development: Cell differentiation and organogenesis (L).

Module P5: Bioinformatics (P)

maximum of 46 students

Module organiser: Dr Alexia Cardona (ac812@cam.ac.uk)

(Inter-departmental module by Dept. of Genetics)

Bioinformatics is an interdisciplinary field that uses computational approaches to process biological data. With the biological and biomedical sciences becoming more data-driven than ever before, bioinformatics is central to these areas. The Bioinformatics module introduces the fundamental bioinformatic concepts and methodologies used to analyse biological data. It is structured around 2 main blocks: data science, omics and approaches to analysis of biological data.

The course is specially designed for students coming from the biological and biomedical sciences. It provides introductory data foundation sessions that introduce students to programming, data visualisation and manipulation skills that will be used throughout the course. Topics are introduced through a set of lectures that introduce theoretical concepts, and practicals which provide hands-on practice using real biological datasets.

More information can be found at <https://bioinfotraining.bio.cam.ac.uk/undergraduate>

Module P6: Development: Cell Differentiation and Organogenesis (D)

(Inter-departmental module with Zoology)

Module organiser: Dr Emma Rawlins (elr21@cam.ac.uk)

This course is the second of two complementary Developmental Biology modules (with P4) that can also be taken on their own. This module examines a second phase of embryonic development, following the initial steps of defining axes, major cell layers, and broad pattern domains (covered in P4). P6 works well with any of the other developmental and cell biology modules, particularly P2, P4 and P9.

A series of topics will be presented, each using particular tissues or organs to highlight individual developmental mechanisms. Thus, the diverse mechanisms to make tubular organs will be used to highlight the importance of cell polarity and cell shape changes, and used as a framework for discussing key techniques in the study of developmental biology; the development of muscles will be used to discuss the transcriptional programmes that drive differentiation, and to highlight different strategies used to generate the pattern of muscles in the body; the importance of stem cells in the formation and maintenance of organs will be discussed using a variety of examples, including oesophagus and intestine; the formation of the vertebral column illuminates mechanisms of cell allocation and morphogenesis, including the role of mechanics; and limb development illustrates how patterning mechanisms are coordinated with cell proliferation.

A mixture of examples from simpler invertebrate models and vertebrates will show how developmental mechanisms have diversified with increasing cell number. We will discuss human diseases that impact on the development of these organs, and how our understanding of organogenesis provides the foundation for regenerative medicine approaches to the treatment of these diseases.

This interdepartmental course (with Zoology) will consist of three lectures per week, and seven interactive sessions (such as journal clubs) in which we will aim to discuss key references and the concepts presented in the lectures.

Module P7: Pathophysiology of Cancer (D, P)

Module organisers: Prof Randall Johnson (rsj33@cam.ac.uk) and Dr Hugh Robinson (hpcr@cam.ac.uk)

We will examine cancer and malignant progression of solid tumours as examples of how to integrate a physiological approach to disease, giving consideration to modern genetic tools and techniques as well as to the unique physiological challenges of malignancy. We will also discuss how this impacts therapeutic choices and drug development. Consideration will be given to how research on pathophysiology is influenced by modern understandings of systems biology and physiology. The course will include lectures and journal club discussions of selected relevant articles. The course is suited to both NST and MVST students and works well with all other modules.

Module P8: Systems and Clinical Physiology (P)

Module organiser: Dr Stewart Sage (sos10@cam.ac.uk)

This module **cannot** be taken with Modulation, Plasticity and Behaviour (N9)

Systems physiology is central to the practice of scientific medicine. This module gives students a more detailed view of some aspects of systems physiology and includes some clinically oriented material that is of particular importance to the practising doctor. Cardiovascular topics include cardiac arrhythmias and the genetics and energetics of heart failure. Renal physiology covers autoregulation of renal blood flow and glomerular filtration rate, acute kidney injury and chronic renal failure. Several areas of endocrine physiology are explored in the form of pancreatic islet and gut hormones, brain control of food intake, the pathophysiology of obesity and the physiology and pathophysiology of bone.

The lecturers giving this course are from the Department of Medicine and the Institute of Metabolic Science as well as PDN.

This module is reasonably self-contained and can be taken in combination with any other modules. There is a small amount of overlap with some of the material covered in other P modules, including P1, P3 and P7, but it is not necessary to take any of these modules in order to understand the material in P8.

PDN MODULE FOR BBS STUDENTS ONLY

Minor 137: Surgical and Radiological Anatomy

Maximum of 24 students

Organisers: Dr Cecilia Brassett (hacteaching@pdn.cam.ac.uk)

This course introduces students to areas of anatomy that are especially relevant to surgical and radiological procedures. The need for a good working knowledge of anatomy in surgical and radiological practice is of course paramount in clinical safety. Applicants for Core Surgical Training and Specialty Radiology Training may improve their scores in the “Experience in and commitment to specialty” component by having chosen to take a relevant module such as this course. Students also choose one practical activity from the following options: attendance at operating theatre sessions; diagnostic and/or interventional radiology session; or preparation of an anatomical prosection. Assessment includes a 1-hour Short Answer Questions paper, a short written report and oral presentation on the practical session. Lecturers are current consultant radiologists and surgeons.

Further details can be found in the Surgical and Radiological Anatomy Course Booklet:
https://www.biology.cam.ac.uk/files/sara_booklet_2023-24_updated_02.02.23.pdf

SOME TOPICS OF RECENT RESEARCH PROJECTS

Two-term Experimental Projects 2022-23	
Supervisor	Experimental Project Title
Allan Herbison, Shel Yeo	Assessment of hypothalamic dynorphin neurons across estrous cycle of female mice
Amanda Sferruzzi-Perri, Cindy Zhang	Interaction of maternal obesity and inflammation in determining pregnancy outcomes
Andrew Murray	Mitochondrial respiration and whole-body metabolism in metabolic syndrome
Andrew Murray	Amylin as a driver of mitochondrial dysfunction in metabolic disease-associated dementia
Asma Soltani, Ole Paulsen	Restoring network activity with chemogenetic suppression of inhibitory interneurons in a mouse model of Rett Syndrome and Autism
Cecilia Brassett, Andrew Grainger	Investigation of the relationship between the latissimus dorsi muscle and the scapula by cadaveric dissection and ultrasound scanning
Cecilia Brassett, John Dowell, Harry Lyall	Investigation of the musculotendinous junction of the latissimus dorsi and the thoracolumbar fascia
Cecilia Brassett, Jonathan Brown	Investigation of the oesophagogastric junction by dissection of cadaveric specimens and observations of endoscopic video recordings
Christof Schwiening	Projects based on the use of human blood flow and ECG to study blood pressure/sympathetic activity (x2)
Christof Schwiening	Does equal absolute aerobic training stress produce equal absolute performance in females and males?
Christof Schwiening, Ole Paulsen, Yin Yuan	Testing a role for pH transients in vesicle release in neuronal primary cultures
Claire Senner	Regulation of Long Non-Coding RNAs by the Nonsense Mediated Decay Pathway
Claire Senner	Investigating the role of nonsense mediated decay in embryonic stem cell differentiation
Clare Baker	Insights into vertebrate sensory cell-type development and evolution from studying electroreceptor development in weakly electric teleost fish embryos
Courtney Hanna	A role for epigenetic modifier KMT2B in placental development
Courtney Hanna, Georgia Lea	Characterising DNMT3B knockout trophoblast stem cells
David Keays, Thomas Cushion	Modelling cortical malformations with human stem cells
Dino Giussani	Embryonic Origins of Heart Disease in a Model of Obstructive Sleep Apnoea During Pregnancy
Elisa Galliano	Sensory deprivation in the olfactory system
Emma Rawlins, Lucia Cabriaes	Fabrication of a microfluidic device to investigate the role of mechanical stimuli in lung epithelial morphogenesis
Ewa Paluch, William Foster	Investigating the Mechanisms of Mammalian Primordial Germ Cell Migration
Hugh Matthews	Modulation of the stretch reflex in athletes
Hugh Matthews, Chris Huang	The role of miR-21-5p in embryonic origins of cardiovascular disease
Jorge Lopez-Tello, Amanda Sferruzzi-Perri	Decoding the importance of placental hormones in determining maternal metabolic health during lactation
Kristian Franze, Sudipta Mukherjee	Investigating the effect of tissue mechanics on FGF signalling in the developing Xenopus brain
Lakshmi Balasubramaniam	Migratory effect of extraembryonic tissue during avian embryo development
Magdalena Zernicka-Goetz, Carlos Gantner, Bailey Weatherbee	Investigating implantation potential of combined human stem cell-derived embryos

Amanda Sferruzzi-Perri, Jonas Zaugg	Impacts of parental obesity in determining pregnancy outcomes
Mekayla Storer	Investigating the role of the nail in mediating regenerative potential in the mammalian digit tip
Milka Sarris	Spatiotemporal control of inflammation through optogenetics
Ole Paulsen, Tanja Fuchsberger	Effects of dopamine on protein synthesis in hippocampal slices
Ole Paulsen, Tanja Fuchsberger, Rich Turner	Correlation of Ab Burden to Early Deficits in Hippocampal Activity in the AppNL-G-F Mouse Model of Alzheimer's Disease
Sarah Bray, Prachi Richa	Investigating the relationship between Notch signalling and neural stem cell delamination during early neurogenesis
Srinjan Basu	Mammalian embryo development: towards a single-molecule perspective
Sumru Bayin	Characterization of injury response in the adult cerebellum

Two-term Theory Projects 2022-2023	
Supervisor	Theory Project Title
Alison Forhead	Control of pancreatic beta-cell mass by glucocorticoids in the ovine fetus
Angela Roberts, Kevin Mulvihill	Computational project: Investigating the behavioural and physiological indices of affective bias in non-human primates with a focus on the causal role of the vmPFC
Angela Roberts, Stephen Sawiak	Development of resting-state functional MRI networks in a non-human primate
David Bainbridge	Can the biological processes underlying menopause be reversed?
David Bainbridge	Literature based project: Did the human hand evolve for manipulation, or violence?
David Bainbridge	Literature based project: Do the fetus' attempts to avoid maternal immune rejection increase the risk of fetoplacental infection?
David Parker	Causality in neuroscience
Eleanor Raffan	From GWAS to function – interrogation of obesity-associated genetic loci by analysis of DNA sequencing, gene expression and multi-species comparisons
Hannah Clarke	Behavioural and sleep disturbances in a primate model of schizophrenia
James Fraser	Computer modelling of muscle velocity recovery cycles
Jasper Poort	The neuronal pathways that underlie visual detection and discrimination
Nick Brown, Helen Attrill	Computational project: How many transmembrane transporters are needed to make a multicellular organism?
Riccardo Beltramo	Visual pathways for spatial navigation
Richard Adams	3D computer graphics for Neuroanatomy Teaching
Steve Edgley	Literature based project: Skeletomotor conditioning

BBS Dissertations 2022-2023	
Supervisor	Dissertation Title
Alison Forhead	Role of exosomes in maternal-feral communication
Alison Forhead	A time to be born: prevention of preterm delivery (x3)
Alison Forhead	The male disadvantage: sex differences in fetal development and responses to stress
Andrew Murray	Metabokines and lipokines - new perspectives on interorgan signaling
Angie Fleming	Whether Alzheimer's disease is predominantly caused by defects in microglia/astrocytes rather than neurons
Asma Soltani	Rett syndrome: Avenues for Potential Treatments
Brian Hendrich	How can stem cell therapy potentially be used to treat neurodegenerative disorders, such as Alzheimer's and Parkinson's disease?
Christof Schwiening	What triggers vesicle release: is it all calcium?
Clare Buckley	Titles related to the cellular mechanisms by which secondary neurulation occurs, the techniques used to study this and why there is a high incidence of neural tube defects at the interface between primary and secondary neurulation.
Courtney Hanna	A role for DNA methylation in regulating gene expression in placental development
David Parker	To what extent are psychopharmacology and cognitive enhancement informed by our current understanding of the chemical environment of the CNS?
David Parker	Why are there so many neurotransmitters?
Eleanor Raffan	Neuroscience of obesity, gene-environment interactions in obesity and other diseases (x2)
Erica Watson	Can risk of autism spectrum disorders be attributed to folate status during pregnancy?
Erica Watson	Discuss the influence of maternal and placental factors on fetal pancreas development and function.
Erica Watson	The role of one-carbon metabolites in In-Vitro Fertilisation or 11. Investigating the existence of a placenta-kidney axis
Hugh Robinson	Targeting calcium channels in cancer
Jenny Morton	Delirium
Julija Krupic	How different types of non-spatial stimuli are represented in the hippocampus
Matt Mason	What is the function of the tensor tympani muscle?
Nick Brown	Bodybuilding and mechanotransduction mechanisms
Steve Edgley	Can we link empirical evidence for synaptic plasticity and neural regeneration to motor function
Steve Edgley	Does the cerebellum contribute to autonomic regulation?

RECENT PUBLICATIONS RESULTING FROM PART II RESEARCH PROJECTS

Recent published papers resulting from, or including work from, Part II projects (with student's name in bold):

Adeniji, M., Lopez-Ruiz, A.M., Jarvis, G., Brassett, C. & Chitnavis, J. (2021). Mapping the genicular arteries in MRI scans of the knee. *Clinical Anatomy*, DOI: 10.1002/ca.23819.

Ahmed, S., Marton, A., Jarvis, G., Brassett, C. & Grant, I. (2021). A novel method for mapping the location of the digital branches of the ulnar nerve in human cadaveric hands. *Journal of Anatomy*, 238:190-191.

Ahmed, S., Marton, A., Jarvis, G., Brassett, C. & Grant, I. (2021). A cadaveric study of the intra-fascicular anatomy of the ulnar nerve in the palm and forearm. *Journal of Anatomy*, 238:207-208.

Batavanis, M.A., Marway, P., Brassett, C. & Adams, R. (2022). Developing a digital 3D model of the middle ear from micro-CT scans for anatomy teaching. *Clinical Anatomy*, DOI: 10.1002/ca.23836.

Bearblock, E., Aiken, C.E. and Burton, G.J. (2021). Air pollution and pre-eclampsia; associations and potential mechanisms. *Placenta*, 104, 188-194.

Bonshahi, A., Brassett, C. & Sherman, K. (2021) Unreported variants of cutaneous innervation at the medial elbow in cadaveric dissections. *Clinical Anatomy*, DOI: 10.1002/ca.23819,

Bonshahi, A., Biyani, G., Sardesai, N., Brassett, C., Sherman, K. & Sardesai, A. (2021). Ultrasonographic visualisation of anatomical variation of the medial cutaneous nerve of the forearm and its depiction by the novel use of custom computer program to generate 2D diagrams. *Regional Anaesthesia & Pain Medicine*, 46(2):182-183.

Devin, J., Brassett, C., Whitaker, R. & Jarvis, G. (2021) How might different passive ureteric features contribute to vesicoureteral reflux? *Clinical Anatomy*, DOI: 10.1002/ca.23819.

Galea, K. (2021). Is there a valid ethical objection to the clinical use of in vitro-derived gametes? *Reproduction and Fertility*, 2(4), S5-S8.

Garrud, T.A.C., Teulings, N., Niu Y., Skeffington, K.L., Beck, C., Itani, N., **Conlon, F.G.**, Botting, K.J., Nicholas, L.M., **Tong, W.**, Derks, J.B., Ozanne, S.E. & Giussani, D.A. (2022). Molecular mechanisms mediating differential effects of dexamethasone and betamethasone on the developing cardiovascular system. *Nature Cardiovascular Research*. Submitted.

Georgantzoglou, A., **Matthews, J.** & Sarris, M. (2021). Neutrophil motion in numbers: How to analyse complex migration patterns. *National Library of Medicine*, DOI 10.1016/j.cdev.2021.203734.

Grant, I., Giussani, D.A. & Aiken, C.E. (2021). Blood pressure and hypertensive disorders of pregnancy at high altitude: A systematic review and meta-analysis. *Am J Obstet Gynecol MFM* 3(5):100400.

Han S.Y, Morris P.G, Kim J.C, **Guru S**, Pardo-Navarro M, Yeo S-H, McQuillan H.J, Herbison A.E (2022) Mechanism of kisspeptin neuron synchronization for pulsatile hormone secretion in male mice. *Cell Reports in press*

Hay Y.A, Deperrois N., Fuchsberger T., **Quarrell T.M, Koerling A-L.**, Paulsen O., (2021) Thalamus mediates neocortical Down state transition via GABAB-receptor-targeting interneurons. *Neuron* DOI: 10.1016/j.neuron.2021.06.030

Hansell, J.A., Richter, H.G., Camm, E.J., Herrera, E.A., Blanco, C.E., Villamor, E., Patey, O.V., Lock, M.C., Trafford, A.W., Galli, G.L.J. & Giussani, D.A. (2021). Maternal melatonin: Effective intervention against developmental programming of cardiovascular dysfunction in adult offspring of complicated pregnancy. *J Pineal Res.* e12766.

- James, K., Brough, T.,** Jarvis, G., Brassett, C. & Jenner, J. (2021). The supraserratus bursa and accessory muscle from serratus anterior to the second rib: potential sites for scapular pain. *Journal of Anatomy*, 238:205.
- Lakshman, R.,** Spiroski, A.M., McIver, L.B., Murphy, M.P. & Giussani, D.A. (2021). Noninvasive Biomarkers for Cardiovascular Dysfunction Programmed in Male Offspring of Adverse Pregnancy. *Hypertension* 78(6), 1818-1828.
- Lam, J., Wilkinson, J.,** Brown, J., Spear, M. & Brassett, C. (2021). Exploration of colonic looping patterns in undisturbed cadaveric specimens. *Clinical Anatomy*, **34(7)**, 1016-1021.
- Lambden, S., Cowburn, A.S., Macias, D., **Garrud, T.A.C.,** Krause, B.J., Giussani, D.A., Summers, C., Johnson, R.S. (2021). Endothelial cell regulation of systemic haemodynamics and metabolism acts through the HIF transcription factors. *Intensive Care Med Exp.* 9(1), 28.
- Lim, A., Biosse-Duplan, G.,** Gregory, A., Mahbubani, K., Riche, F., Jarvis, G., Brassett, C. & Scott, J. (2021) Studying tibial weight bearing before and after a fibular osteotomy in cadaveric specimens. *Clinical Anatomy*, DOI: 10.1002/ca.23819.
- Lim, A., Biosse-Duplan, G.,** Gregory, A., Mahbubani, K., Riche, F., Brassett, C. & Scott, J. (2022) Optimal location for fibular osteotomy to provide maximal compression to the tibia in the management of delayed union and hypertrophic non-union of the fibia. *Injury* 53(4), 1532-1538.
- Lloyd-Davies, C.,** Collins, S.L., Burton, G.J. (2021). Understanding the uterine artery Doppler waveform and its relationship to spiral artery remodelling. *Placenta* 105, 78-84.
- Lopez-Ruiz, A.M., Adeniji, M.,** Jarvis, G., Brassett, C. & Chitnavis, J. (2021). A novel approach: use of MRI scans to investigate the anatomical distribution of the vasculature of the patella. *Clinical Anatomy*, DOI: 10.1002/ca.23819.
- Lopez-Tello J, Jimenez-Martinez MA, Salazar-Petres E, **Patel R,** George AL, Kay RG, Sferruzzi-Perri AN (2022) Physiological changes in the mouse renal system in response to pregnancy. *Int. J. Mol. Sci.*23: 6287.
- Liu SX,** Matthews HR & Huang CL-H (2021). Sarcoplasmic reticular Ca²⁺-ATPase inhibition paradoxically upregulates murine skeletal muscle Na^v 1.4 function. *Scientific Reports* **11**, 2846.
- Maghsoudi, D., West, C.,** Brassett, C. & Chitnavis, J. (2022) Are there common intraosseous patterns of vascularity in the knee? *Clinical Anatomy*, DOI: 10.1002/ca.23836
- Manoharan, S.M.,** Gray, R., Hamilton, J. & Mason, M.J. (2022) Internal vascular channel architecture in human auditory ossicles. *Journal of Anatomy* 241:245-258.
- Mohideen, F.,** El-Khoury, M., Mouritsen-Luxhøj, C., Townend, R., **Choo, A., Wong, E.,** Jarvis, G., Gregory, A., Brown, J., & Brassett, C. (2022) Morphological analysis of the ileocaecal junction and associated clinical implications. *Clinical Anatomy*, DOI:10.1002/ca.23836.
- Patel, S., Sutharson, M.,** Brown, J. & Brassett, C. (2021). Morphological associations between the major duodenal papilla and the safety and efficacy of sphincterotomy in humans. *Journal of Anatomy*, 238:190.
- Smith, A.,** Brassett, C., Gooding, C., Abood, A. & Norrish, A. (2021) The optimal muscle flap for interposition myoplasty after hip joint excision arthroplasty: vastus lateralis or rectus femoris? *Clinical Anatomy*, DOI: 10.1002/ca.23819.
- Smith, A.,** Brassett, C., Gooding, C., Abood, A. & Norrish, A. (2022) Vastus lateralis versus rectus femoris muscle flaps for recalcitrant hip joint infection: An anatomical study comparing the effectiveness of acetabular dead space control. *Clinical Anatomy*, 35(7), 961-973.

Sumal, A.S., Jarvis, G., Norrish, A.R., Brassett, C. & Whitaker, R.H. (2021). The role of the angle of the fibularis longus tendon in foot arch support. *Clinical Anatomy*, 34(4), 651-658.

Thirunavukarasu, A.J., Ferro, A., Sardesai, A., Biyani, G., Dubb, S.S., Brassett, C. & Hamilton, D. (2021). Temporomandibular joint anatomy: Ultrasonographic appearances and sexual dimorphism. *Clinical Anatomy*, 34(7), 1043-1049.

West, C., Maghsoudi, D., Wilson, B., Jarvis, G., Brassett, C. & Chitnavis, J. (2022). Detailing vasculature of the infrapatellar fat pad and implications for knee surgery. *Clinical Anatomy*, DOI: 10.1002/ca.23836.

Wilkinson, A., Menelaou, K., Rakoczy, J., **Tan, X.S.** & Watson, E.D. (2021) Disruption of Folate Metabolism Causes Poor Alignment and Spacing of Mouse Conceptuses for Multiple Generations. *Frontiers in Cell and Developmental Biology* (9). DOI:10.3389/fcell.2021.723978

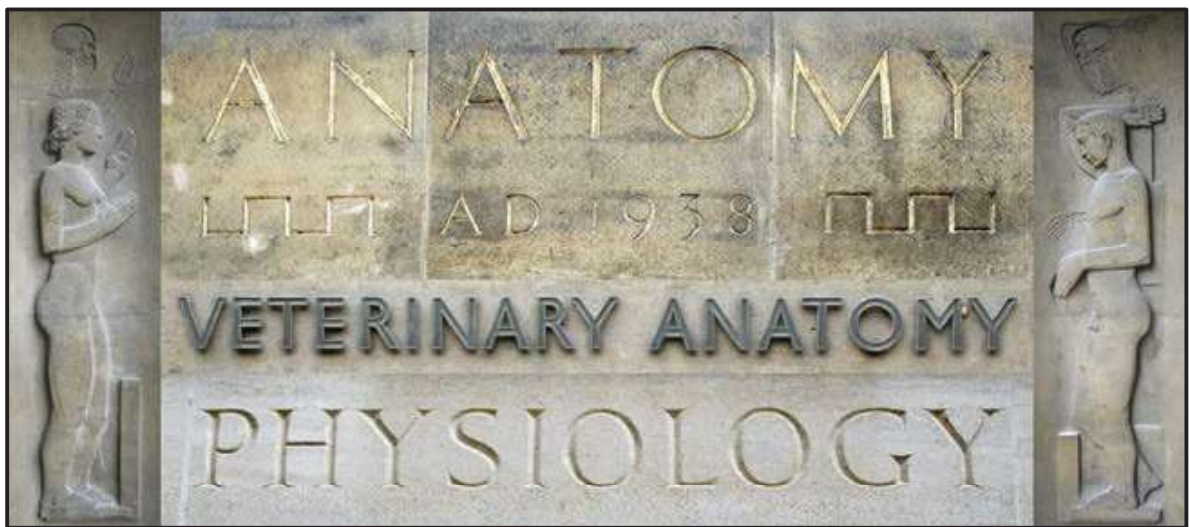
Yutong Chen, Dylan Siriwardena, Christopher Penfold, Adam Pavlinek, and Thorsten E. Boroviak (2021). An integrated atlas of human placental development delineates essential regulators of trophoblast stem cells. *Development* 149(13). DOI:10.1242/dev.200171

PROVISIONAL PART II PDN TIMETABLE 2023/24

MICH'MAS	Monday	Tuesday	Wednesday	Thursday	Friday
9-10	N4 Cellular Neuroscience		N4 Cellular Neuroscience P1 Cell Physiology	N1 Developmental Neurobiology	N4 Cellular Neuroscience
10-11	N1 Developmental Neurobiology	P1 Cell Physiology	N3 Circuits and Systems	P3 Fetal & Placental Physiology	N1 Developmental Neurobiology
11-12	P1 Cell Physiology P4 Early Dev and Patterning: Gen & Cell Mechanisms	N3 Circuits and Systems	P4 Early Dev and Patterning: Gen & Cell Mechanisms	N3 Circuits and Systems	P4 Early Dev and Patterning: Gen & Cell Mechanisms
12-1	P3 Fetal & Placental Physiology				P3 Fetal & Placental Physiology
1-2		N1 (Occasional & optional slot)			
2-3	N3 (2-4 Occasional & optional slot)	P4 (2-4 Occasional & optional slot)		P9 Journal Club (2 – 4) optional	N4 (2-4 Occasional & optional slot)
3-4	N3 (2-4 Occasional & optional slot)	P4 (2-4 Occasional & optional slot)	Neuro-Workshop (3-5)	P9 Journal Club (2 – 4) optional Neuro-Workshop	N4 (2-4 Occasional & optional slot)
4-5	P9 Cell Assembly & Interactions <i>Adrian Seminar</i>		Neuro-Workshop (3-5) P9 Cell Assembly & Interactions	<i>Foster Club Talk</i>	P9 Cell Assembly & Interactions

LENT	Monday	Tuesday	Wednesday	Thursday	Friday
9-10					N9 Modulation, Plasticity & Behaviour
10-11	P7 Cancer Pathophysiology		N9 Modulation, Plasticity & Behaviour	N6 Higher Order Brain Function and Dysfunction	P7 Cancer Pathophysiology
11-12	N9 Modulation, Plasticity & Behaviour P8 Systems Physiology	N6 Higher Order Brain Function and Dysfunction	P8 Systems Physiology	P2 Journal Club (some weeks only)	P8 Systems Physiology
12-1	N6 Higher Order Brain Function and Dysfunction	P2 Development & Stem Cells	P2 Development & Stem Cells	P2 Development & Stem Cells	
2-3	P6 Dev: Cell Differentiation & Organogenesis	P6 Journal Club (2-4) optional	P6 Dev: Cell Differentiation & Organogenesis	P7 Workshop (2-4)	P6 Dev: Cell Differentiation & Organogenesis
3-4	P5 Bioinformatics (3-5)	P6 Journal Club (2-4) optional P5 Bioinformatics Neuro-workshop (3-5)	Neuro-workshop	P7 Workshop (2-4)	
4-5	P5 Bioinformatics (3-5) <i>Adrian Seminar in Neuroscience</i>	P5 Bioinformatics Neuro-workshop (3-5)		P5 Bioinformatics <i>Foster Club Talk</i>	

Applicants **MUST** submit an application **both** to the Department via the Google Form via the Part II section of the PDN website, **AND** via the formal NST route via Microsoft Forms.



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