PART II PHYSIOLOGY, DEVELOPMENT AND NEUROSCIENCE 2022-2023

NST PART II PHYSIOLOGY, DEVELOPMENT AND NEUROSCIENCE

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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 fifteen 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 sixteen 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. 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/cQ9jT5tHJGcAAZA78
   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 20th May 2022.

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 February. 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 25 places

Course Organisers: Dr Hannah Clarke (hfc23@cam.ac.uk) & Dr Amanda Sferruzzi-Perri (ans48@cam.ac.uk)

BBS students must take 4 of the 15 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.

111: Module N6 Central Mechanisms of Reward, Punishment and Emotion (15 places)

137: Surgical and Radiological Anatomy (12 places)

138: Module N1 Developmental Neurobiology (5 places)

139: Module N2 Molecular and Cellular Neuroscience (5 places)

140: Module N4 Sensory Transduction (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)

<u>Major subject 415 may also be taken with:</u>

128: Bioinformatics, run by Genetics and also a PDN module (see page 15 for module P5)

137: Surgical and Radiological Anatomy, run by PDN but only as a minor BBS subject (see page 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 *(shared with Part II Zoology*) P3 Fetal and Placental Physiology P4 Development: Patterning the Embryo *(shared with Part II Zoology*) P9 Cell Assembly and Interactions *(shared with Part II Zoology)*	P1 Cellular Physiology P3 Fetal and Placental Physiology	N1 Developmental Neurobiology *(shared with Part II Zoology*) N2 Molecular and Cellular Neuroscience *(shared with Part II PNB*) N4 Sensory Transduction N7 Neural Circuits and Behaviour *(shared with Part II PNB*)
Lent term		
P2 Development and Stem Cells P6 Development: Cells & Organs *(shared with Part II Zoology)* P7 Pathophysiology of Cancer	P2 Development and Stem Cells P5 Bioinformatics *(shared with Part II BBS Genetics)* P7 Pathophysiology of cancer P8 Systems and Clinical Physiology	N6 Central Mechanisms of Reward, Punishment & Emotion *(shared with Part II PNB*) N9 Neuronal Plasticity, Modulation and Behaviour *(shared with Part II PNB*)

 # Part II PNB: Psychology, Neuroscience 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 N1-2, N4-6, N7 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 N1-2, N4-6, N7 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 2021/22:

(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 do's 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)

Maximum of 80 students
(Inter-departmental course 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 discuss the formation of the peripheral nervous system from the migratory neural crest and cranial neurogenic placodes (good models for understanding the control of 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, explore how axons make and refine the synapses that will generate functional neural circuits, and discuss how circuit designs lead to function. We also consider how nervous systems evolved.

This course is given by researchers in the Departments of PDN, Zoology, Genetics, 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 N2: Molecular and Cellular Neuroscience (N)

Maximum of 40 students

Module organiser: Dr David Parker (djp27@cam.ac.uk)
This module **cannot** be taken with Cellular Physiology (P1).

While many approaches can be applied to analyses of nervous systems, it is obviously important for any mechanistic understanding that we determine the cellular and synaptic properties underlying sensory, motor, and cognitive functions. The voltage-dependent ion channels that determine the resting and active properties of cells originate from a superfamily of at least 143 genes, with further diversity and functional variability resulting from alternative splicing, posttranslational modifications, and the plasticity of the varying combinations of subunits that form channels. This results in a massive range of potential cellular properties (e.g. adaptation, tonic spiking, bursting, post-inhibitory rebound, plateau potentials). At the synaptic level there is estimated to be in excess of 200 transmitter substances, each of which can differ in the mechanisms of their release and their effects. The independent or co-release of these transmitter substances can also result in interactive effects that cannot be predicted from knowledge of their individual effects in isolation.

This module provides a basis from which you can investigate various aspects of cellular and synaptic function. The lectures will cover voltage-dependent ion channels, oligodendrocytes and glial cells, ionotropic transmitter receptors (including NMDA and AMPA-type glutamate receptors),

Cys-loop receptors (e.g., nicotinic acetylcholine), G protein-coupled receptors, the influence of pH on neuronal function, the role of calcium in synaptic transmission and plasticity, and mechanisms of transmitter release and activity-dependent and neuromodulator-evoked plasticity. A knowledge of these effects is essential to understanding how signals are the processed by the nervous system and will provide insight that can cross over to other neuroscience modules.

Module N4: Sensory Transduction (N)

Module organiser: Dr Hugh Matthews (hrm1@cam.ac.uk)
This module **cannot** be taken with Fetal and Placental Physiology (P3)

The process of transduction within individual sensory receptors has consequences for, and imposes limits on, the perception of sensory events. Considerable advances have been made in recent years in elucidating the means by which primary sensory stimuli are transduced and processed. The module begins by considering transduction and coding in olfactory receptors, and then explores their initial analysis within the olfactory bulb. The modality then switches to phototransduction, examining the molecular mechanisms which enable vertebrate photoreceptors to respond with incredible sensitivity to individual photons of light, yet which also allow the cells to recover rapidly and to respond effectively at high light intensities. This is followed by consideration of invertebrate phototransduction and the involvement of TRP channels, which were originally discovered in this system. The focus then switches to mechanotransduction, especially the transduction and encoding of auditory information in both vertebrates and invertebrates. The integration of sensory signals will then be discussed in the simple nervous system of the nematode, *C. elegans*. These special senses will be contrasted with the molecular and cellular mechanisms responsible for the transduction of pain.

Module N7: Neural Circuits and Behaviour (N)
Maximum of 80 students

Module organiser: Dr David Parker (djp27@cam.ac.uk)
This module **cannot** be taken with Development: Patterning the Embryo (P4).

Connections between groups of neurons form circuits that generate specific outputs. These outputs have traditionally been related to the properties of the component cells and synapses, but there is growing awareness that other aspects could contribute, including glial cells and extracellular signals. These circuits, or networks, form the middle ground in approaches to understanding the nervous system: they assemble the molecular and cellular components needed to process sensory inputs, perform cognitive functions, and pattern motor outputs. Insight into the organisation and function of these circuits is thus essential to our understanding of both nervous system function and behaviour. Gaining this understanding is considered to be the major problem facing neuroscience today, as evidenced by the major funding initiatives currently supporting research into this area (the EU Human Brain Project, and the BRAIN initiative in the United States).

This module will examine the principles of neural circuit function. It will use invertebrate, lower vertebrate, and mammalian model systems (cerebellum, hippocampus, and cortex) to illustrate the general principles of circuit function and our current understanding. The module will also introduce the molecular, anatomical, electrophysiological, imaging, and computational techniques used in network analyses.
The central role of neural circuits means that this module provides general links to other modules that focus on molecular and cellular mechanisms (e.g. how do these properties influence higher

functions?), or higher-level aspects of sensory, motor, or cognitive functions (e.g. what mechanisms underlie these effects?).

Module P1: Cellular Physiology (P)
Maximum of 80 students

Module organiser: Dr Christof Schweining (cjs30@cam.ac.uk)
This module **cannot** be taken with Molecular and Cellular Neuroscience (N2) or Development: Patterning the Embryo (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)
Maximum of 80 students

Module organiser: Prof Dino Giussani (dag26@cam.ac.uk)
This module **cannot** be taken with Sensory Transduction (N4).

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.

Module P4: Development: Patterning the Embryo (D)

Module organiser: Dr Richard Adams (rja46@cam.ac.uk) and Dr Howard Baylis (hab28@cam.ac.uk) for Zoology

This module **cannot** be taken with Neural Circuits and Behaviour (N7) or Cellular Physiology (P1).

This course is the first of two complementary modules (with P6), which can also be taken on their own. Our aim is to explore a fundamental biological question: how does a single cell, the fertilized egg, have all the information to make an animal? Our current knowledge of the underlying molecular mechanisms that create cell diversity and pattern in the early embryo will be examined in depth. We will discuss how the experimental advantages of different model organisms have aided the discovery of the principles of development, and the insights provided by comparing the developmental strategies of vertebrates and invertebrates. In this first module we will address key aspects of early development, including how development is regulated, how the patterning of spatial information is established and how morphogenetic mechanisms shape the embryo. At each stage we will discuss the cellular mechanisms required and the molecular networks that drive them. By comparing the development of different animals, we aim to come to an understanding of conserved strategies of animal development.
These themes will be covered from the establishment of polarity in the egg, and its elaboration after fertilisation, to a consideration of how these events set the body axes. We will then see how axial patterning directs the morphogenetic movements of gastrulation and the grouping of cells into segments with differing identities.
This interdepartmental course (with Zoology) will consist of three lectures per week.

Module P9: Cell Assembly and Interactions (D)

(Inter-departmental course 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 will 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 will begin with a discussion of current ideas about of how cells were created during evolution, and how eucaryotic cells arose from procaryotes. We then address how membrane compartments are constructed, and the dynamics of transfer between them. Next, we will discuss the key role of the cytoskeleton in cell shape, organization and movement. This is followed by an examination of how cells become polarized and adhere together to form higher order multicellular assemblies. We then study how cells sense and respond to the mechanical properties of their surroundings. Finally, we look at long range signalling between cells by examining how cells integrate and respond to the diverse signals that arrive at their surface, exploring how the spatial organisation of intracellular signals has a profound influence on the nature of signalling.

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.

Lent Term Modules

Module N6: Central Mechanisms of Reward, Punishment and Emotion (N)

Maximum of 80 students

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

How does the brain process reward and punishment and how does this help us understand emotions and their dysregulation? At the beginning you will hear about the varied functions of reward, including learning, approach, positive emotion and economic decision making and how these functions are instantiated in neural circuits including dopamine, the striatum, amygdala, orbitofrontal and lateral prefrontal cortex. You will then learn how reward processes can go awry in depression and whether this same reward circuitry underlies social behaviour and social cognition. You will then be introduced to the neuro-computational mechanisms that may underlie decision-making, including reward/punishment-based decisions in health and disease. Punishment is of course as important as reward for controlling our behaviour and so you will be told about the limbic and cortical mechanisms by which punishing stimuli impact on our motivations and emotions and inform our decision making. The range of strategies at our disposal for regulating our negative emotions will also be discussed and how those strategies are implemented within interacting brain circuits. In considering these brain circuits you will be introduced to genetic technologies and how they have been harnessed to look deeper into the brain circuits underlying emotion regulation, before your attention will be turned to the genetics underlying disorders of negative emotion. How, when and why these circuits become dysregulated in psychiatric disorders and how they relate to psychiatric symptoms will be discussed, and the importance of understanding body-brain interactions in health and psychiatric disease considered. Finally, you will explore the interplay between cognition and emotion. By the end of the course, you should have a better sense of one of the most exciting and active areas of brain research in this decade, that is at the heart of what the brain is all about.

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

Maximum of 40 students

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 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 look at these questions and 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. Contemporary as well as traditional research methods for investigating neuronal plasticity and modulation will be considered, including opto- and chemogenetic approaches, imaging and electrophysiology.
This module would work very well in combination with any of Modules N2, N4, N6 and N7, although none are essential. The first lecture will include an introduction to different forms of cellular and synaptic plasticity and modulation.

Module P2: Development and Stem Cells: Embryonic and Extra-embryonic Tissues (D, P)
M*aximum of 40 students*

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 an 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 trophectoderm 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 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 functions of the extra-embryonic lineages, and how interactions between the trophectoderm and the maternal tissues 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 invasion, including interactions with the maternal immune system, and the role of oxygen and cytokines. The role of the extravillous trophectoderm in spiral arterial remodelling and establishing the maternal circulation to the placenta will be considered. Correlates will be drawn between normal pregnancies and the common complications, including miscarriage and preeclampsia, in which trophoblast invasion is impaired.

The module will involve a mix of lectures, journal clubs and interactive sessions.
Useful combination modules include: P3 Fetal and placental physiology (M), P4 Development: Patterning the embryo (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)
(*Also available as a BBS subject*)

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 course 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).

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)
Maximum of 40 students

Module organiser: Prof Randall Johnson (rsj33@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.

Module P8: Systems and Clinical Physiology (P)
Maximum of 80 students

Module organiser: Dr Stewart Sage (sos10@cam.ac.uk)
This module **cannot** be taken with Neuronal Plasticity, Modulation 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 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.

PDN MODULE FOR BBS STUDENTS ONLY

Minor 137: Surgical and Radiological Anatomy
Maximum of 15 students

Organisers: Dr Cecilia Brassett & Dr Helen Taylor (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/sites/www.biology.cam.ac.uk/files/sara_booklet_2022-23.pdf

Two-term Theory Projects 2021-2022 N.B There were more theory than experimental projects offered than in previous years due to Covid-19 but we expect more laboratories to be able to offer 'wet' projects in 2022-23.

Supervisor	Theory Project Title
Albert Cardona	Neurotransmitter identity of neurons in identified neural circuits
Alison Forhead	Fat fetuses: endocrine control of adipose tissue development
Allan Herbison, Paul Morris	Understanding synchronised activity within arcuate kisspeptin neuron population using GCaMP imaging
Allan Herbison, Su Young Han	Analysis of the GnRH pulse generator in a mouse model of polycystic ovary syndrome (PCOS)
Amanda Sferruzzi-Perri, Emma Siragher	Placental mechanisms governing fetal growth alterations with hypoxia
Andrew Murray	Molecular signatures of metabolic disease and the modifying effect of dietary inorganic nitrate
Angela Roberts, Kevin Mulvihill	An investigation of the behavioural and physiological indices of affective bias in non-human primates with a focus on the causal role of the vmPFC
Angela Roberts, Steve Sawiak	Cortical myelination mapping from adolescence to adulthood in a non-human primate with MRI
Angela Roberts, Taylor Lynn-Jones	Investigating the development of exploratory behaviours in juvenile marmosets
Bénédicte Sanson, Guy Blanchard, Elena Scarpa	Investigating how multiple cell divisions perturb each other mechanically in a developing epithelium in vivo
Bill Colledge	Bioinformatic Analysis of Gene Expression in Hiat1 Mutant Mice
Christof Schwiening	Are lower rates of cardiovascular drift associated with better marathon performances than are predicted from training?
Christof Schwiening, Ian Hosking, Shreeya Singhal, Riccardo Conci	Assessing the physiological impact of modifications to the standard NHS elbow crutch
Courtney Hanna	Investigating the DNA methylation landscape in cultured human placental trophoblast stem cells
Eleanor Raffan	From GWAS to function – interrogation of obesity-associated genetic loci by analysis of DNA sequencing, gene expression and multi-species comparisons
Eleanor Raffan	Investigating the interaction between appetite, obesity and owner management in pet dogs
Elisa Galliano	Sensory deprivation and cell heterogeneity in olfactory bulb: data analysis
Elisa Galliano	Sensory deprivation and cell heterogeneity in olfactory bulb: systematic review
Emma Rawlins	Data analysis: Analyzing the contribution of multipotent progenitor cells to normal and accelerated lung development
Emma Rawlins	Data analysis: Investigating the role of FGF signalling in lung epithelial morphogenesis
Erica Watson	Exploring imprinted gene misexpression and feto-placental phenotypes in a mouse model of abnormal folate metabolism
Ewa Paluch, Margherita Battistara	Quantitative analysis of cell shape changes in early embryonic development
Fengzhu Xiong, Susie McLaren	Investigating central nervous system mechanics in the developing chicken embryo
Hugh Matthews	Modulation of the stretch reflex in athletes
Hugh Matthews, Chris Huang	Ephaptic conduction in cardiac muscle
James Fraser, Iztok Caglic	Age-stratified MRI-derived prostate volumes in men with histopathologically-proven prostate cancer
James Fraser, Nikita Sushentsev	Comparative expression of carbonic anhydrases 9 and 12 (CAIX/CAXII) in human prostate cancer
James Fraser, Tristan Barrett	Age-related physiological change in the seminal vesicles
Jasper Poort	Visual cortical activity during visual discrimination learning
Jenny Morton	Therapeutic approaches to sleep and circadian abnormalities in Huntington's disease patients
Magdalena Zernicka-Goetz, Maciej Meglicki, Lisa Iwamoto-Stohl	Cell fate specification in the early mouse embryo
Matt Mason	Structure and function of the ear of domestic dogs, investigated with micro-CT
Matt Mason	Structure and function of the ear of seals
Mekayla Storer	Why can't mammals regenerate their limbs? A grant proposal

Ole Paulsen, Audrey Hay, Yuqi Li	Impact of silencing the midline thalamic nuclei in coordinating hippocampal sharp wave-ripples and neocortical spindles during slow wave sleep in the mouse
Ole Paulsen, Tanja Fuchsberger, Richard Turner	Changes in neuronal activity in slices of a mouse model of Alzheimer's Disease at a very early stage
Randall Johnson	Role of metabolites in immune response
Richard Adams, Sue Jones	3D computer graphics for Neuroanatomy Teaching
Sarah Bray, Leila Muresan	Deciphering developmental and oncogenic signals: How do signaling dependent transcription factors find their target genes in the nucleus?
Srinjan Basu	Role of MLL1 and MLL2 in mouse pluripotent stem cell differentiation
Sue Jones, Bill Colledge	Neuronal plasticity during puberty
Susanna Mierau, Bianca Dumitrascu	Detecting state transitions in cellular scale cortical network activity
Tereza Cindrova-Davies	The role of senescence in pre-eclampsia, the potential use of senelytic therapy to treat pregnancy pathologies
Thorsten Boroviak, Erin Slattery, Christopher Penfold	Decoding the epigenetic landscape of naïve and primed pluripotent stem cells in non-human primates
Amanda Sferruzzi-Perri	Grant proposal/literature review: Deciphering the mechanisms governing sex-related differences in placental dynamics
Hannah Clarke	Grant Proposal:Investigating the neurobiological basis of social dysfunction in schizophrenia

Two-term Experimental Projects 2019-2020* N.B. We are making reference to the 2019-20 projects as they are more representative of what is planned next year. Due to Covid-19, the project format for 2020-21 and 2021-22 was unusual.

Supervisor	**Experimental Project Title**
Dr Amanda Sferruzzi-Perri	Role of placental endocrine malfunction in the programming of metabolic dysfunction in the offspring
Dr Andrew Murray	Inorganic nitrate, mitochondrial function and lipid metabolism in cardiometabolic disease
Dr Angeleen Fleming	Characterising a novel zebrafish model of Parkinson's disease
Dr Cecilia Brassett	Determining the anatomical relationship of the medial cutaneous nerve of the forearm to the cubital tunnel
Dr Cecilia Brassett	Determining the ideal site for fibular osteotomy in treating non-union of tibial fractures
Dr Cecilia Brassett	How does the vesicoureteric junction work?
Dr Cecilia Brassett	Correlating bone microarchitecture of the mandibular condyle with the common sites of intracondylar fractures at the temporomandibular joint
Dr Cecilia Brassett	Investigating the vascularity of the knee in MRI scans
Dr Cecilia Brassett	Investigation of the mobility of the rectus femoris pedicled flap for interposition myoplasty after hip joint excision arthroplasty
Dr Clare Buckley	Testing the role of contractile force in regulating cell polarity during organ development
Dr David Parker	Investigation into the Jendrassik effect
Dr Elisa Galliano	Adult-born bulbar dopaminergic neurons go to an olfactory cocktail party
Dr Emma Cahill	Extending fear-potentiated 'state anxiety' in the elevated plus-maze to cued-fear conditioning and the role of memory extinction
Dr Emma Cahill	How does the predictability of footshock influence ultrasonic calling in the rat in fear conditioning?
Dr Emma Cahill	Individual differences in activation of the so-called extended amygdala by threat cues.
Dr Erica Watson	Analysis of liver structure and function in the context of abnormal folate metabolism
Dr Erica Watson	Role of folate metabolism in establishing uterine structure and function
Dr Erica Watson	The role of the nonsense mediated decay pathway in regulating long non-coding RNAs during mouse trophoblast development
Dr Fabian Grabenhorst	How to make the perfect milkshake: processing of sugar, fat, and protein by the brain's reward system
Dr Gabriel Balmus (Dept of Clinical Neurosciences)	Understanding the role of USP30 in mitophagy with relevance to Parkinson's Disease

Dr Guillaume Hennequin	Using DeepLabCut to extract mouse 3D head movement
Dr Hugh Matthews	Development of a plastic loose patch electrode for in-vivo recording
Dr Hugh Matthews	Development of attractor reconstruction analysis for real time arrhythmia detection
Dr Hugh Matthews	Development of vectorcardiographic analysis for real-time arrhythmia detection
Dr Hugh Matthews	Quantitation of the stretch reflex in normal subjects and ballet dancers
Dr Hugh Robinson	Voltage-gated sodium channels in brain-metastatic breast cancer cells
Dr James Fraser	ECG signal complexity and risk of cardiac arrhythmia
Dr James Fraser	Understanding abnormal skeletal muscle excitability
Dr Kristian Franze	The mechanical regulation of neuronal growth
Dr Masuda-Nakagawa & Prof Cahir O'Kane (Dept of Genetics)	Functional circuitry of odour discrimination in Drosophila larvae
Dr Matt Mason	Microvasculature of the middle ear ossicles in humans
Dr Matt Mason	Middle ear cavities and low-frequency hearing in mammals
Dr Milka Sarris & Dr Angeleen Fleming	Investigating neutrophil trafficking in neurodegenerative disease
Dr Rob White	Organisation of transcription in the nucleus
Dr Simon Tunster	Characterising the placental defect unserlying Phlda2-driven placental growth restriction
Dr Steve Edgley	Serial and higher order conditioning of human eyeblink responses
Dr Thorsten Boroviak	A systematic screen to define a signalling environment required to fate interconvert human naïve embryonic stem cells towards hypoblast stem cells
Dr Thorsten Boroviak	Defining the essential gene regulatory network controlling primate trophoblast self-renewal
Prof Angela Roberts	Characterizing functional connectivity of distinct regions of prefrontal and cingulate cortex using the immediate early gene, cfos, in marmoset monkeys
Prof Angela Roberts & Dr Clarke	Characterizing social interactions within family groups of marmoset monkeys
Prof Chris Huang & Dr Hugh Matthews	Effects of modified cellular Ca2+ homeostasis on Na+ current activation
Prof Graham Burton	The role of advanced glycation end products (AGE) and their receptor (RAGE) in human endometrial organoids
Prof Jenny Morton	Signatures of rhythmic auditory stimuli in sheep electroencephalogram
Prof Jenny Nichols & Dr E.M. Corujo-Simon	How are the founder lineages segregated in the early human embryo?
Prof Magdalena Zernicka-Goetz	Self-assembly of mouse stem cells in vitro into synthetic embryos
Prof Martin Johnson	Role of hypoxia-induced metabolites in immunotherapy for cancer.
Prof Ole Paluch	Shape changes of mouse embryonic stem cells during fate transitions
Prof Ole Paulsen	Autism-susceptibility genes are enriched in subplate neurons.
Prof Ole Paulsen	Differential role of GABABRs and extra-synaptic GABAARs in spontaneous UP-state and epileptiform burst duration in juvenile mouse brain slices
Prof Ole Paulsen	Molecular mechanisms of synaptic tagging during plasticity in the hippocampus

BBS Dissertations 2021-2022	
Supervisor	**Dissertation Title**
Alison Forhead	A time to be born: Prevention of preterm delivery
Alison Forhead	Too much, too young: maternal age and consequences for the offspring
Bill Colledge	Is there cross-talk between serotonin signalling in the brain and Kiss1 neurons?
Clare Buckley	How do prenatal treatments for neural tube defects work?
David Bainbridge	Do the fetus' attempts to avoid maternal immune rejection increase the risk of fetoplacental infection?
David Parker	To what extent are neuropharmacological interventions informed by our current understanding of the chemical environment of the CNS?
David Parker	Neural networks: artificial and natural
Dino Giussani	Black women and their infants are more likely to experience adverse pregnancy outcomes; is there a biological basis for this?
Dino Giussani	Fetal growth restriction during high altitude pregnancy: What is the real cause?
Eleanor Raffan	Is obesity a disease of the mind?
Elizabeth Murchison	A comparison between the mechanisms of immunological evasion employed by the placenta and cancer
Emma Rawlins	Can the principles of organ development be harnessed for lab- or farm-based production of organs for human clinical transplants?
Erica Watson	Oocyte inheritance of non-nuclear factors that influence embryonic development
Erica Watson	How placental formation and function influences congenital malformations
Erica Watson	How ART affects the epigenome and the health of the baby
Erica Watson	What is the functional importance of gene clusters in the placenta?
Golnar Kolaghar	Intestinal adaptation in response to high-caloric diets: a focus on gut hormone responses
Golnar Kolaghar	Exploring the physiological implications of intestinal microbiome alterations associated to high-caloric diet
Helen Taylor	The role of imaging in the diagnosis and management of facial trauma.
Hugh Robinson	Innervation of tumours and its role in cancer
Randall Johnson	How can the understanding of the immune response and immune evasion of breast cancer increase the immunotherapy success rate?
Steve Edgley	Why are neurodegenerative disorders so difficult to treat and what success have we had so far?
Stewart Sage	The implication of ACE2 receptor pathways in the cardiovascular effects of COVID-19
Stewart Sage	STIM1 and Orai1 interactions

Recent published papers resulting from, or including work from, Part II projects include (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, online ahead of print.

Allison, B.J., **Brain, K.L.**, Niu, Y., Kane, A.D., Herrera, E.A., Thakor, A.S., Botting, K.J., Cross, C.M., Itani, N., Shaw, C.J., Skeffington, K.L., Beck, C. & Giussani, D.A. (2020). Altered Cardiovascular Defence to Hypotensive Stress in the Chronically Hypoxic Fetus. *Hypertension* **76(4)**, 1195-1207.

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,* in press.

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 variatns of cutaneous innervation at the medial elbow in cadaveric dissections. *Clinical Anatomy*, DOI: 10.1002/ca.23819, online ahead of print.

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.

Botting, K.J., **Skeffington, K.L.**, Niu, Y., Allison, B.J., **Brain, K.L.**, Itani, N., Beck, C., Logan, A., Murray, A.J., Murphy, M.P. & Giussani, D.A. (2020). Translatable mitochondria-targeted protection against programmed cardiovascular dysfunction. *Science Advances* **6(34)**, eabb1929.

Boukhatmi H, Martins T, Pillidge Z, **Kamenova T**, Bray S (2020) Notch Mediates Inter-tissue Communication to Promote Tumorigenesis. *Current Biology* 30(10):1809-1820.e4

Camm EJ, **Inzani I**, De Blasio MJ, Davies KL, Lloyd IR, Wooding FBP, Blache D, Fowden AL, Forhead AJ (2020) Thyroid hormone deficiency suppresses fetal pituitary-adrenal function near term: implications for the control of fetal maturation and parturition. Thyroid
doi: 10.1089/thy.2020.0534. *Online ahead of print*.

Cook, G.M.W., Sousa, C., Schaeffer, J., **Wiles, K., Jareonsettasin, P., Kalyanasundaram, A., Walder, E., Casper, C., Patel, S., Chua, P.W.,** Riboni-Verri, G., Raza, M., **Swaddiwudhipong, N., Hui, A., Abdullah, A., Saj Wajed,** Keynes, R.J. (2020) Regulation of nerve growth and pattering by cell surface protein disulphide isomerase. *eLife* 9:e54612 DOI 10.7554/*eLife* 54612'

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, online ahead of print.

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, online ahead of print.

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.

Grant I., Soria R., Julian, C.G., Vargas, E., Moore, L.G., Aiken, C.E. & Giussani, D.A. (2020). Parental ancestry and risk of early pregnancy loss at high altitude. *FASEB J*. **34(10)**,13741-13749.

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.

Hess, R.M., Niu, Y., Garrud, T.A., Botting, K.J., Ford, S.G. & Giussani, D.A. (2020). Cardioprotective action of hydrogen sulphide in the embryonic heart. *The Journal of Physiology* **598(19)**, 4197-4208.

Itani, N., Skeffington, K.L., Beck, C., Niu, Y., Katzilieris-Petras, G., **Smith, N.** & Giussani, D.A. (2020). Protective effects of pravastatin on the embryonic cardiovascular system suring hypoxic development. *FASEB J*. 34(12), 16504-16515.

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.

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, online ahead of print.

Liu SX, Matthews HR & Huang CL-H (2021). Sarcoplasmic reticular Ca 2+ -ATPase inhibition paradoxically upregulates murine skeletal muscle Na v 1.4 function. *Scientific Reports* **11,** 2846.

Mason, M.J., **Wenger, L.M.D.,** Hammer, Ø. & Blix, A.S. (2020) Structure and function of respiratory turbinates in phocid seals. *Polar Biology* 43:
157-173.

Maghsoudi, D., West, C., Brassett, C. & Chitnavis, J. (2022) Are there common intraosseous patterns of vascularity in the knee? *Clinical Anatomy,* in press.

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*, in press.

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.

Perera, S.N., Williams, R.M., Lyne, R., **Stubbs, O.**, Buehler, D.P., Sauka-Spengler, T., Noda, M., Micklem, G., Southard-Smith, E.M. & Baker, C.V.H. (2020) Insights into olfactory ensheathing cell development from a laser-microdissection and transcriptome-profiling approach. *Glia* **68**, 2550-2584.

Sarbjit-Singh SS, Matthews HR & Huang CL-H (2020). Ryanodine receptor modulation by caffeine challenge modifies Na + current properties in intact murine skeletal muscle fibres. *Scientific Reports* **10,** 2199.

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, online ahead of print.

Sowton, AP., Padmanabhan, N., Tunster, S.J., McNally, B., Murgia, A., Yusuf, A., Griffin, J.L., Murray, A.J. & Watson, E.D. (2020) *Mtrr hypomorphic mutation alters liver morphology, metabolism and fuel storage in mice. Mol Genet Metab Rep. 23:100580, 2020*

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.

Teulings, N.E.W.D., **Garrud, T.A.C.**, Niu, Y., Skeffington, K.L., Beck, C., Itani, N., Conlon, F., Botting, K.J., Nicholas, L.M., Ashmore, T.J., Blacknmore, H.L., Tong, W., Camm, E.J., Derks, J.B., Logan, A., Murphy, M.P., Ozanne, S.E. & Giussani, D.A. (2020). Isolating adverse effects of glucocorticoids on the embryonic cardiovascular system. *FASEB J*. **34(7)**, 9664-9677.

Thirunavukarasu, A.J., Ferro, A., Margolis, A., Gray, R., Dubb, S.S. & Brassett, C. (2020). Microarchitecture and stress patterns of the mandibular condyle: a micro-computed tomographic study. *British Journal of Oral and Maxillofacial Surgery,* 58:10, e227.

Thirunavukarasu, A.J., Sardesai, A., Ferro, A., Biyani, G., Hamilton, D., Dubb, S.S. & Brassett, C. (2020). A protocol of ultrasound imaging of the temporomandibular joint. *British Journal of Oral and Maxillofacial Surgery,* 58:10, e226-227.

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PROVISIONAL PART II PDN TIMETABLE 2022/23

MICHAELMAS	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
9-10	**N2** Cellular Neuroscience		**N2** Cellular Neuroscience **P1** Cell physiology	**N1** Dev Neurobiology	**N2** Cellular Neuroscience
10-11	**N1** Dev Neurobiology	**P1** Cell Physiology	**N4** Sensory Transduction	**N4** Sensory Transduction **P3** Fetal Physiology	**N1** Dev Neurobiology
11-12	**P1** Cell Physiology **P4** Patterning Embryo	**N7** Neural Circuits	**N7** Neural Circuits **P4** Patterning Embryo		**N7** Neural Circuits **P4** Patterning Embryo
12-1	**N4** Sensory Transduction **P3** Fetal Physiology				**P3** Fetal Physiology
2-3				**P9** Journal Club (2 – 4)	**N4** Workshop (2-4)
3-4			**Neuro-Workshop** (3-5)	**P9** Journal Club (2 – 4) **Neuro-Workshop**	**N4** Workshop (2-4)
4-5	**P9** Cell Assembly & Interactions *Adrian Seminar in Neuroscience*		**Neuro-Workshop** (3-5) **P9** Cell Assembly & Interactions	*Foster Club Talk*	**P9** Cell Assembly & Interactions

LENT	Monday	Tuesday	Wednesday	Thursday	Friday
9-10					**N9** Neuronal Plasticity
10-11	**P7** Cancer Pathophysiology		**N9** Neuronal Plasticity	**N6** Central Mechanisms	**P7** Cancer Pathophysiology
11-12	**N9** Neuronal Plasticity **P8** Systems Physiology	**N6** Central Mechanisms	**P8** Systems Physiology	**P2** Journal Club *(some weeks only)*	**P8** Systems Physiology
12-1	**N6** Central Mechanisms	**P2** Dev & Stem Cells	**P2** Dev & Stem Cells	**P2** Dev & Stem Cells	
2-3	**P6** Organogenesis	**P6** Journal Club (2-4)	**P6** Organogenesis	**P7** Workshop (2-4)	**P6** Organogenesis
3-4	**P5** Bioinformatics (3-5)	**P6** Journal Club (2-4) **Neuro-workshop** (3-5) **P5** Bioinformatics	**Neuro-workshop**	**P7** Workshop (2-4)	
4-5	**P5** Bioinformatics (3-5) *Adrian Seminar in Neuroscience*	**Neuro-workshop** (3-5) **P5** Bioinformatics		**P5** Bioinformatics *Foster Club Talk*	

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.