**BSc Biomedical Science: Year 2 Courses Outline and Academic Leads**

Year 2 is made up of three major courses, which like Year 1, are subdivided into a variable number of modules, each with its own Academic Lead(s). Year 2 sees the first elements of choice entering the programme, with students being able to select two Specialist Options which will either give them an opportunity to integrate their biomedical knowledge with another discipline (currently materials science and humanities) or to extend their learning to greater depth (experimental pharmacology and “omics”). It is envisaged that other options will be added as the programme develops. In addition, students select a title for a tutored dissertation, which allows them to extend and develop their ability to explore the scientific literature, indentify and critically appraise relevant material and produce an extended piece of academic writing which allows them to develop their capacity to make sound, evidence-based, scientific judgements.

Development of transferable skills continues to be a strong feature of the programme, but now these skills are fully integrated into the science modules, with exception of a small number of stand alone sessions on subjects such as career management. The inclusion of timetabled white space for private study is increased as students acquire the skills of self-direction and self-management. The tutored dissertation is their first opportunity to undertake a substantial piece of scientific writing.

***Summary of Year 2***

Year 2 incorporates 25 weeks of teaching, each of 9 sessions. This is made up of 21 mandatory weeks and 4 weeks where students have a choice of module. Lectures will normally be of 1 h and tutorials 1 – 2 h as appropriate to task. Practicals may be from 2 h to whole day experiments depending on the nature of the topic studied.

Compulsory teaching (21 weeks)

Lectures: 180

Tutorials: 26

Practicals: 11

Other teaching formats: 4

Transferable skills sessions: 4

Sessions to work on tutored dissertation: 11

Teaching formats for Novel Options depend on the topics selected, but contact time for those 4 weeks will be in the range of 35-45 hours.

**Term 1: Pharmacology, Pathology, Psychology and Population (PPPP)**

Title of module: **Pathology of infectious diseases**

Teaching weeks: **Weeks 1-3**

Academic leads: **Dr Wendy Barclay, Dr Ramesh Wigneshweraraj, Prof D Wright**

Campus: **St Mary’s andSouth Kensington**

**Overall learning objectives:**

Virology

The student should be able to:

* Understand basic replication cycles for viruses that cause disease in humans.
* Explain the strategies for control of viral infections including development of antiviral drugs and vaccination.
* Appreciate how viruses are detected in the laboratory and what assays can be used in virus research.
* Understand how viruses are quantified.

Microbiology

The student should be able to:

* Understand basic life cycles of micro-organisms that cause disease in humans.
* Explain the strategies for control of bacterial infections including development of drugs and vaccination.
* Appreciate how resistance to anti-bacterial drugs may develop and be transmitted between organisms
* Understand how micro-organisms may be identified

Parasitology

The student should be able to:

* Understand the life cycle strategies of major protozoan, platyhelminth and nematode parasites of medical importance
* Understand their distribution, explain the disease symptoms and the scientific rationale of treatment
* Appreciate how a knowledge of parasite biology, and vector biology where applicable, can lead to more effective methods of control.

**Course content (approx numbers of lectures, tutorials, practical classes):**

25 lectures

3 tutorials

4 practical exercises

1 conference

**Transferable skills and integrated skills (IS)**

Transferable skills modules: 1

IS in module: Self-motivation and self-management, communication and literacy, scientific debate, team-working, data interpretation and handling, scientific reading and writing and ethics

**Summative assessment of the module:**

**Coursework:** Data handling exercises

Short (30 min) online test

Oral presentation in conference

**Examination:** In the PPPP examination

**Term 1: Pharmacology, Pathology, Psychology and Population (PPPP)**

Title of module: **Epidemiology and Public Health**

Teaching weeks: **Weeks 4-5**

Academic leads: **Dr Ioanna Tzoulaki and Dr Matthew Fisher**

Campus: **St Marys**

**Overall learning objectives**

Students should be able to:

* Describe global patterns of infectious and non-infectious disease, appreciate the disparities worldwide and identify broad underlying causes for these patterns.
* Appreciate the hierarchy of evidence in study design through knowledge of the strengths and weaknesses of various study designs.
* Understand the importance of applying evidence to clinical decision making
* Understand, interpret and discuss the statistical findings commonly reported in scientific papers
* List and understand the main principles regarding how to read and critically evaluate a scientific paper
* Describe, and give examples, of the main methods of intervention to improve health, on a national and international scale, including education, protection and prevention.

**Course content (approx numbers of lectures, tutorials, practical classes):**

14 lectures

2 tutorials

1 debate

**Transferable skills and integrated skills (IS):**

Transferable skills sessions: 1

IS in module: Evidenced based scientific debate, communication skills, team working,

numeracy, statistics and data handling

**Summative assessment of the module**

**Coursework:** Oral presentation

**Examination:** In the PPPP examination

**Term 1: Pharmacology, Pathology, Psychology and Population (PPPP)**

Title of course component: **Introduction to pharmacology**

Teaching weeks: **Weeks 6-9**

Academic Lead: **Dr Chris John**

Campus: **Hammersmith**

**Overall learning objectives**

Students should be able to:

* Discuss the pharmacokinetic differences between drug administration routes
* Understand the concepts of agonism, antagonism, inverse agonism and allosteric modulation
* Understand the principal features of drug metabolism
* Explain the mechanisms of action of the main drug groups used to manage common cardiovascular conditions
* List the key features of adrenergic, cholinergic, glutamatergic and GABAergic neurotransmission, the drugs used to modulate each and their clinical use
* Describe the principal disorders of the central nervous system and understand the extent to which pharmacological therapies exist for each
* Describe the drugs used to modulate the immune system and treat auto-immune disorders
* Have an understanding of the neural pathways involved in addiction and the pharmacology of opioids, alcohol and drugs of abuse
* Discuss the properties of general and local anaesthetics
* Understand the mechanisms of action of analgesic drugs
* Describe experiments to illustrate the pharmacodynamic and pharmacokinetic properties of drugs at a molecular, cellular, tissue and whole organism level
* Understand the role of animal models of disease in research and the principles of translating data from animals to man.
* Appreciate that drugs affect multiple systems using caffeine as an example

**Course content (approx numbers of lectures, tutorials, practical classes):**

40 lectures

6 tutorials

3 practicals

**Transferable skills and integrated skills (IS):**

IS in module: Communication and scientific literacy, team-working, problem-solving, statistics and data handling

**Summative assessment of the module**

**Coursework:** Practical write-up

**Examination:** In the PPPP examination

**Term 1: Pharmacology, Pathology, Psychology and Population (PPPP)**

Title of module: **Evolutionary Psychology and Human Behaviour**

Teaching weeks: **Weeks 10-11**

Academic leads: **Dr Antony Aleksiev and Dr Matthew Hodes**

Campus: **Hammersmith and St Mary’s**

**Overall learning objectives**

Students should be able to:

* Understand the principles of the evolution of behaviour, with the emphasis on human and primate behaviour
* Understand the basics of cognition: mechanisms and function
* Explain the mechanisms of learning in animals and humans
* Explain the mechanisms and function of decision making and choice of animals and humans
* Appreciate aspects of social behaviour and evolution
* Describe adaptations in brain anatomy and physiology in relation to behaviour
* Identify salient aspects of human psychological development
* Appreciate the extent of individual variation in development and function
* Identify key risk factors for maladaptation and psychiatric disorder
* Summarise the main types of psychiatric [psychological and pharmacological] interventions for selected, common psychiatric disorders

**Course content (approx numbers of lectures, tutorials, practical classes):**

17 lectures

3 tutorials

**Transferable skills and integrated skills (IS):**

IS in module: Self-motivation and self-management, communication and literacy,

team-working, problem-solving, statistics, data handling, scientific reading and writing. computer and information technology

**Summative assessment of the module**

**Coursework (eg: essay, practical write-up):** 1000 word essay

**Examination:** In the PPPP examination

**Term 2: Advanced Cell and Molecular Science**

Title of module: **Advanced Molecular Biology**

Teaching weeks: **Weeks 2-4**

Academic Lead: **TBA**

Campus: **Hammersmith and South Kensington**

**Overall learning objectives**

* Students should be able to:
* demonstrate an advanced understanding of the following topics
  + cell organization
  + DNA replication, transcription, protein synthesis and enzymology
  + DNA recombination
  + gene structure, function and regulation
  + molecular cloning and molecular tools for studying genes and gene activity
* Design strategies to investigate the function and regulation of specific genes
* Understand and manipulate biological information obtained from sequencing databases
* Understand and comply with the legal and regulatory requirements relating to genetic material
* Understand and critique scientific papers dealing with advanced molecular biology
* Analyse and interpret data generated from relevant experiments
* Write a detailed experimental lab report, using appropriate statistical methods

**Course content (approx numbers of lectures, tutorials, practical classes)**

30 lectures

3 tutorials including 1 computer based learning session

3 practicals

**Transferable skills and integrated skills (IS):**

 IS in module: Communication and scientific literacy, ethics, team-working, problem-solving, computer and IT skills, statistics and data handling

**Summative assessment of the module:**

**Coursework:** 2 *practical write-ups, 1 data handling exercise*

**Examination:** In the Advanced Cell and Molecular Science examination

**Term 2: Specialist Options**

Title of module: **Biomedical Humanities**

Teaching weeks: **Weeks 5 - 6**

Academic leads: **Ms Giskin Day and Dr Abigail Woods**

Campus: **South Kensington**

**Overall learning objectives:**

Students should be able to:

* Explain key concepts in the philosophy of biomedicine such as mind—body dualism and its critiques
* Give a reasoned analysis of Descartes’ ideas on selfhood
* Analyse media coverage of biomedical science and insightfully discuss news values and the press process
* Discuss the importance of language with respect to the biomedical sciences, with particular emphasis on the use of metaphor in relation to genetics
* Appreciate public engagement issues in biomedical science including the role of film, new technology and how museums display biomedical artefacts.
* Discuss important controversies in the discipline and understand them from a social, historical and philosophical point of view
* Understand past medicine, past science, and past societies on their own terms
* Understand the difference between primary and secondary sources
* Critically assess the claims made in historical research
* Analyse the translation of medical research into medical practice
* Consider the changing settings of medical practice and the consequences for medical research
* Use history to consider causes and possible outcomes of current medical developments and controversies

**Course content (approx numbers of lectures, tutorials, practical classes):**

6 workshops

2 learning-based excursions

1 film screening

**Transferable skills and integrated skills (IS):**

IS in module: The ability to read, analyse and critique a wide variety of sources in depth, written and analytical skills, oral and written presentation skills, team working skills

**Summative assessment of the module:**

**Coursework:** Production of press release based on recent Nature article

Comparison of two historical accounts of a scientific development

**Examination:** **In Specialist Options examination**

**Term 2: Specialist Options**

Title of Module: **Experimental Pharmacology**

Teaching Weeks: **Weeks 7 - 8**

Academic lead: **Dr Chris John and Dr Anabel Varela-Carver**

Campus: **Hammersmith**

**Overall learning objectives:**

Students should be able to:

* Use a range of *ex vivo* preparations to demonstrate the effects of autonomic, cardiac and anaesthetic agents
* Design simple *ex vivo* experiments, prepare accurate dilutions from stock drug solutions and perform experiments safely and in accordance with the law
* Quantify results and present them in an appropriate graphical format
* Use simple statistical procedures, including correlation, regression and multivariate ANOVA correctly to analyse quantitative data generated from practical experiments
* Write a detailed laboratory report following standard scientific structure
* Understand the reasons why animals are used in medical research
* Understand the centrality of animal welfare and ethical considerations to the use of animals in medical research

**Course content (approx numbers of lectures, tutorials, practical classes):**

8 lectures,

2 tutorials

1 computer based tutorial

4 practicals

**Transferable skills and integrated skills (IS):**

IS in module: Self-motivation and self-management, team-working, problem-solving, written communication, statistics and data handling, literature review and critical appraisal, computer and IT skills

**Summative assessment of the module:**

**Coursework:** Practical write-up

**Examination:** In the Specialist Options examination

**Term 2: Specialist Options**

Title of module: **Nanotechnology and biomedical sciences – the good, the bad and the future**

Teaching weeks: **Weeks 5 – 6**

Academic Lead**: Prof Terry Tetley**

Campus: **South Kensington, RBH**

**Overall learning objectives**

The student should be able to:

* Understand the discipline and diversity of nanotechnology
* Explain how nanotechnology can contribute to the diagnosis and treatment of disease
* Understand the role of nanotechnology in imaging and research
* Appreciate how imaging at the nanoscale enhances our understanding of mechanisms at the tissue, cell and molecular level
* Explain how cells, in culture and in tissues, interact with artificial materials
* Understand how micro- and nano- engineering is used to study and control how cells interact with biomaterials
* Understand how modern biomaterials can be used to develop medical devices
* Outline the potential use of fabricated cellular arrays in clinical applications
* Understand the potential future use of nanotechnology in the biomedical sciences
* Appreciate the risks, ethical and regulatory issues associated with synthesis, use and disposal of nanomaterials

**Course content (approx numbers of lectures, tutorials, practical classes):**

14 lectures

4 tutorials

2 practicals

**Transferable skills and integrated skills (IS):**

IS in module: Self-motivation and self-management, team-working, problem-solving, written communication, statistics, data handling, literature review and critical appraisal,

computers and IT skills

**Summative assessment of the module:**

**Coursework:** 1000 word essay from a choice of titles

**Examination:** In the Specialist Options examination

**Term 2: Specialist Options**

Title of module: **The applications of “Omics” – the paradigm of pregnancy**

Teaching weeks: **Weeks 7 – 8**

Academic Lead: **To be confirmed**

Campus: **South Kensington & Hammersmith**

**Overall learning objectives**

The student should be able to:

• Understand the main complications of human pregnancy

• Explain how the approaches of “Omics” may help the understanding of these complications

• Identify the very tight patient grouping criteria needed for such studies, and the reasons why they are needed

• Understand the strengths and limitations of: genomics, proteomics, metabolomics

• Identify the types of samples to which these approaches can be applied effectively

• Understand how this data may complement other approaches (eg NMR & other forms of scanning)

• Discuss the data currently available in such studies, identifying how future studies should be planned

• Explain how this consideration of one model system may be applied to other investigations

**Course content (approx numbers of lectures, tutorials, practical classes):**

12 lectures

4 discussion groups

4 tutorials

2 practicals

**Transferable skills and integrated skills (IS):**

IS in module: Problem-solving, statistics, data handling, computers and IT skills

**Summative assessment of the module:**

**Coursework:** Write-up of practical work

**Examination:** In the Specialist Options examination

**Term 2: Advanced Cell and Molecular Science**

Title of module: **Cancer Biology**

Teaching weeks: **Weeks 9-11**

Academic leads: **Dr Charlotte Bevan and Dr Mark Sullivan**

Campus: **Hammersmith**

**Overall learning objectives:**

The student should be able to:

* Understand the primary factors likely to lead to the development of cancer
* Understand the importance of interactions between normal and abnormal cells
* Appreciate how different potential causes of cancer may interact
* Appreciate how an knowledge of causes can help identify the most appropriate therapeutic approaches

**Course content (approx numbers of lectures, tutorials, practical classes):**

24 lectures

3 tutorials

**Transferable skills and integrated skills (IS)**

Transferable skills sessions:1

IS in module: Communication and literacy, evidence based argument, scientific reading and writing, team-working.

**Summative assessment of the module:**

**Coursework:** Poster presentation

**Examination:** In the Advanced Cell and Molecular Science examination

**Term 2: Tutored Dissertation**

Title of module: **Tutored dissertation – titles vary: see Appendix 4 for example titles and a list of supervisors**

Teaching weeks: **Teaching will be distributed throughout term 2 and will be organised by mutual arrangement between tutors and tutees.**

Academic Lead**: Dr Peter Clark**

Campus: **All Campuses**

**Overall learning objectives**

The student should be able to:

* Conduct a comprehensive literature search in a currently topical area of Biomedicine.
* Select and edit the information appropriate to the topic.
* Accurately interpret and critically analyse the relevant information.
* Use their prior scientific understanding to draw evidence-based conclusions from literature
* Produce a major piece of evidence-based, correctly referenced written work, justifying their conclusions

**Course content (approx numbers of lectures, tutorials, practical classes):**

1 introductory lecture

4 (minimum) 1-to-1 tutorials with supervisor

11 sessions for private study on dissertation

**Transferable skills and integrated skills:**

IS in module: Self-motivation & self management, scientific literature searching and critical appraisal, evidence-based scientific argument, scientific writing, computer and IT skills.

**Summative assessment of the module:**

**Coursework:** 4000 word dissertation

**Examination:** None

**Term 3: Immunology**

Title of module: **Immunology**

Teaching weeks: **Weeks 1-4**

Academic Lead: **Dr Hugh Brady**

Campus for teaching: **South Kensington**

**Overall learning objectives**

Students should be able to:

* Describe the organisation and development of the immune system in the context of lymphoid tissues and organs, T lymphocytes, B lymphocytes, antigen presenting cells, and the processing and handling of foreign antigens.
* Describe the components and function of the innate immune system.
* Describe the structure and function of B and T cell antigen receptors.
* Explain the mechanisms and pathways of lymphocyte activation, proliferation, and differentiation.
* Describe the structure of products encoded by the MHC locus and their function in immune responses.
* Explain the mechanisms involved in the regulation of immune responses.
* List the main effector mechanisms of immunity, and describe how they provide protection for the host against viruses, parasites and intracellular bacteria.
* Describe the immunological mechanisms underlying allergy, autoimmunity, graft rejection and tumour surveillance.

**Course content (approx numbers of lectures, tutorials, practical classes)**

29 lectures

2 tutorials

1 Poster Presentation

1 all day lab class

**Transferable skills and integrated skills (IS):**

Transferable skills session: 1

IS in module: Self-motivation & self management, scientific literature searching and critical appraisal, evidence-based scientific argument, scientific writing, computer and IT skills, problem solving, team working.

**Summative assessment of the module**

**Coursework:** Oral presentation

Poster presentation

Practical (computer-based test)

**Examination:** In the Immunology examination