Imperial College
London

BSc in Medical Sciences with ANAESTHESIA & CRITICAL CARE

Introduction

The BSc course in Anaesthesia & Critical Care covers some of the most common, and most important issues in modern medical science. There are nearly 3 million general anaesthetics carried out per year in the UK. Chronic pain affects between one-third and one-half of the population. Sepsis is responsible for more deaths in this country than prostate, breast and bowel cancer combined, with one person dying every 10 minutes. Acute respiratory distress syndrome (ARDS) can result from a variety of insults including respiratory infections, and is the main reason nearly 7 million people have died in the 4 years since the appearance of COVID-19. This course will address aspects of each of these issues, touching on the 'how' of modern anaesthesia and critical care practice, but focussing on the 'why'. Students will explore these areas with experts from some of the most research active departments in the country.

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Course Administrator Helen Bell (h.bell@imperial.ac.uk)

Aims and Objectives

The overall aim of the BSc course is to equip students with an understanding of research principles, along with the knowledge and skills required to participate in the research process from design to evaluation. More specifically, students will:

- explore the mechanisms by which both anaesthesia and critical illness produce profound derangements in physiology.
- address the involvement of normal and dysregulated immune response to drive many of these changes.
- consider the current gold standard treatments for a variety of scenarios including sepsis, acute respiratory failure and burns injury. Students will then utilise their understanding of the underlying science to evaluate whether the evidence really supports the medicine.
- explore the future of anaesthesiology and Intensive Care, addressing topics such as design of our next generation of painkilling drugs, artificial organ support technologies, personalised medicine and machine learning in the ICU.

Structure

The course itself consists of three separate Modules, characterised by different learning strategies. Module 1 forms the bulk of the 'taught' material, comprising 12 weeks of content including lectures, team-based learning sessions, workshops and 'flipped classroom' type sessions. Module 2 is a 5-week long, self-directed module, and Module 3 is a 16-week long research project.

Module 1

Module Leads Dr Kieran O'Dea (k.odea@imperial.ac.uk)
Dr David Antcliffe (d.antcliffe@imperial.ac.uk)

The initial taught component of the course is designed to both provide students with the underlying science behind perioperative and intensive care medicine, and to enable students to begin to develop communication, interpretation and evaluation skills. The module will be split into 3 blocks of 3 weeks of teaching, with a consolidation week in between each. Consolidation weeks can be used for preparation of assessments, meeting with faculty, organising consultant contact (for Module 2) and revising material. As a general template, block 1 is designed primarily to provide important underlying knowledge, block 2 designed more to allow students to evaluate current treatments utilising this knowledge, and block 3 to see where the future may take us. Specific topics to be covered will include:

- molecular basis and physiological consequences of anaesthesia
- science and clinical monitoring of pain sensation
- presentation and management of burns
- sepsis pathophysiology and treatment
- immune responses to infectious and non-infectious insults
- mechanisms of organ injury and repair
- heart-lung interactions during ICU
- cardiac and respiratory mechanical support
- ICU acquired weakness and delirium
- development of novel targets for pain relief
- positive and negative 'side effects' of anaesthetic agents
- psychology and rehabilitation in ICU
- machine learning
- personalised medicine in the ICU
- ethics

The majority of teaching will take place on campus. Currently one day per week, most weeks, will be primarily dedicated to asynchronous learning such as preparation for tasks and working on pre-sessional material. The rest of the time you will spend on-site learning through various formats including face-to-face interactive lectures, small-group work, team-based learning, journal clubs, simulation sessions etc.

Module 1 will be assessed via 3 in-course assessments designed to evaluate core skills within the specialism-specific framework. These will consist of a written piece (Letter to the Editor), an oral piece (presentation on a controversial topic) and a piece based on management and interpretation of supplied data.

You will receive specific references from lecturers where appropriate. Useful 'generic' reading for the course includes:

- Medzhitov. Origin and physiological roles of inflammation. *Nature*, Vol 454, 24 July 2008.
- Seeley et al. Inflection points in sepsis biology: from local defense to systemic organ injury. *Am J Physiol Lung Cell Mol Physiol* 303: L355–L363, 2012.
- Yadav et al. Is Acute Respiratory Distress Syndrome a Preventable Disease? *Am J Respir Crit Care Med* 195: 725-736, 2017.

Module 2

Module Leads Dr Istvan Nagy (i.nagy@imperial.ac.uk)
Dr Brijesh Patel (brijesh.patel@imperial.ac.uk)

Module 2 is designed to enhance the students' scientific and research skills through primarily self-directed learning. The module will involve both individual and group tasks, to engage students in critical appraisal of literature and evaluation of scientific problems. Students will develop their skills through two tasks, one a group 'critical summary' and the other an individual 'science in context' task.

Critical summary

Students will work in small groups (4-6) to produce a 'critical summary' based on a topic relevant to the field. In addition to writing a review students will also evaluate the work of another group and have the opportunity to revise their own work in light of others' comments. Thus students will participate in team working, communication and critical appraisal, and experience the peer review process.

Science in context

Here the students will work independently to produce a clinical case study. This will be based on observation of a patient organised during Module 1. The assessment will be in the form of a poster presentation plus Q&A session, and should include a case summary and an in-depth critique of the evidence for either the underlying pathophysiology or clinical management and guidelines.

Module 3

Module Lead Dr Matthieu Komorowski (m.komorowski14@imperial.ac.uk)

The final component of the BSc will take the form of a 16-week research project (including a 2 week Easter break plus time to write-up). In the majority of cases this will be a piece of original research, either clinical-, data-, or laboratory-based. This will enable the students to put the skills developed during the course into practice in a real-life sense. At the end of the project students will write up their work in the form of a research paper, and give an oral presentation reflecting on their work and considering future research directions.