Imperial College
London

BSc in Medical Sciences with RESPIRATORY SCIENCE

Introduction
Respiratory disease is common, reflecting environmental, occupational and inherited factors. Respiratory patients have a significant clinical and economic impact on the NHS and respiratory conditions have a substantial personal impact on the affected individuals and their families. This course gives students an opportunity to study in depth the science underlying a number of respiratory conditions and their management.

This course will comprise a two week introductory foundation course followed by three 5-week taught modules and either a research project or a specialist course (two 5-week modules).

Course Director
Professor Louise E. Donnelly l.donnelly@imperial.ac.uk

Course Administrator
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Aims and Objectives
The aim of this course is to provide a scientific basis for the practice of, and research into, respiratory medicine. It will allow students to achieve the following broad outcomes:

- An understanding of the molecular, cellular and pathophysiological processes of a range of pulmonary diseases and of how this knowledge underpins diagnostic investigations and provides the evidence base for conventional and novel treatment strategies.
- An understanding of the principles of research and the ability to assess critically published evidence and data generated in the laboratory
- The ability to communicate scientific concepts effectively with professional colleagues both verbally and in writing
- The ability to work effectively in groups in order to perform practical studies and to be able to communicate scientific knowledge accurately to other students
- An understanding of the epidemiological principles that underpin the conduct of a clinical audit

In addition, the specific course objectives are to provide students with an understanding of the:

- Burden of lung disease, nationally and internationally
- Principles underlying the diagnosis and investigation of lung disease
- Techniques used to diagnose lung disease
- Molecular and cellular basis of pulmonary inflammation (e.g. in COPD, asthma, acute lung injury, cystic fibrosis and idiopathic fibrosis)
- Role of environmental factors in these processes (e.g. smoking, occupational allergens, infectious agents)
- Role of specific mediators in the healthy and diseased lung
- Principles of drug development for lung disease
- Use of established guidelines in clinical practice
- Laboratory investigation and research into lung disease
- Ethical use of animal models to investigate mechanisms of lung disease
- Role of epidemiological investigation in the study of cause of disease

Content
The course content will include a broad range of respiratory sciences including, the physiology and pharmacology, pathophysiology, genetics and epidemiology of lung diseases and pulmonary diagnostics. Importantly, students will have the opportunity to attend clinics and observe novel diagnostic procedures in a research-active environment, thus relating their newly acquired scientific knowledge in a variety of clinical contexts. Our BSc students will be encouraged to attend grand rounds and seminars, often from prestigious international visiting scientists. By the end of the BSc, students will have an understanding of the scientific basis of lung diseases, the aetiological factors involved, the investigation of these processes, and novel treatments not yet in routine practice.

Format of teaching
The course will be taught in a mixture of lectures, seminars, practical classes and clinic visits. Students will also be encouraged to attend the winter meeting of the British Thoracic Society to gain wider experience of academic medicine.

Introductory Module:

Module Leader
Professor Sue Smith, Royal Brompton campus sue.smith@imperial.ac.uk

Overarching Aim
To provide students with the tools to develop and extend the study and research skills necessary to complete a successful BSc.

Specific Aims
- To revise the anatomy, physiology and pharmacology of the human respiratory tract.
- To improve practical laboratory skills
- To enhance the ability to critically appraise written sources and verbal presentations
- To improve the ability to carry out a literature search and write a well-structured and scholarly essay

Content
Although we will be reviewing and expanding knowledge and understanding of respiratory science, learning facts is not the primary focus of the introductory course. In contrast, it is an opportunity for students to improve their abilities to search and appraise the scientific literature, communicate scientific concepts verbally and in writing, and learn more about experimental design. The tutorial programme forms the backbone of the module during which students will be working with the same assigned tutor throughout to enable continuity and the giving of targeted feedback where necessary.

Module 1: Investigation, management and new therapies for lung disease: Bench to Bedside

Module Leaders
Professor Louise E. Donnelly, Royal Brompton campus l.donnelly@imperial.ac.uk
Dr Duncan Rogers, Royal Brompton campus duncan.rogers@imperial.ac.uk

Aims
To understand the scientific basis underlying the pathophysiology of lung disease and the pharmacology of existing therapies and to use this knowledge to develop new therapies for the clinic.

Content

- **Current therapies for specific lung disorders will be critically evaluated and used to introduce the concepts of evidence-based scientific and clinical strategies for the development of improved treatments**
- **The emphasis will be on investigating chronic respiratory conditions including chronic obstructive lung disease (COPD), cystic fibrosis, asthma, cough, sleep disorders and respiratory muscle dystrophies**

Module 2: Molecular Cell Biology of the Lung in Health and Disease

Module Leaders

Dr Uta Griesenbach, Royal Brompton campus u.griesenbach@imperial.ac.uk
Dr Meinir Jones, Royal Brompton campus meinir.jones@imperial.ac.uk
Professor Jane Mitchell, Royal Brompton campus j.a.mitchell@imperial.ac.uk
Professor Terry Tetley, Royal Brompton campus t.tetley@imperial.ac.uk

Aims

- To understand how the complex network of specialised cells maintain pulmonary homeostasis and contribute to lung disease via differential release, and response to, a discreet number of locally acting mediators.
- To understand the relative contribution of inherited traits and environmental factors to the pathology of specific lung diseases

Content

- The complex interactions of specific mediators including nitric oxide, endothelin-1 and cytokines and their relative contributions to lung health and diseases such as asthma, COPD, CF and pulmonary hypertension will be explored.
- Relevant/related cell signalling pathways and possible therapeutic interventions will be covered.
- The contributions of genetic diversity and environmental agents to lung disease etiology will also be covered.

Module 3: Infectious and Allergic Lung Disease

Module Leaders

Dr Michael Edwards, St Mary's campus michael.edwards@imperial.ac.uk
Dr Debbie Jarvis, Royal Brompton campus d.jarvis@imperial.ac.uk

Aims

- To understand the cellular and molecular mechanisms underlying allergic hypersensitivity
- To understand cellular and molecular aspects of host defence to infectious microorganisms of the respiratory system
- To understand the contributions of infectious micro-organisms to human respiratory disease in individuals and populations
- To explore interplay between respiratory infections and allergies in asthma.
- To describe current trends in allergic disease and apply basic epidemiological principles to design and interpret epidemiological studies

Content

- Overview of innate and adaptive immunity of the respiratory tract.
- The immunological basis and clinical manifestations of allergic disease and its treatment.
- An overview of the hygiene hypothesis, and how respiratory infections and allergic mechanisms can lead to asthma
- The consequences of respiratory tract infection with pathogenic micro-organisms and the immune and inflammatory responses to infection to the individual.
- Modulation of allergic mechanisms and immunity to infection as treatments for respiratory disorders.
- The effect of respiratory infections and population based interventions on reducing prevalence and severity of respiratory disease.

Modules 4 and 5

Projects - A wide variety of laboratory, library, and clinical projects will be offered.

Past BSc Project Titles in Respiratory Science

- Regulation and Function of SOCS Proteins in bronchial epithelial cells
- Investigating the role of BBS proteins and primary cilia in lung alveologenesis
- Does meeting the clinical defining criteria for the Systemic Inflammatory Response Syndrome (SIRS) equate to biochemical inflammation following cardiac surgery?
- Air pollution effects on the exacerbations of asthma and COPD
- Do engineered nanoparticles induce a pro-fibrotic response in the alveolar unit?
- Mechanisms of type I interferon regulated immune responses to rhinovirus infection in vivo
- Does the lack of CFTR in immune cells of cystic fibrosis patients directly impair the immune system and, therefore, affect host response to microbial infection?
- Is 'natural tolerance' at high allergen exposure, associated with inhibitory IgG_4 antibodies?
- Assessment of CFTR potentiators in the context of CF gene therapy
- IgG modulation of IgE-associated risk for wheeze in high risk (mite sensitised) children: a potential predictive bioassay.
- Effect of red wine extract, resveratrol, on leukocyte migration
- Mitochondrial Reactive Oxygen Species (ROS) production and function during oxidative stress induced inflammation in mouse models of COPD.
- The role of JAK/STAT pathway in the pathogenesis of Chronic Obstructive Pulmonary Disease.
- Macrophage migration inhibitory factor (MIF) expression and function during oxidative stress induced inflammation in mouse models of COPD

- Associations between lifetime occupation, respiratory symptoms and disease in the older workforce
- Hypoxaemia, dyspnoea, and exercise tolerance in patients with pulmonary arteriovenous malformations
- The long term effectiveness of a staged assessment in managing children with problematic asthma
- The Role of Transient Receptor potential (TRP) channels in airway disease
- Adenocarcinoma morphology as a prognostic marker in lung cancer
- Effects of a novel environmental control device on sleep quality in people with atopic asthma and rhinitis.
- Comparison of functional responses of M1 and M2 monocyte-derived macrophages

What do the students think of the BSc in Respiratory Science?

'Although my opinion is somewhat biased, Respiratory BSc is definitely the best BSc to choose! Perfect location, enjoyable course, highly proclaimed experts in Respiratory Medicine as lecturers and a great social atmosphere are just a few of the things that Respiratory BSc has to offer. Furthermore if you are looking for a more clinically orientated BSc with "nice hours", Respiratory is definitely the BSc for you. The first module enables students to spend time in adult and paediatric clinics and there is much opportunity for hands on learning in the lung function laboratory! Respiratory has always been highly regarded as a BSc and is known for its good social vibe. Lectures are based at the Royal Brompton Hospital, a specialist hospital in Cardiology and Respiratory Medicine so you are surrounded by experts in their fields and there is unlimited access to a variety of resources to help you through your BSc. The Royal Brompton is a great place to be based and further more is only a few minutes away from the Kings Road, where you can find some the best shops, eating places and pubs in London. Many afternoons were spent with the whole group in one of these nice pubs or restaurants! Below are some key facts about the Respiratory BSc which I hope you will find useful when deciding which BSc to pick:

Subject: Respiratory Medicine- Avoid this BSc if you have no interest in lungs or Respiratory disease whatsoever!

Modules: Module 1: Physiology and pharmacology of lung disease
Module 2: Molecular cell biology of the lung in health and disease
Module 3: Infectious and allergic lung disease

Location: Royal Brompton mostly. Some practical sessions at South Kensington and a few lectures at St Mary's Hospital in Module 3!

Time: Lectures happen 3-5 days a week- this varies between the modules. The day starts around 9 and usually ends at 12. So lots of time to work in the afternoons or do other similar things!

Lectures: Lectures roughly last between 45mins-1 hour long and are mostly very engaging. There are many interactive sessions, workshops and discussion sessions as well as tutorials, which are really interesting and more enjoyable than having endless lectures!

Assessment: One essay and one other form of assessment per module.

Imperial College is the only University in the country to offer Respiratory Medicine as a BSc and much of the teaching takes place in the National Heart and Lung Institute which is one of the leading research centres in the World! All the lecturers and course leaders are very friendly, approachable and supportive and if you put in the hours in you are guaranteed to enjoy Respiratory BSc!'

'The Respiratory Sciences BSc was very well organised with excellent lectures, tutorials and practical sessions. In Module 1 there were sessions to be spent in occupational and paediatric respiratory medicine clinics. These were very good as they allowed the lecture content in Module 1 to be seen being applied in clinical practice, and also as a way of easing the transition from clinical training in Year 3 to the academic nature of the BSc year.
Throughout the taught modules, there were discussion sessions and journal clubs which were very useful as they gave an opportunity to critically appraise papers, discuss ideas on the lecture content and also ask any questions that may not have been answered in the lecture. These sessions were very good as they helped with coursework preparation and the way of forming supported arguments that would be assessed in the exams in February. For these sessions a reading list was provided before the session, so it is worth reading over these papers and doing some preparation work beforehand.
The Respiratory Sciences BSc had an average number of lectures and taught sessions with most afternoons being free for self-directed learning; however there was a large amount covered in the lectures, which required a large amount of further reading.'