IMPERIAL

Computational Modelling of the Lung

Location: Hammersmith Campus

Supervisors: Professor Steven Niederer and Professor Salman Siddiqui

Funding: 4-year post-graduate PhD research studentship, at UK home student rates.
International students can apply but will need to explain how they will cover international fees at the School of Medicine (See https://www.imperial.ac.uk/students/fees-and-funding/tuition-fees/postgraduate-tuition-fees/2024-25/postgraduate-research-programmes/faculty-of-medicine/)

Start Date: 1st October 2025
We are seeking a highly motivated PhD student to develop state-of-the-art computational models of the lung, advancing our understanding of pulmonary function and respiratory disease. The project is sponsored by and will work closely with GSK to use model developments in their drug development pipeline. This project offers an exciting opportunity to work at the intersection of applied mathematics, computational modeling, and medical science, contributing to the next generation of lung digital twins.

Project Overview
The respiratory system is a complex, dynamic structure that plays a vital role in human health. Computational models offer a powerful tool to study lung function across scales, from airflow dynamics to gas exchange and cellular responses (Fig.1). In this PhD, you will develop and validate multi-scale models of lung physiology, integrating mathematical frameworks, high-performance computing, and clinical imaging data.

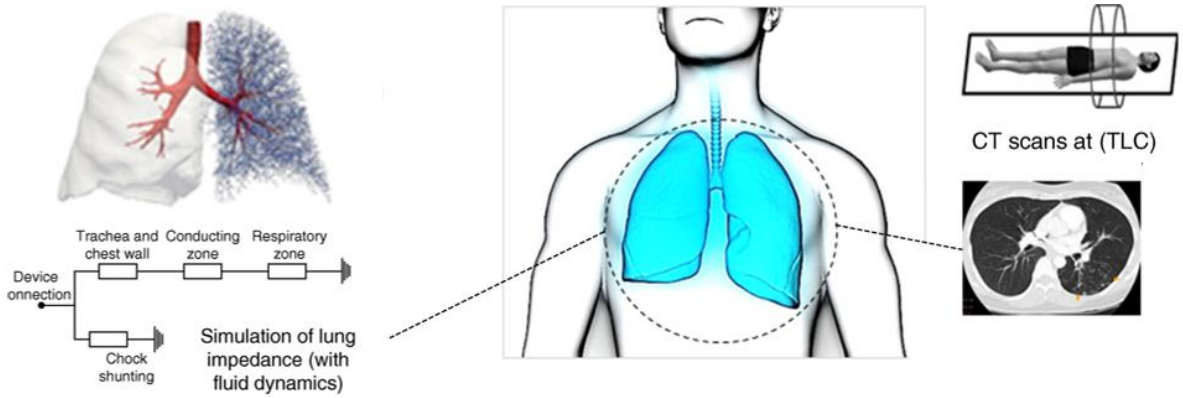

Fig. 1: Adapted from: Foy BH, Soares M, Bordas R, Richardson M, Bell A, Singapuri A, Hargadon B, Brightling C, Burrowes K, Kay D, Owers-Bradley J, Siddiqui S. Lung Computational Models and the Role of the Small Airways in Asthma. Am J Respir Crit Care Med. 2019 Oct 15;200(8):982-991.

The project will focus on COPD (Chronic Obstructive Pulmonary Disease), a progressive lung disease that makes it difficult to breathe. The disease is characterized by persistent respiratory symptoms and airflow limitation due to airway and/or alveolar abnormalities.

Key research questions may include:

- How do changes in airway anatomy impact lung function?
- Can computational models help personalize treatment strategies for lung diseases such as COPD and fibrosis?
- How can we integrate patient-specific data into simulations to improve predictive accuracy?

Key Responsibilities

- Develop and implement computational models of lung mechanics, airflow, and gas exchange.
- Utilize numerical methods and high-performance computing for large-scale simulations.
- Collaborate with clinicians, experimentalists and GSK to validate models using imaging and physiological data.
- Publish findings in high-impact journals and present at international conferences.

Candidate Requirements

We are looking for candidates with a strong background in one or more of the following areas:

- **Computational Modelling & Simulation:** Finite element methods, computational fluid dynamics, or multi-scale modelling.
- **Applied Mathematics & Physics:** Partial differential equations, numerical methods, and dynamical systems.
- **Programming & High-Performance Computing:** Proficiency in Python, C++, or similar languages.
- **Interest in Biomedical Applications:** Previous experience in physiological modelling is desirable but not required.

Why Join Us?

- Work in a multidisciplinary environment with leading experts in computational biology, engineering, and medicine.
- Strong industry collaboration with opportunities for multiple placements.
- Access to state-of-the-art computational resources and real-world clinical data.
- Opportunity to contribute to groundbreaking research with direct clinical applications.
- Competitive stipend and funding for conference travel.

How to Apply

Interested candidates should send a CV, academic transcripts, and a brief statement of research interests to s.niederer@imperial.ac.uk Informal inquiries are welcome.
Join us in shaping the future of pulmonary computational modelling and advancing respiratory healthcare!