Title: Fluid Dynamics in the Human Glomerulus: the formation of ultrafiltrate and possible counter-current enhancement of solute diffusion

Type of award PhD Research Studentship

Department Mechanical Engineering, Fluids and Aerodynamics Research Group

Scholarship Minimum £17,668 p.a. subject to confirmation of eligibility and award

Duration 3.5 years

Eligibility Home/EU/Overseas

Start Date September 2023

PhD Topic Background/Description

The renal glomeruli form primary urine through filtration as the first stage in urine production and are susceptible to changes in disease. The current concept of glomerular physiology involves afferent arterioles branching from a vascular pole into smaller and smaller vessels until filtration capillaries are reached. The form, distribution and orientation of the vessels all play a role in the efficacy of the filtration process; however, little is generally understood of the enabling microcirculation within the glomerulus and its surrounding Bowman’s capsule. The morphology of the renal glomerulus is highly optimised to enable throughput, but additionally it is a highly resilient system which avoids complications such as fouling. It is indeed with some astonishment that the structure and functioning of the renal glomerulus remains much the same across species, indicating that it retains important characteristics unchanged by evolution and adaptation, reinforcing its uniqueness.

The research will use mathematical modelling of blood and urinary flows through the glomerulus to reveal the extent of conduit filtration overall and establish whether counter-current enhanced filtration of solutes occurs in the filtration capillaries. We will further investigate how this might compare with other animals and how hypertension or the changes associated with diabetes affect glomerular filtrate production. The form of the glomerular structure and composition is available thanks to the unique imaging capabilities at the Wolfson Bioimaging Facility at the University of Bristol.

Prospective candidates should have a maths/engineering background or be a numerate biological scientist with a keen interest in mathematical modelling of biological processes.
Candidate Requirements
Applicants must hold/achieve a minimum of a master’s degree (or international equivalent) in a science, mathematics or engineering discipline. Applicants without a master’s qualification may be considered on an exceptional basis, provided they hold a first-class undergraduate degree. Please note, acceptance will also depend on evidence of readiness to pursue a research degree.

If English is not your first language, you need to meet this profile level:
Profile E
Further information about English language requirements and profile levels.

Basic skills and knowledge required:
Essential:
High calibre in applied mathematics and programming skills
Desirable:
Knowledge in fluid dynamics and bioengineering. Experience with developing scientific computing software.

Scholarship Details
Funding is subject to award of either DTP or UoB Postgraduate Research Scholarship, further information on Postgraduate Research Scholarships can be found at http://www.bristol.ac.uk/engineering/postgraduate/funding/pgr-scholarships/

Minimum tax-free stipend at the current UKRI rate is £17,668 for 2022/23.
For eligibility and residence requirements please check the UKRI UK Research and Innovation website.

Informal enquiries
Please email Dr Alberto Gambaruto (alberto.gambaruto@bristol.ac.uk)

For general enquiries, please email came-pgr-admissions@bristol.ac.uk

Application Details
To apply for this studentship, submit a PhD application using our online application system [www.bristol.ac.uk/pg-howtoapply]

Please ensure that in the Funding section you tick “I would like to be considered for a funding award from the Mechanical Engineering Department” and specify the title of the scholarship in the “other” box below with the name of the supervisor.

Closing date for applications: 31 January 2023