Title: Fluid mechanics of the upper respiratory airways: investigation of morphological form in relation to evolutionary optimisation of physiological function

Type of award PhD Research Studentship

Department Mechanical Engineering

Scholarship Details
- University of Bristol Postgraduate Research Scholarships
- EPSRC Doctoral Training Partnerships
- China Scholarship Council Joint Scholarship
- Faculty of Engineering Dean’s Scholarship

If you are interested in this potential PhD project, please visit http://www.bristol.ac.uk/engineering/postgraduate/funding/ for more details on these general scholarships

Duration 3.5 years

Eligibility Please use the above link and individual scholarships for further details on criteria for eligibility.

Start Date 24 September 2018

PhD Topic Background/Description
The project proposes an investigation of the upper airways (especially nasal cavities) of extinct and extant species, to investigate the evolutionary optimisation of the morphology. Extant species show an impressive diversification of anatomical form of the upper airways, driven in part by the optimisation for heat and humidity exchange, as well as other physiological functions including the sense of olfaction. It is observed that endothermic (warm blooded) animals have more complex upper airway morphologies than ectothermic (cold blooded) animals. Understanding the morphology of the airways can provide us with a wealth of knowledge regarding a species evolution history, adaptation to different environmental conditions and the evolution of endothermy.

The complexity of the problem lies in the non-linearity between the morphology, fluid mechanics and physiological function, and currently no study has linked anatomical form of the airways to a specific physiological function. The proposed project will make use of Computed Tomography scans of extinct and extant vertebrate species, from which three-dimensional morphological models can be reconstructed for subsequent analysis. This analysis is two-fold: firstly, to obtain a description of the complex anatomical shapes in order to quantitatively measure the anatomy of the nasal cavities and upper airways, and secondly, the numerical simulation of the air flow to measure the heat/humidity exchange in living and extinct animals. This will be related to the animal’s environment, size and behaviour in extant animals and this information used to infer such properties in extinct animals, to
understand what characteristics are important and have driven the design of the nasal passage morphology.

The research involves collaborations with national and international institutions, bringing together a multidisciplinary group of researchers, from applied mathematics to palaeobiology, making this project both dynamic and interesting. The candidate will play a role in liaising with the different institutions.

URL for further information:
http://biofluids.blogs.ilrt.org/

Further Particulars

Candidate Requirements
A first or 2:1 honours degree in Maths, Physics, Engineering, Palaeobiology or Geology and Biology.

Basic skills and knowledge required
Good ability in mathematics and numerical methods. Knowledge of fluid mechanics and some programming skills are expected. Knowledge of biology, bioengineering and palaeobiology desirable.

Funding Notes
If awarded, the successful candidate will be offered one or both of the following:
- full UK/EU/Overseas PhD tuition fees
- a tax-free bursary at the current RCUK rate (£14,553 p.a. in 2017/18)

Informal enquiries
Please contact Dr Alberto Gambaruto, alberto.gambaruto@bristol.ac.uk

For general enquiries, please email gsen-pgrs@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 Dr Alberto Gambaruto.

Closing date for applications 15 / 22 January 2018

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