PROJECT TITLE: Diversification and extinction in the history of life

University of Bristol Theme: Digital and Data Research Challenge Area
Research Group(s): Palaeobiology
Lead Supervisor: Philip Donoghue, University of Bristol, School of Earth Sciences
Co-Supervisor: Daniele Silvestro, Department of Biology, Université de Fribourg; Davide Pisani, University of Bristol, School of Biological Sciences; Michael Benton, University of Bristol, School of Earth Sciences

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Project keywords: biodiversity, Earth history, diversification, extinction, Bayesian modelling
Funder: University of Bristol Scholarship

Project Background
Earth abounds with life, creating and seemingly filling every possible ecological niche, on Earth’s surface, above and below it. But it has not always been that way. Earth was originally a lifeless planet and from the origin of life, biodiversity has flourished through the interplay of speciation and extinction. Insights into the history of biodiversity are derived necessarily from analyses of the fossil record and the past decades have witnessed the assembly of global datasets that characterise the distribution of fossil organisms across temporal and geographic space. These have informed debates on the limits of biodiversity and how they may have evolved over Earth history. Accommodations have been made for biases in sampling, both rooted in the incompleteness of the rock record and the retrieval of fossils, but synthetic analyses of the history of biodiversity have not attempted to address the fundamental challenge, that temporal ranges of fossil species underestimate their true ages of origination and extinction. The aim of this project is to use probabilistic and AI-based methods to derive better estimates of the history of biodiversity.

Project Aims and Methods
The fossil record is an invaluable and unique archive of evolutionary history, but it requires interpretation. This is because fossil occurrences always underestimate the true temporal range of lineages because origination is a genomic phenomenon invisible to the fossil record and because stratigraphic ranges are truncated by secular variations in the rock record in which the fossil record
You will use state of the art methods for estimating lineage origination and extinction times based on global fossil occurrence databases including the PBDB and Geobiodiversity Database. Methods include the Bayesian Brownian Bridge model and new deep learning models that are under development by Co-supervisor Daniele Silvestro. These analyses will allow you to revisit classic questions including diversification dynamics, the impact of background and mass extinction events on the history of biodiversity, whether there are limits to biodiversity on Earth and whether they have evolved over Earth history.

**Candidate**
The project is best suited to candidates who enjoy computational methods and have an interest in the history of biodiversity. Some programming experience would be beneficial.

**Training**
You will be provided with training in programming and in the application of the open source software. There is scope for the successful candidate to contribute to software development if that is of interest.

**Background reading and references**

**Useful links**
https://donoghue.blogs.bristol.ac.uk/
http://www.bristol.ac.uk/earthsciences/courses/postgraduate/

**Eligibility**
UK and International students are eligible for a University of Bristol Scholarship. UoB Scholarships are fully funded for 4 years and cover university fees, living expenses at the UKRI standard rate, and an allowance of £2000 per year towards research expenses.

**Application deadline:** Tuesday 16th January, 2024, 23.59 GMT
(Interviews are expected to take place in mid/late February)

**How to apply**
Applications are online only at: http://www.bristol.ac.uk/study/postgraduate/apply/
Please select “PhD in Geology” as the programme in the online application system.
Please specify the project title and supervisors for the project that you are applying for.
To ensure your application is considered under the University of Bristol Scholarship funding scheme you must complete the Funding page in your online PhD application as follows:
1. For “What is your likely source of funding?” select Studentship
2. For the free text field “Please give the name of your scholarship or studentship” enter University of Bristol Scholarship.
3. Set “Percentage from this source” to 100%
4. Set “Is this funding already secured?” to No