School of Earth Science, PhD Project

PROJECT TITLE: The evolutionary origin and assembly of animal bodyplans

University of Bristol Theme: Climate and Environment Research Challenge Area AND Digital and Data Research Challenge Area
Research Group(s): Bristol Palaeobiology
Lead Supervisor: Professor Philip Donoghue FRS, University of Bristol, School of Earth Sciences
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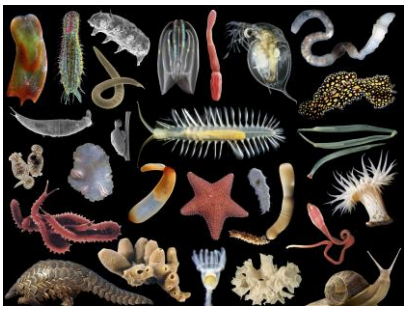
Project keywords: Metazoa, bodyplans, evolution, animals, phylogenetic, genome, fossil
Funder: University of Bristol Scholarship



Modern diversity of animal bodyplans

The fossil record shows that the majority of animal bodyplans had originated by the Cambrian

Project Background

The origin and early evolutionary history of animals is one of the most formative episodes in Earth history, precipitating the emergence of distinct animal bodyplans and their impact on the environment around them. While significant progress has been made in understanding the emergence of bilaterian phyla, the origin and early evolution of animals remains poorly constrained, not least since the evolutionary relationships of the non-bilaterian phyla remain unresolved. This includes the position of placozoans, and whether ctenophores are a distinct lineage of eumetazoans, coelenterates, or the sister lineages to all other animals. The ancestor of all bilaterians is also contested, with the position of acoel flatworms debated. Until these fundamental branching relationships are resolved, it will not be possible to resolve the interrelationships of their fossil relatives or obtain lasting insights into the evolutionary assembly of the animal bodyplan and the organ systems that brought about the Cambrian Explosion.

Project Aims and Methods

This project combines genomic and palaeontological approaches to understanding the origin and early evolution of animal bodyplans. You will seek to resolve phylogenetic debate over the relationships of ctenophores, placozoans and acoelomorphs to the rest of the animal kingdom through comparative genomics. There is a rich history of lively debate over the affinities of these phyla which differ largely on how the same phylogenetic trees should be rooted. This project will exploit genes that duplicated within the evolutionary history of animals and their relatives to provide multiple independent tests of rooting positions within animal phylogeny. These data will also be used to establish the relative sequence and absolute timing of evolution of innovations that are key to the success of the animal body plan, providing insights analogous to those provided by fossils arranged within stem-lineages. Finally, you will rationalise the fossil record of early animals, including the enigmatic Ediacaran macrobiota within the context of the ensuing phylogenetic framework, combining the best of genomic and palaeontological data to uncovering the basis of the Cambrian Explosion.

We welcome the input of candidates in shaping the design of the project and its development during the course of the PhD and we are very open to candidates who are interested in focusing on one or more aspects of the project, as described.

Candidate

The project is suited to a student with a bachelors or masters degree in Earth Sciences, Systematics, Palaeontology, Biological Sciences, Biochemistry, Zoology or Genetics. We do not anticipate that candidates will have the skills required to undertake this advertised project; a PhD is about training and you will be supported in the development of the required skills.

Training

You will be provided with training in phylogenetics and palaeontology. There will be opportunities to undertake research visits to international research institutions to support the analysis of palaeontological material.

Background reading and references

Carlisle, E., Yin, Z., Pisani, D., and Donoghue, P. C. J., 2024, Ediacaran origin and Ediacaran-Cambrian diversification of Metazoa: Science Advances, v. 10, no. 46, p. eadp7161.
Clark, J. W., and Donoghue, P. C. J., 2023, Constraining whole-genome duplication events in geological time: Methods in Molecular Biology, v. 2545, p. 139-154.
Dunn, F. S., Liu, A. G., Grazhdankin, D. V., Vixseboxse, P., Flannery-Sutherland, J., Green, E., Harris, S., Wilby, P. R., and Donoghue, P. C. J., 2021, The developmental biology of *Charnia* and the eumetazoan affinity of the Ediacaran rangeomorphs: Science Advances, v. 7, no. 30, p. eabe0291.
King, N., and Rokas, A., 2017, Embracing uncertainty in reconstructing early animal evolution: Current Biology, v. 27, no. 19, p. R1081-R1088.

Useful links

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 £2100 per year towards research expenses.