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EDUCATION

A Multi-omic Analysis of the Photosynthetic Endosymbioses of *Paramecium bursaria*
Doctor of Philosophy
Natural History Museum
University College London

October 2011 - July 2016

Joint institution PhD in Bioinformatics on the reconstruction of cellular interactions in a nascent endosymbiotic system. This research was co-supervised by Professor Max Telford (Professor of Zoology, EMBO YIP 2000) at University College London (UCL) and Professor Thomas Richards (Professor of Evolutionary Genomics, EMBO YIP 2012) at the Natural History Museum, London. This research involved the development of novel machine learning and computational methods to analyse 'single' cell metagenomic and metatranscriptomic datasets. It involved the first use of these datasets in the study of non-model multi-eukaryote systems. Additionally, this work included extensive phylogenomic analyses and the use of mass spectrometry data to recapitulate the metabolome of *P. bursaria* and its algae.

The thesis was examined (and upgraded) by Professor Saul Purton (Professor of Algal Biotechnology, UCL), Professor Andrew Roger (Professor of Biochemistry and Molecular Evolution, Dalhousie) and Professor Nick Lane (Professor of Evolutionary Biochemistry, UCL).

Master of Arts (Honours) Natural Science - Biological Sciences
Oxford University

October 2008 - June 2011

Honours schools: Cellular & Developmental Biology and the Biology of Plant & Animal Disease
During this degree I conducted the following independent research:

- The evolution of the folate biosynthesis gene fusions in the eukaryotes (supervised by Dr Thomas Richards) (now published - see publications section below for full citation).
- Explaining the functional diversity of leucine rich repeats (supervised by Dr Adrian Smith).
- A proposal to investigate the exchange of proteins between *Ignioccocus hospitalis* and *Nanoarchaeum equitans* (supervised by Professor Ian Moore).

RESEARCH EXPERIENCE

Associate Research Fellowship
University of Exeter

March 2016 - Present

Postdoctoral research post with Professor Thomas Richards at the University of Exeter. This research is partially based on the completion of PhD research, particularly, experimental induction of RNAi in *P. bursaria* and automation of assembly optimisation using Bayesian hyperparameter selection methods. Finally, this project also involves an analysis of protein transmembrane domain evolution between domains of life with deep recurrent neural networks.

National Data Science Bowl II

December 2015 - March 2016

Participated in a Kaggle machine learning competition aiming to estimate left ventricular volume of a heart at systole and diastole from 3D MRI videos as part of 3-person team with PhD students from University of Edinburgh. This regression problem solution involved GPU-accelerated deep recurrent neural networks.

National Data Science Bowl I

December 2014 - March 2015

Participated in a Kaggle machine learning competition on the image classification of plankton images into 121 classes. Formed part of 6-person team with PhD students from University of Edinburgh. Placed in top ~ 5% of teams (57/1049) by model averaging several deep convolutional neural networks trained using online image augmentation and supplemented with conventional visual feature extraction and hierarchical label classification data.

American Epilepsy Society Seizure Prediction Challenge

August - October 2014

Participated in a Kaggle machine learning competition trying to differentiate pre-seizure iEEGs from normal brain activity as part of 3-person team with PhD students from University of Edinburgh. Placed in the top 5% of teams (16/527) using an ensemble of random forest models trained on a range of signal analysis features e.g. multivariate auto-regression models and frequency power bands.

ETE Toolkit Python3 Port

April 2015

Ported a $> 15,000$ LOC toolkit for the analysis and visualisation of phylogenetic trees to Python3. This was merged back into the main codebase and formed a significant part of the next major version release.

NASA E-MIST Project

July - October 2013

Conducted research on the E-MIST (Exposing-Microbes In the StraTosphere) project with Dr David J. Smith. This role involved ground-based trials for investigating the transcriptomic response to high UV-C flux exposure in *Bacillus*. This experience also involved assisting with the design and construction of an exposure and sampling apparatus for atmospheric microbes that could be mounted on high altitude weather balloons (now published).

BBC Cloud Lab Documentary

October 2013

Acted as NASA representative and scientific adviser for the British Broadcasting Company (BBC) 'Cloud Lab' documentary on atmospheric sciences. In this role I created microbial sampling and exposure protocols as well assembling the necessary materials and airship fixtures to conduct these experiments. I additionally briefed Dr Jim McQuaid (University of Leeds) and producers on the relevant microbiological background.

Society for General Microbiology Harry Smith Vacation Studentship June - August 2010

Funded summer research project (9 weeks) with Dr Thomas Richards at the University of Exeter on the evolution of folate biosynthesis gene fusions in the eukaryotes.

BioMAP Egypt

July - August 2008

Research assistant (5 weeks) on the BioMAP GIS project monitoring biodiversity in the Sinai desert in association with the University of Nottingham and the Suez Canal University.

AWARDS AND GRANTS**School of Informatics Jamboree Prize**

26th March 2015

University of Edinburgh

Poster Competition Prize

NASA Planetary Biology Program

July - October 2013

John F. Kennedy Space Centre

Competitive award which funded a short term (10 week) research fellowship with Dr David J. Smith at NASA Kennedy Space Centre on bacterial adaptations to extreme conditions (£3500).

Earth and Space Foundation Exploration Award

2013

John F. Kennedy Space Centre

Awarded for work conducted at NASA Kennedy Space Centre with Dr David J. Smith in the use of terrestrial environments to advance the exploration of space (£300).

FEMS Young Scientist Meeting Grant

19th-24th October 2013

Sant Feliu de Guixols, Spain

Federation of European Microbiological Societies (FEMS) grant to attend and present at the European Molecular Biology Organisation (EMBO) conference: Comparative Genomics of Eukaryotic Microorganisms 2013 (£350).

FEMS Young Scientist Meeting Grant

15th-20th October 2011

Sant Feliu de Guixols, Spain

Federation of European Microbiological Societies (FEMS) grant to attend and present at the European Molecular Biology Organisation (EMBO) conference: Comparative Genomics of Eukaryotic Microorganisms 2011 (£350).

Society for General Microbiology Undergraduate Student Grant

5th-7th September 2011
University of York

Grant for travel and accommodation to attend and present at the Society for General Microbiology (SGM) Summer 2011 conference at the University of York (£170).

Dukinfield Exhibition in Biological Sciences

October 2009-July 2011
Somerville College, Oxford

Awarded and maintained throughout my undergraduate degree for academic excellence (£300).

Society for General Microbiology Harry Smith Vacation Studentship

June 2010-August 2010
University of Exeter

Award funding a summer research project with Dr Thomas Richards at the University of Exeter on the evolution of folate biosynthesis gene fusions in the eukaryotes (£1890).

PUBLICATIONS**“Complex patterns of gene fission in the eukaryotic folate biosynthesis pathway.”**

Maguire, F., Henriquez, F.L., Leonard, G., Dacks, J.B., Brown, M.W., Richards, T.A.
Genome Biology and Evolution 6, 2709-2720, 2014

“Organelle Evolution: A Mosaic of ‘Mitochondrial’ Functions”

Maguire, F., Richards, T.A.
Current Biology 24(11), R518-R520, 2014

“Relative iEEG Feature Importance in Seizure Prediction”

Gray, G., Lowe, S., **Maguire, F.**
In preparation

“Diverse molecular signatures for ‘active’ Perkinsea in marine sediments”

Chambouvet, A., Berney, C., Romac, S., Audic, S., **Maguire, F.**, de Vargas, C., Richards, T.A.
BMC microbiology 14(1), 110, 2014

“A Balloon-Based Payload for Exposing Microorganisms in the Stratosphere (E-MIST)”

Smith, D.J., Thakrar, P.J., Bharrat, A.E., Dokos, A.G., Kinney, T.L., James, L.M., Khodadad, C.L., **Maguire, F.**, Maloney, P.R., Dawkins, N.L.
Gravitational and Space Research 2 (2), 2014

“Cryptic infection of a broad taxonomic and geographic diversity of tadpoles by Perkinsea protists”

Chambouvet, A., Gower, D.J., Jirku, M., Yabsley, M.J., Leonard, G., **Maguire, F.**, Bittencourt, G., Wilkinson, M., Richards, T.A.
Proceedings of the National Academy of Sciences, USA, 10 August 2015

“Molecular Diversity and Distribution of Marine Fungi Across 130 European Environmental Samples”

Richards, T.A., Leonard, G., Mahe, F., del Campo, J., Jones, M.D.M., **Maguire, F.**, Dunthorn, M., Vargas, C., Massana, R., Chambouvet, A.
Proceedings of the Royal Society B 282 (1819) 20152243

CONFERENCES AND WORKSHOPS**CIFAR IMB 2016**

1-5th June 2016
Toronto,
Ontario, Canada

Oral presentation: “An analysis of RNAi pathway components and function in *Paramecium*”

Introduction to Machine Learning for Life Sciences Workshop

1st-2nd June 2015
University of Exeter, Cornwall
Tremough, United Kingdom

Invited Talk: “Stumbling Over the Decision Boundary”

Invited Talk: “Casting a Deep Net: Classifying Plankton from Images”

School of Informatics Jamboree 2015

26th March 2015
University of Edinburgh,
Edinburgh, United Kingdom

Poster presentation: “Classifying Plankton Species with Deep Learning and Computer Vision”
Graham, M., Gray, G., Lowe, S., Maguire, F., Selega, A., Stanciu, D.
(Presented in absentia).

EMBO YIP Course

2nd-7th December 2013
EMBL,
Heidelberg, Germany

Oral presentation: “Key endosymbiont proteins implicated in the maintenance of the photosynthetic endosymbiosis between *Paramecium bursaria* and *Chlorella*”
Poster presentation: “Key principles in molecular phylogenetics”

EMBO: Comparative Genomics of Eukaryotic Microorganisms

19th-24th October 2013
Sant Feliu de Guixols, Spain

Poster presentation: “Key endosymbiont proteins implicated in the maintenance of the photosynthetic endosymbiosis between *Paramecium bursaria* and *Chlorella*”.

National Association for Research in Science Teaching

25th-28th March 2012
Indianapolis, IN, USA

Oral presentation: “Working on the Public’s Perception and Understanding of Science and Scientists through a Popular, Open-access ‘AskScience’ Website”
de la Rubia, L.A., Marus, S., Maguire, F.
(Presented in absentia).

Tennessee Maths and Science Education Research Conference

2nd-3rd February 2012
Murfreesboro, TN, USA

Oral presentation: “Online Conversations as a Way of Understanding the Public’s Views of the Nature of Science: Research on Reddit’s ‘AskScience’ ”
de la Rubia, L.A., Marus, S., Maguire, F.
(Presented in absentia)

Systematics Association: Young Systematists Forum

1st December 2011
Natural History Museum

Poster presentation: “Folate Biosynthesis Gene Fusions Evolution in the Eukaryotes”.

Society for General Microbiology Summer Conference

5th-7th September 2011
University of York, UK

Poster presentation: “Evolution of Folate Biosynthesis Gene Fusions in the Eukaryotes”.

EMBO: Comparative Genomics of Eukaryotic Microorganisms

15th-20th October 2011
Sant Feliu de Guixols, Spain

Poster presentation: “Evolution of Folate Biosynthesis Gene Fusions in the Eukaryotes”.

TEACHING AND SUPERVISION

- Wellcome Trust Biomedical Informatics Hub Introduction to Python and Advanced Python (January-March 2016)
- Introduction to Machine Learning for the Life Sciences Workshop (June 1st-2nd 2015)
- Wellcome Trust ISSF Genomics Course (February 4th-25th 2015)
- Wellcome Trust Biomedical Informatics Hub Unix and Perl Course (October 2014-July 2015)
- Co-supervision of final year undergraduate project at University of Exeter identifying components of the RNAi system in *Paramecium bursaria* (November-December 2014)
- Wellcome Trust Biomedical Informatics Hub Image Processing with Python Workshop (18th-19th September 2014)
- Software Carpentry Exeter Bootcamp (14th-15th November 2013)
- Supervision of a visiting summer research student registered at the University of Oxford. The project involved bioinformatic analysis of arsenate resistance HGTs. (June-October 2013)

WORKSHOPS AND TRAINING

- Workshop on Gaussian Processes for Global Optimisation (17th September 2015) at University of Sheffield, Sheffield, UK
- Gaussian Process Summer School 2015 (14-16th September 2015) at University of Sheffield, Sheffield, UK
- European Molecular Biology Organisation Young Investigator PhD course (2nd-7th December 2013) at European Molecular Biology Laboratory, Heidelberg, Germany.
- Molecular Evolution Workshop (22nd July - 1st August 2012) at the Marine Biological Laboratory, Woods Hole, Massachusetts, USA
- Completed massively open online courses (MOOC) in: machine learning, mathematical logic, linear algebra, algorithms, databases, probabilistic graphical models, statistics, data analysis, automata theory, functional analysis, and music theory

OUTREACH

Moderator of the “AskScience” science education forum with over 15 million monthly views and 250,000 unique visitors per day.

TECHNICAL SKILLS

- Expert with UNIX/Linux, Zsh/Bash, Python, Awk, Git, L^AT_EX
- Familiar with R, Awk, C, C++, perl, matlab, statistics and machine learning, Linux HPC System Administration
- Several open source contributions to bioinformatics projects in python and C++
- Basic knowledge of Javascript (including D3.js), CSS, Nim, Verilog, Prolog, Go
- Extensive domain specific knowledge in bioinformatics: transcriptomics, molecular evolution/phylogenetics, genomics, metabolomics, sequence analysis, annotation
- Familiarity with an array of basic molecular and microbiological techniques and methodologies: PCR, culturing, cloning, sequencing technologies, microscopy.

PROFESSIONAL MEMBERSHIPS

- International Society for Infectious Disease
- British Psychological Society
- Federation of European Molecular Biology Societies
- University and Colleges Union (UCU)

OTHER INTERESTS

- Technical co-founder of ‘Awesound’ a start-up based on short-form sharing of spoken-word audio clips.
- PADI Open Water Diver
- St. John’s Ambulance First Aider
- RYA Level 3 Sailing
- Languages: German (intermediate), French (basic)
- Musical instruments: French Horn and Bass Guitar

REFERENCES

References available on request.