

# FINLAY MAGUIRE

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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 - December 2015

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 genomic, metabolomic and transcriptomic 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 *Ignioccoccus hospitalis* and *Nanoarchaeum equitans* (supervised by Professor Ian Moore).

## SHORT TERM PROJECTS

**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 network models.

**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 GPU-accelerated deep convolutional neural network models 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 autoregression models and frequency power bands.

**ETE Toolkit Python3 Port**

April 2015

Ported a > 15,000LOC 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.

**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 as 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

### **Introduction to Machine Learning for Life Sciences Workshop**

Invited Talk: “Stumbling Over the Decision Boundary”  
Invited Talk: “Casting a Deep Net: Classifying Plankton from Images”

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

### **School of Informatics Jamboree 2015**

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*).

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

### **EMBO YIP Course**

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”

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

### **EMBO: Comparative Genomics of Eukaryotic Microorganisms**

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

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

### **National Association for Research in Science Teaching**

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*).

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

**Tennessee Maths and Science Education Research Conference**

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*)

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

**Systematics Association: Young Systematists Forum**

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

1st December 2011  
Natural History Museum

**Society for General Microbiology Summer Conference**

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

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

**EMBO: Comparative Genomics of Eukaryotic Microorganisms**

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

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

**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<sup>A</sup>T<sub>E</sub>X
- Intermediate with R, C, C++, perl, matlab, high-performance linux system administration, statistics and machine learning
- 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.