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Conference

Report of the 2016 *Protistology-UK* Spring meeting

The 2016 Spring meeting was a double celebration. First was the change of the Society's name from *British Society for Protist Biology* to the more snazzy (and shorter!) *Protistology-UK*. Second was the actual meeting of the newly-named Society, which was held at Bournemouth University (UK) on 6–8th April and hosted by Genoveva Esteban. The meeting consisted of a plenary lecture and three symposia—one of which was a special workshop sponsored by *PhycoNet* (a Biotechnology and Biological Sciences Research Council [UK] Network in Industrial Biotechnology and Bioenergy). There were 50 scientists and graduate students in attendance; an assemblage of protist enthusiasts from all over the UK and several additional countries from three different continents including Europe, North America and Asia. The meeting was sponsored by *PhycoNet*, the *Microbiology Society* (UK), *Elsevier* and Bournemouth University (UK).

The meeting began not with lectures, but with a field trip to East Stoke Nature Reserve in Dorset (south of England), a freshwater fen habitat which is the subject of ongoing protistological research, and a hot spot of protist diversity. The visit commemorated the announcement that the site will be protected due to its intriguing microbial communities found within, a first for the UK. Visitors were treated to a guided tour by Genoveva Esteban and a conservation officer from the Dorset Wildlife Trust; an information board (Fig. 1) was revealed highlighting the importance of the site for microbial life. Infamous British weather was ever present, so as to give visitors an authentic experience of fieldwork in the UK.

The plenary lecture was delivered on the opening evening by Gill Malin (University of East Anglia, Norwich, UK) which was a timely summary of a changing ocean and the implication in regards to protist ecology. The talk focused on DMSP (dimethylsulphoniopropionate), a zwitterion found within the cells of protists. DMSP is the main precursor for dimethylsulphide (DMS), a 'trace-gas' that plays an important role in the global sulphur cycle via sea-air exchange, transferring sulphur to terrestrial and freshwater environments where it can be a limiting nutrient. DMS is an area of ongoing research involving a way in which the earth's system is cooled via production of aerosol reflective particles. The talk explored how such research could predict oceanic change.



Fig. 1. Genoveva Esteban and Alan Warren (forefront of the image) unveiling the protists information board at East Stoke Nature Reserve (UK).

Three symposia were organised, the first of which focused on *Eukaryote taxonomy and diversity studies in an High Throughput Sequencing (HTS) era*, chaired by David Bass (Natural History Museum, London, and Centre for Environment, Fisheries and Aquaculture Science [Cefas]).

Presentations in this session began with back-to-back talks by Cedric Berney (CNRS & UPMC, Station Biologique, Roscoff, France) who summarised an international collaborative project proposing an integrative and dynamic database framework, such as *Unieuk* and *Eukref* to bring together and curate the big molecular data that is being produced, working as a common language in protistology. The second talk presented the *Tara Oceans* project and some of its exciting results, including the thousands upon thousands of protist lineages/genetic 'types' being recovered from the world's oceans. The proposed *Unieuk/Eukref* will hopefully bring understanding and order to this, and we all look forward to it.

Micah Dunthorn (University of Kaiserslautern, Germany) gave an enlightened talk on his molecular diversity studies of soils in Neotropical rainforests—a geographical area that is largely unexplored as far as protists are concerned. Micah reported a novel approach for examining sequence reads,

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many found as having little similarity to the known databases. This molecular approach suggests that Apicomplexan parasites dominate the protistan soil communities in the tropical areas, which was equally diverse in the communities thus far examined.

Michael Cunliffe (Plymouth University, UK) spoke on the developing field of HTS, which reveals marine protist and fungi diversity at the molecular level, and what HTS diversity actually means, its use and misuse in understanding microbial eukaryote diversity. In particular, Michael showed a few examples linking HTS-derived diversity data with microscope-derived data, and the value of combining HTS with environmental metadata.

The final talk in the session was delivered by Grant D. Stentiford (Cefas, UK) who spoke from an agency perspective on the importance of a clear taxonomy on issues such as UK food security (e.g. parasite identification and ranges). The use of morphological species identification increased molecular resolution should improve our understanding of the moving target of the anthropogenic species concept. This is important in that UK regulations (as well as global) on import/export based upon a particular parasite must have a clear identifying marker so as to be useful in understanding its presence or absence from a given region, such that policy in place must not be hindered by a changing species identification.

Day two contained the second Symposium entitled *Eukaryote Genome*, chaired by Demetra Andreou (Bournemouth University). This section included invited talks by Ross F. Waller (Cambridge University) who introduced Dinoflagellates as a new and fascinating way in which to study chromatin structure. The talk explored the radically different nuclear organisation in this phylum in regards to other eukaryotes. Ross' lectures are always aesthetically very pleasing indeed—and this one on dinoflagellates was no exception.

Bryony A.P. Williams (Exeter University, UK) spoke about microsporidian parasites, their environmental genomics, providing insights into metabolism and host exploitation. She highlighted the host specificity of some members in the group, as well as the actual locations where they inhabit the host cell, and the importance of sequencing genomes for the identification of molecular signatures of intracellular organisms.

William H. Lewis (PhD student at Newcastle University [M. Embley and R. Hirt] and Bournemouth University [G. Esteban], UK) spoke about his research on anaerobic ciliate genomes to understand endosymbiotic archaea and the diminishing genomes of their ciliate hosts' hydrogenosomes ('anaerobic' mitochondria). Ciliates are an excellent model to study hydrogenosomes from a molecular, evolutionary and ecological perspective. Will uses single-cell genome and transcriptome sequencing of the ciliates, their organelles and their endosymbionts. The talk emphasised the importance of deep sequencing to answer questions of evolution and ecology.

Tom A. Williams (Bristol University, UK) gave insight into the widest to date population genomic survey of

Microsporidium. High genomic streamlining in ancestors of this group is contrasted with the apparent specialisation from different world regions sampled. The enormity of such a project is obvious while the ending target will be genetic resolution to the population level.

The symposium concluded with 'contributed and students' talks starting with Gareth Bloomfield (Cambridge University, UK) who discussed his project on the origins of macromycetozoa. These 'slime moulds' exhibit evolution that remains unclear. Gareth looked at fruiting bodies as a way to examine such theories which included an interesting observation of a cannibalistic amoeba interaction. Martin Carr (University of Huddersfield, UK) spoke about Choanoflagellates as an analog to study the evolution of animals, with comparisons of missing genes between these groups and the functional ecological significance for protein synthesis. A higher than expected morphological diversity of the group was reported and interestingly few freshwater–salt water incursions were identified.

The third symposium was on *Protist Ecology* and was chaired by Daniel Franklin (Bournemouth University, UK), which included the invited talk by David J.S. Montagnes (Liverpool University, UK) about potential thermal sensitivities of phagotrophic protists using a study model for consumer–prey dynamics to study how warming environments could affect predator–prey interactions. Important areas such as cyanobacteria blooms and the thermal tolerance of mixotrophic eukaryotes were explored.

Manuela Hartmann (Southampton University, UK) spoke about the importance of the smallest phagotrophic phytoplankton (the picoplankton) in the Arctic, a little-known protist group but one of great ubiquitous ecological significance for the open ocean. CO₂ fixation and bacterivory were examined, with this research highlighting the importance of mixotrophy as an important survival strategy globally, not just in the tropics.

The contributed and student talks concluded the section first with Lars Grossmann, (University of Duisburg-Essen, Germany) who spoke about HTS and the similarities of communities using standardised sampling techniques. The distinct habitat types were found to contain distinct microbial assemblages.

The session concluded with PhD student Hunter N. Hines (Bournemouth University, UK, and Harbor Branch Oceanographic Institute, USA) who gave a lecture on his discovery of flagship ciliates in Florida, many being new records of occurrence. This research further confirms the notion that microbial diversity is unexplored globally, and that biodiversity and biogeography of large ciliate species such as *Loxodes rex* offer to continue research into microbial eukaryote global distribution and dispersal. Hunter won the Protistology-UK prize for best student's presentation.

The third and final day of the conference held an *Applied Phycology Workshop* sponsored by *PhycoNet*. The session was introduced by John Day from the Culture Collection of Algae and Protozoa, Scottish Association for Marine Science,

UK. First up was Saul Purton (University College London, UK), who gave an overview of *PhycoNet*—an UK-based network enabling biologists, engineers and industrial partners to consolidate their knowledge and expertise to unlock the industrial biotechnology potential of microalgae. Saul also gave a lecture about the therapeutic proteins synthesised from the model flagellated algae *Chlamydomonas* after genetic engineering. Antibacterial enzymes to target human pathogens, and bio-encapsulated vaccines for oral delivery in aquaculture and poultry industries were discussed.

A sticky business—development of efficient biofilm photobioreactors for microalgae was presented by Björn Podola (University of Köln, Germany), explaining the difficulties in the production of microalgae at industrial scale. Björn illustrated a new technology to achieve exactly that by using porous substrate bioreactors (PSBRs), which achieve great algal yield using vertical surfaces of biofilm cultures and significant reduction of liquid volume.

Brenda Parker (University College London, UK) gave a talk on the exploration of the economic feasibility of protist processing as a biofuel. The marine diatom *Phaeodactylum tricorutum* was examined at all stages for economic recovery, and novel large scale cost-effective production methods were discussed from a biological as well as economic perspective. John Love (Exeter University, UK) gave a talk on algal microfossils and their use as proxies to reconstruct past environments. Love and his group have developed new protocols using Fluorescent Activated Cell Sorting (FACS) that allows rapid analysis and purification of microfossils as well as enabling for molecular sequencing. This method can help to explore past protist communities of water bodies, and compare to modern analogues with regards to

environmental change. Alla Silkina (Swansea University, UK) gave an overview on the use of microalgal pigments in industry, e.g. as antioxidants, immune-system boosters and as colourants; Alla also presented novel production-process technologies for a range of high value pigments.

In addition to the lectures, there were poster sessions for the Protistology-UK meeting attendees to view the work of, and interact with students. The meeting concluded with final remarks by David Bass (current President of the Society) on the importance of protists in ecology, taxonomy, biotechnology and science in general, and the announcement that the 2017 meeting will take place during the Annual Conference of the Microbiology Society, 3–6 April, in Edinburgh (Scotland, UK).

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