THE PHYCOLOGIST

The Newsletter of the British Phycological Society

Editor: **Bruce Osborne**

Home page: http://www.brphycsoc.org/

Number 62

August 2002

Contents

Editorial	1
BPS Winter Meeting University of Galway	2
Pongy plankton and sunscreens	4
Phylogenetic analyses	8
Harmful Marine Dinoflagellates: new CD-ROM	10
Council Officers	11
Instructions for Contributors	12

Editorial

The Daily Telegraph of the 27 July 2002 published a league table of British University Departments based on the assessment, by academics, of their quality, management effectiveness and standard of facilities. These league tables, based on the percentage of departments rated 'excellent', read like the current football premiership, with a premier league, first division, second division, third division and fourth division. There are really no major surprises with the Universities in the premier league although, unlike their football counterpart, it comprises only five 'clubs'. Similarly the ranking of the third division 'clubs 'are generally predictable, with a large number from the former polytechnics. There are some exceptions, however, with some of the more established universities cropping up in both the second and third divisions despite a near 50% of departments being ranked as 'excellent'. The Daily Telegraph also identifies a particularly worrying trend, that student applications last year broadly reflected these rankings, with universities in the top divisions experiencing an increase in applications whilst those at the bottom suffered a slump. This means that even good departments in some lower ranked universities may suffer indirectly due to a perception that the institute in general is of an overall low standard. The consequences are fairly obvious. Whilst the better universities get even better the poorer ones get even poorer, both in terms of personnel, students and financial support, a situation with clear parallels to the current state of British football. What must also be worrying are the long-term consequences for the lower ranked universities? Drawing on two other football analogies are mergers, or even relegation, a possibility?

The British Phycological Society is a Registered Charity, No. 246707 and The Phycologist is a Registered Publication, ISSN 0965-5301

This issue contains information on the next winter meeting at the University of Galway, a notable 'first' as this will be the first time that this event has been held outside the UK. Note, in particular, that abstracts must be submitted by the **30 September** to ensure adequate time for the circulation of the full programme with the last 2002 issue of The Phycologist.

Yet again I have another apology. Due to some editorial confusion associated with two articles on the International Phycological Congress in Greece last year the article that should have been attributed to **Mary Holmes** was incorrectly attributed to Tean Mitchell, although the photograph was of Mary! The article by Tean actually appears in this issue. My apologies to Mary, whose contribution to the recent account of the Bangiophycidae for *Seaweeds of the British Isles*, a BPS sponsored publication has, by all accounts, been very significant.

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BPS WINTER MEETING UNIVERSITY OF GALWAY

Where?

The 51st BPS Winter Meeting and Annual General Meeting will take place at **The National University of Ireland, Galway (http://www.nuigalway.ie)**, Ireland from 2-4 January, 2003. This is the first time that the Winter Meeting has been held outside the UK All presentations will be located on the NUI Galway campus. The Conference dinner will be in the SAS Radisson Hotel on the Saturday evening. The meeting will be partly sponsored by the Martin Ryan Marine Institute (http://mri.nuigalway.ie) and the Irish Marine Institute (http://www.marine.ie) and the registration fee (including lunch and evening meals) is not likely to exceed €150.

When?

The meeting will start with registration and a reception in the **Martin Ryan Institute, NUI, Galway** on the night of 2 January and presentations will be given on the 3 and 4 January. The Annual General Meeting will be on the afternoon of 4 January. An all-day tour of the botanically, geologically and archeologically interesting limestone karst-like region, called the Burren, will be offered on 5 January for those interested, at an extra cost of about €35, which includes lunch.

Accommodation

This will be in local hotels and hostels. A corporate rate of €62 per single room and €69 per double room for bed and breakfast has been reserved at Brennan's Yard Hotel (Tel. +353 91 568166; Fax. +353 91 568262; http://www.brennansyardhotel.com. E-mail: info@brennansyardhotel.com) in the center of Galway about 15 mins very pleasant walk from the University. We have booked 40 rooms until 15th November. To get the special rate please say that you are attending the meeting at NUI Galway. Rooms are also available in the SAS Radison Hotel (Tel. +353 91 538300; Fax. +353 91 538380; http://www.radisonsas.com; E-mail: Sales.Galway@RadissonSAS.com) at about €102 without breakfast. Hostel accommodation can be found locally as well (http://www.gulliver.ie/goireland). In general B&B's are more expensive than the rate for Brennan's yard. **You should book all accommodation directly with the hotel/hostel prior to making travel arrangements.**

Getting to Ireland

Flights to Dublin are available from London Heathrow, London Gatwick, London Stanstead, Birmingham, Manchester, Edinburgh, Glasgow, Cardiff and Bristol, as well as some other regional airports primarily by the carriers **Aer Lingus, British Midland and Ryanair. The sooner you book the cheaper the fare will be!** Direct International, including UK flights to Shannon, situated some distance south of Galway, may also be possible, although there is an infrequent bus link between Shannon and Galway. Although Britain and Ireland are in a common passport area and part of the European Union, since 11 September airlines are demanding a passport or other means of identification prior to travel. This is particularly true of Ryanair so don't get caught out!

Getting from Dublin to Galway

Commuter flights from Dublin to Galway are available from **Aer Arann**. There is also a direct bus service from the airport to Galway by CityLink (http://www.citylink.ie), which is cheap and takes about 3 hours. There are trains from Dublin to Galway (http://www.irishrail.ie) but the train station (Heuston NOT Connolly) is on the other side of Dublin. There are connecting buses from the airport or from Connolly station to Heuston, but they are infrequent and transfers could take 2 or more hours. Regular direct airport coaches to the major bus station in Dublin called Busaras are available. Transfers to Heuston rail station would then be by bus from Connolly station (just over the road from the bus station) or taxi. It is important to note that the currency in Ireland is the Euro and transactions in Sterling are NOT possible. The current pound Sterling: Euro rate is 1:1.61, but may vary. The US dollar rate is at or near parity with the Euro.

Tourist Information

Comprehensive tourist information about Galway can be found at http://www.galway.ie. For other information about Ireland contact the Irish Tourist Board (http://www.ireland.travel.ie).

Web site for Conference

More information is posted on the website (http://www.brphycsoc.org). Contact Mike Guiry (Mike. Guiry@seaweed.ie; Tel. +3531 91 750410; Fax. +3531 91 525005) for further information.

Abstracts

Abstracts should be submitted no later than **30 SEPTEMBER 2002 ON A WORD FORM OBTAINABLE FROM THE WEB SITE (http://www.brphycsoc.org).**

For those interested the 52 BPS meeting will take place at the University of Lancaster, England in early January 2004.

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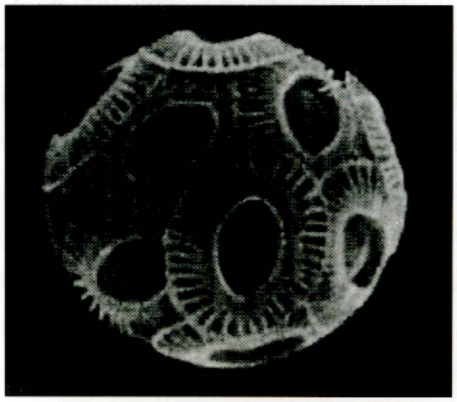
PONGY PLANKTON AND SUNSCREENS FROM SEAWEED

Report of the 7th International Phycological Conference held in Thessaloniki, Greece, 16-25 August 2002



Emiliana huxleyi

Tean Mitchell, Department of Biological Sciences, University of Plymouth

Similarities between phytoplankton and skunks do not readily come to mind but it seems that one of the world's most numerous and important microalgae, *Emiliana huxleyii*, may also use a powerful pong to protect itself from predators.

In the rich waters of the Antarctic, swarms of krill consume millions of *Emiliana* in the spring blooms each year, but these minute coccolithophorid microalgae fight back by releasing dimethylsuphide. The "smell" attracts flocks of gulls which feast on the krill, thus "saving" the algae!

Just one of the many fascinating stories from the gathering of the 7th International Phycological Congress in Greece this summer. The theme of the conference was "Everything Changes" and there was no shortage of papers showing how algal research is constantly progressing and changing too, embracing new technologies and developing new concepts.

Whether it is climate change, pollution, ecosystem function or biodiversity, there are phycologists around the world researching algae and their major role in all these areas of interest to politicians, economists, businesses and scientists alike.

From ultrastructures to algal assemblages, from ecology to chemistry, research on all aspects of algae from freshwater and the sea, from every possible ecosystem and with no corner of the world neglected - only funding constraints seemed to restrict the enthusiasm and inventiveness of the international community of phycologists from pursuing every scientific avenue in their desire to understand the algae – from how they evolved, to how they work and to what uses they may be put by man…..

Papers on bioremediation, biogeochemical cycling, climate change, commercial cultivation, novel medicines, and acquaculture were all part of the "Algae and Human Affairs" sessions. Three other sessions covering physiology and ecology, cellular and molecular biology, and hotly debated taxonomy made up the nearly 200 papers and more than 400 posters presented to an international audience from the world famous (too many to mention) to the unknown (ie, me!).

The importance of the microalgae in biogeochemical cycling was highlighted by Gunter Kirst of Bremen University who is interested in the role of *E. huxleyi* in the release of cloud condensing nuclei (CCN) as a by-product of its use of dimethylsuphonioprionate (DMSP) as a sort of anti-freeze, and to attract the gulls as mentioned above !

Philip Boyd from Otago University, New Zealand and Frank Gervais from the Alfred Wegener Institute for Polar and Marine Research in Germany, reported results of the SOIREE iron fertilisation experiments in the Southern Ocean, which show that high nutrient-low chlorophyll areas can increase productivity four-fold with the addition of iron filings.

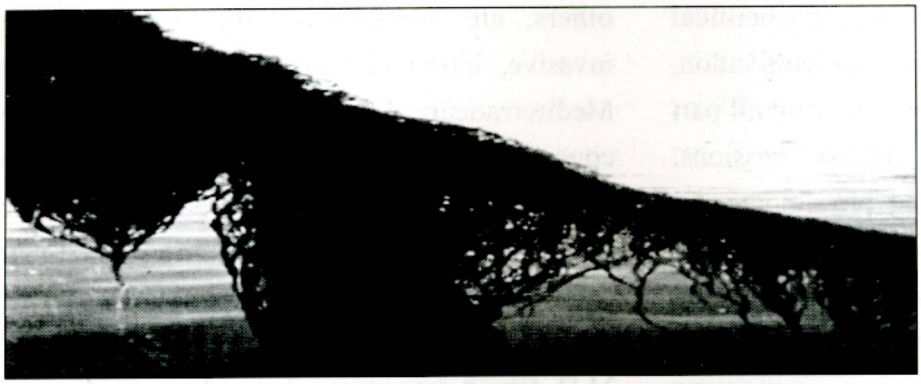
The downside of algal success was highlighted by several researchers from the University of Nice-Sophia Antipolis in France who, among others, are investigating the impact of the invasive, introduced *Caulerpa* species on the Mediterranean. While many researchers are concerned about long-term effects, there was some good news that where the endemic seagrass, *Posidonia oceanica*, grows densely, it can fight off invasion of *C. taxifolia*.

Caulerpa sp

M.D. Stuart from New Zealand reported on an eradication programme for the removal of *Undaria pinnatifida* from mussel farms partly to prevent damage to the viability of the farms and partly to protect the World Heritage sites at Fiordland and the Sub-Antarctic Islands, by removing the sporophytes before they developed. The unknown longevity of gametophytes and as well as the difficulty of locating sporophytes meant an unknown longterm outcome.

Phycologists have embraced new molecular technologies in the last few years and many researchers presented work using sequencing and PCR procedures, especially those involved in taxonomy. Using a mix of classical descriptive methods and molecular investigations, many researchers reported on taxonomic advances and proposals for new phylogenies.

Misidentification and incomplete characterisation of a group of red seaweeds was blamed on huge morphological plasticity and overlapping habitats. As the Gracilariales include my own research organism, I was particularly interested in the work of a team from Louisiana University and the Smithsonian Institute in America who are constructing a global phylogeny of the Gracilariales based on sequencing their rbcL genes.



Gracilaria cultivation on ropes for agar production

Their results from over 100 sequenced specimens worldwide identified at least 5 major clades within the genus *Gracilaria* and a single monophyletic clade for *Gracilariopsis*.

The use of molecular techniques also seems to have produced a rash of new genera and species. A collaboration between Waterloo University, Canada and Texas University, USA using sequencing had produced a molecular phylogeny of the Bangiales where the researchers were able to propose a new genus on the basis of their investigations, leading to the creation of the new species *Psuedobangia kaycoleia*. Using similar techniques, Robert Sheath and his team from Guelph, Canada and Sao Paulo, Brazil also had a new species to propose creating a new gigartinalean genus *Pseudosterrocladia*, for a specimen found in Belize. Max Hommersand and Susan Fredericq used traditional structural methods, backed by sequencing to suggest a new tribe for a section of the Ceramaliales family.

I was particularly excited by a Bayden Wood's paper about the use of Fourier-Transform-Infrared Spectroscopy to carry out non-destructive imaging of macromolecular composition of algal material. With polyploidy and plasticity causing all sorts of problems with my own, mainly vegetative, organism, this technique may be able to answer many questions about differences in physiological states and chemical variations between populations. I am hoping to use this method myself to develop a ploidy-detection system which will allow me to investigate population structures more easily, despite the problems of high numbers of vegetative individuals in my study populations.

Global ozone depletion has led to concerns about algal productivity as increased UV-B levels can bring about profund changes in community structure and function as well as inhibiting growth in economically important species. Linda Franklin from Australia said that studies on the effects of UV on individual organisms still failed to provide sufficient understanding to make any meaningful predictions about the global impact of ozone depletion on algal productivity and ecology. Other researchers had found rising temperatures, CO_2 levels and enrichment of coastal waters all having potentially dramatic effects on diversity and productivity in a wide range of species from unicellular benthic diatoms to commercially grown macrophytes.

Responses of different algae to changes in UV radiation is of considerable interest, as ozone depletion causes increased radiation around the globe.There were a number of presentations among the physiology papers which found algal species able to adapt to different UV levels depending on historical exposure, such as position on the shore and latitude. The idea that

novel sunscreens might eventually result from such work raised the spirits of hard pressed researchers in the competitive world of scientific funding.

A particularly heart-warming story was of a project in India where rural women are cultivating *Spirulina*. Once harvested, it is used to prepare food products such as biscuits, papadoms, noodles and sweets, which the women then sold to the public, making a major contribution to incomes, independence and self-esteem.

For delegates there were the added delights of being in a city with a fascinating cultural heritage, a wonderful selection of restaurants, cafes and bars, and superb markets. The hosts had designated a day off during the scientific programme and provided cultural tours, scenic cruises and, the one I took advantage of, a diving trip. Diving in the clear blue, warm water was a wonderful experience and I can't wait to repeat it.

I made many new friends and renewed other acquaintances, as well as taking advantage of the gathering of so many eminent phycologists to make contact with as many as I could who might be able to help me in my ongoing research.

Our hosts at the Aristotle University of Thessaloniki were superb - with a tasty and enjoyable welcome supper, a huge banquet on the beach with traditional dancing and a reception at a delightful old villa in the centre of town.

I was very grateful for the grant assistance from the British Phycological Society, without which this trip to the only international conference happening during my PhD would not have been possible.

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The picture says it all!

PHYLOGENETIC ANALYSES: NUCLEOTIDE SUBSTITUTION MODELS COME OF AGE

It is common to find articles in which phylogenetic studies based on DNA sequences use particular evolutionary models of nucleotide substitution without any rationale for choosing among these models. However, there are phylogenetic techniques that allow us to test the suitability of different models of nucleotide substitution for particular data sets. Importantly these techniques have recently been proved effective through simulation analyses. We summarize these developments and provide 'rules of thumb' for their predictive ability

Phylogenetic reconstruction seems now to have a firmer basis, with improved tree sampling techniques and more reliable inferences from current models of evolution. For the former, Bayesian methods are convincing us of the futility of the search for *the tree* (Lewis 2001). They tell us that we cannot pick up any single tree if it is not *significantly* better than any of the other examined trees. Instead what these methods do is to collect together the largest possible number of undistinguishable optimal trees and make a consensus out of them. The clades can then be statistically assessed with estimates of the percentage of times that any common sets were found among these trees. An excellent software programme for performing Bayesian phylogenetic analyses is available at http://morphbank.ebc.uu.se/mrbayes/ (Huelsbank and Ronquist, 2001; for a review on Bayesian phylogenetics see Huelsenbeck et al., 2001). But Bayesian, like earlier likelihood methods, needs to be supplied with a model of nucleotide substitution. The key question is what model to choose? Most of the time this decision comes arbitrarily, perhaps following the default options in the computer programme of choice, or even running through each model sequentially until a believable tree based on previous assumptions is obtained. Fortunately, existing model fitting techniques can help us to provide the most appropriate solution. A convenient software programme for this is Modeltest (Posada and Crandall, 1998; available at http://bioag.byu.edu/zoology/crandall_lab/modeltesr.htm). To use it a likelihood score must first be calculated for every model tested (currently 56 models) on a 'base tree'. Modeltest can then search for the best model for a particular data set using two statistical tests, the Akaike information criterion (AIC, which compares all the models at once), or a series of hierarchical likelihood ratio tests (hLRTs, that compares pairs of nested models). Modeltest is already a popular programme, simple and useful, which has left many of us thinking 'How could we have lived with it before?'Since its introduction, however, we have been wondering, 1) How reliable is it? 2) What determines the accuracy of its predictions? 3) What if we get different outcomes from the AIC and hLRTs tests?

Recently Posada and Crandall (2001) addressed these questions in a timely and comprehensive study. They analyzed the performance of the two statistical tests, together with seven other variant model-fitting strategies. First they generated nucleotide data sets using various models of nucleotide substitution and examined how often they recovered these sequences using the different analyses. They also examined the influence of various conditions, including the number of taxa and characters used, base tree type, rate of nucleotide substitution, presence or

absence of a molecular clock, on the efficiency of model recovery. Whilst these results are based on simulations and not on real DNA sequences, they are highly encouraging with a success rate often above 90% for the models in predicting the correct results. The two most important factors determining the success of these analyses were the number of diagnostic characters used (minimum of 500, optimum of 1000+) and the number of taxa (20 generally good, but more improved the accuracy). Counter intuitively the base tree was not important, as long as the tree was not random: a Neighbour-Joining tree based on a Jukes-Cantor model worked most of the time as well as a base tree based on more complex models. Tree height had either little impact or a negative effect on accuracy. Rather surprisingly, perhaps, inclusion of a molecular clock did not affect the efficiency of recovery. Overall, their results favour the hLRT analysis over that of the AIC when used in Modeltest. On average hLRT was roughly 15-20% better. No other model performed better than the hLRT of Modeltest.

Presumably when several factors come together in these analyses a multiplicative effect would decrease the efficiency of the model predictions. According to their results and our interpretation, however, there are only three basic conditions that any data sets should have in order for Modeltest to work well; more than 500 characters, a minimum of 20 taxa and at least a tree height of 0.1. These criteria do not, quite frankly, seem too severe in order to obtain sound phylogenetic analyses.

As a cautionary note, however, there is another aspect to keep in mind. Actuall patterns of nucleotide substitution presumably convey much more complexity than those available through simulations. That is why it is a matter of urgency to develop new models that provide a better description of the real way in which evolution proceeds at the DNA level. Lewis (2001) has recently highlighted important recent advancements in that direction: codon models in which the probabilities of change are not dependent on a matrix of 4 x 4 nucleotides but of 61x 61 codons. Unfortunately these new models are not considered in Modeltest.

In conclusion after Posada and Crandall's (1998, 2001) work there is no reason for persisting with the common practice of choosing arbitrarily the model of nucleotide substitution in phylogenetic analyses. Providing simple conditions are complied with the model fitting may work reasonably well. We believe that using model-based predictions of nucleotide substitution prior to performing phylogenetic analyses will become the routine practice among phylogeneticists working on algae as well as other organisms.

References

Huelsenbeck, J. P. and Ronquist, F. (2001). MRBAYES: Bayesian inference of phylogenetic trees. *Bioinformatics* **17**, 754-755.

Huelsenbeck, J. P., Ronquist, F., Nielsen, R. and Bollback, J. P. (2001). Bayesian inference of phylogeny and its impact on evolutionary biology. *Science* **294**, 2310-2314.

Lewis, P. O. (2001). Phylogenetic systematics turns over a new leaf. *Trends in Ecology and Evolution* **16**, 30-37.

Posada, D. and Crandall, K. A. (1998). MODELTEST: testing the model of DNA substitution. *Bioinformatics* **14**, 817-818.

Posada, D. and Crandall, K. A. (2001). Selecting the best-fit model of nucleotide substitution. *Systematic Biology* **50**, 580-601.

Alberto Saez and Linda Medlin
Alfred Wegner Institute, Am Handelshafen 12, D-27570, Bremerhaven, Germany.

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There is much current interest in harmful/toxic algae and cyanobacteria and the following new publication should provide useful information on one of these groups The authors are Maria Faust and Rose Gulledge. The CD runs on both Windows and Macintosh and costs €49 or £29.95 (without VAT and postage). It is puiblished by the Expert Centre for Taxonomic Identification, University of Amsterdam (http://www.eti.uva.nl). ISBN: 90-75000-21-9.

The CD-ROM can either be ordered by E-mail to orders@eti.uva.nl or by post to the following address

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Copy should be submitted, preferably, on disc (ms word for windows) and the editor reserves the right to edit the material before final publication.

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Deadlines are January 31 for the April issue, May 31 for the August issue and September 30 for the November issue

Printed by Walsh Printers, Roscrea, Ireland