Partnership for Observation of the Global Oceans

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REPORT ON POGO VISITING FELLOWSHIP PROGRAMME 2013

Report from the Visiting Professorship Host

Name of Visiting Professor: Dr Declan Schroeder
Name of Host: Dr Hans Verheye
Host institution: South African Department of Environmental Affairs: Oceans & Coasts Research, Cape Town

Dates of Training: 27 November – 4 December 2013
Subject of Training: Molecular mining of the Continuous Plankton Recorder and other archived datasets

Please provide a brief description of activities undertaken during the visiting professorship period. Please include elements of formal training (e.g. lectures, practicals and field trips) as well as research collaboration, if applicable

In summary, the course was a combination of taught and hands-on practical sessions (see schedule below) that illustrated "best practice" in acquiring molecular data from archived marine samples. It started with a intellectually stimulating Public Lecture by Dr Schroeder, entitled "The Virus, the Sea and the Honeybee Conundrum – Virus Ecology: implications for honeybee health and marine ecosystem function". This lecture had been fairly widely advertised – both on campus and in the local newspaper as well as via the internet-based South African Network for Coastal and Oceanic Research (SANCOR). As result it attracted some 70 people in total, including scientists and academics as well as numerous non-academia, in addition to the course participants. In his lecture, Dr Schroeder provided a wider context behind using molecular-based methods to describe key biological processes. Viruses are active, dynamic and instrumental drivers in controlling host populations and found in most environments including the oceans. At the Marine Biology Laboratory in Plymouth, innovative marine virus research is being undertaken looking at distinct host-virus interactions. Dr Schroeder presented some key findings illustrating how marine viruses have co-evolved with their respective hosts producing unique systems that have profound effects on the hosts they infect and consequently on the global biological processes that depend on these marine systems. More specifically, he talked about how our understanding of the persistent viral infection mechanisms of a giant dsDNA virus has advanced, particularly looking at the viral infection of the main calcite producer, a species of coccolithophore, in our oceans. He also covered his research findings on the description of the giant dsDNA virus found in some species of brown algae that are showing unprecedented viral diversity, challenging current conventions of restricted host range and predictions of emerging infections. In closing, the discovery of a ssRNA virus infecting marine diatoms has challenged the wide-held belief that while terrestrial plants are predominantly infected by RNA viruses, their aquatic photosynthetic equivalents (algae) have only DNA viruses. Moreover, these viruses that infect marine diatoms are most similar to honeybee viruses. Hence the honeybee virus system was adapted and adopted as a model system to study this cryptic infection strategy. This research confirmed the unique relationship between one honeybee virus, and its main vector and worldwide honeybee colony losses.

The remainder of the course was laboratory-based and the 27 participants were taught the What's, Why's and How's of molecular technologies such as DNA extraction, PCR and Sequencing (including next-generation sequencing). The course was designed for marine biologists and biological oceanographers with limited or no experience in molecular techniques. Participants had at least a BSc Hons (or equivalent 4-yr degree) and had *a priori* justified why they would benefit from attending this course. They had been encouraged to bring their own preserved sample(s) to analyse during the workshop. The focus was on ethanol and buffered formalin-preserved samples such as tow silks from the Continuous Plankton Recorder, water samples containing phytoplankton, as well as various other biological specimens or parts thereof, including sponges, fishes (*inter alia* coelacanth!), sharks, and dolphins. On 3 December Dr

Schroeder gave an additional seminar, this time to the local marine research community (incl. the course participants), entitled "Is *Emiliania huxleyi* responding to a rapidly changing world?", which was hosted under the auspices of SANCOR.

Course schedule:

	November				December			
	27	28	29	30	1	2	3	4
	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday
	LT2, John Day Building	Honours lab, MCB				Honours lab, MCB		DAFF, Foretrust
9:30 - 11:00		Welcome & Introduction	Practical: Process samples	Practical: Process samples		Practical: DNA extraction	Practical: PCR	Lecture & Practical: Bioinformatics
11:00 - 11:30	coffee break							
11:30- 13:00		Lecture & Practical: Health & Safety	Lecture: DNA & DNA extraction	Lecture: PCR		Practical: DNA extraction	Early lunch*	Lecture & Practical: Bioinformatics
13:00- 14:00	lunch							
14:00- 15:30		Practical: Prepare samples	Lecture: Formalin & DNA	Lecture: Sequencing		Practical: DNA extraction	Practical: PCR	Wrap-up & Feedback
15:30- 16:00	tea break							
16:00- 17:00		Flex-time^				Flex-time		Departure
evening	Public lecture			Meeting Dinner				

*: SANCOR lecture

^: cover outstanding questions and/or overspill due to delays

How do you think the training was received by the students? Did it meet its objectives? What do you think the students gained from the training? What was the impact of the training on your institute? How did the visiting professorship benefit you personally? If a course feedback questionnaire was distributed to the students at the end of the course, please provide a summary of the feedback provided

Course participants – not less than 28 in total! – were biodiversity researchers working at various academic and research institutions in southern Africa, including South Africa, Namibia (3), Madagascar (2) and Tanzania (1); there were also two participants from as far afield as Costa Rica and Australia (both currently studying in South Africa). All have just started work on using genotyping technologies such as next-generation sequencing. Seven of the participants were scientists and sample analysts employed by the South African Department of Environmental Affairs (DEA), three of whom are working in my lab and used archived plankton samples (incl. a CPR sample) during the course. In general, the course was very positively received by all, and in most cases met their respective objective(s). All participants gained extremely valuable experience in a number of techniques they may at best have heard of, in addition to the practical insights and the theoretical background that were covered in the lectures and seminars given by Dr Schroeder.

Many key techniques to explore the true extent of Biodiversity within the marine environment are currently only known by a few research groups and individuals. Moreover, the rapid advances made in the field of molecular biology are challenging established paradigms regarding our understanding of species concepts. This training course helped disseminate and standardise research-based molecular protocols applied to existing environmental samples such as the South African CPR sister survey, whilst also introducing technologies developed elsewhere for other purposes (e.g. the medical field). A 40-page methods manual was also developed and distributed to the course participants. The manual will be of great practical value to both local researchers and research users. In addition, while established datasets are elsewhere being used in new ways to address fundamental questions regarding the stability of the ecosystem in a rapidly changing world, it is anticipated that our CPR database, once established, will also be used likewise. Finally, earlier plans to have our own Genetics Laboratory established at DEA

have subsequent to the course been firmed up and steps are currently undertaken to implement these plans as part of the refurbishment of DEA's labs that were partially destroyed in a fire last year.

A course evaluation and feedback questionnaire, to which about half of the participants responded, revealed that the pre-course information was overall satisfactory, useful and accurate, and that the venue (MCB at UCT) with its labs and facilities were generally rated good to excellent, except for the access to a single extraction/fume hood by the large number of participants causing some congestion and wastage of valuable time. Regarding the course structure, most participants unequivocally rated the tutors to be friendly and approachable (even during coffee/tea/lunch breaks), the theoretical, demonstration and hands-on practical sessions interesting and varied, the structure clear and easy to follow, and the questions asked were at all times satisfactorily answered. Comments elicited in respect of course content (useful aspects, useless aspects, potential omissions) were quite varied and were largely a function of the degree of prior knowledge and/or experience that the participants had acquired, or their research-specific expectations. Many found it was wonderful, of course, to be able to extract DNA from formalin-preserved samples, which is usable for genetic analyses. While it was appreciated that the protocol/sample treatment to be followed depended on the type of sample/specimen analysed, one participant would have liked to have learnt more about a successful, direct DNA extraction method from small individuals such as small copepods. Another one would have liked to have learnt in greater depth about mDNA analysis, microsatellite analysis and how to develop new markers. There was also a feeling among several participants that in future courses, more time should be devoted, or possibly even added, to more theoretical background (through more and detailed lectures) in general, to bioinformatics and new sequences as well as to software (key programmes for basic analysis) in particular, and also to enable some discussion of the results that are obtained during the course.

One participant found the course a fantastic learning experience and highly recommended this course to be run again; the skills and knowledge gained far exceeded the expectations and equipped one for future research endeavours. Another participant concluded that "This is the type of training any aspiring genetist [sic] requires" and recommended that "More people should be encouraged to participate … These types of workshops should be carried out more often to serve as refreshers courses". Yet another one summed up the course as follows: "Its [sic] all thanks to Declan for having imparted his skills and information to me, thanks to Pavs and the whole organising committe [sic] for making sure that the workshop was a success". I am convinced that he/she was commenting on behalf of all attending!

Do you envisage that any future collaborations (e.g. publications, proposals, future visits, student exchanges) will result from this visit? Please provide details

An overall aim of the course was to ensure that future requirements for technique and instrumentation development were appreciated by all relevant parties. By holding the workshop in Cape Town, it was possible to use the high-quality laboratory facilities of the Molecular and Cell Biology (MCB) Department at the University of Cape Town (UCT), to work on samples from a range of marine environments. This work will be able to be extended well after conclusion of the course, through the establishment of an MoU between the two research institutions. In addition, Dr Schroeder currently maintains close collaborative research with scientists from the MCB (UCT) and also with one of my DEA colleagues, Dr Maya Pfaff, who actually also assisted Dr Schroeder with the running of the course. This course has also laid a firm foundation for the creation of opportunities for future exchange of personnel and collaboration with Dr Schroeder's lab, especially now that DEA will soon have their own specialised labs, as indicated above.

Please provide a break-down of the expenses incurred by the training (those covered by the POGO grant and those covered by your institute) [Note: original receipts should be sent by post for the expenditure covered by POGO]

Grants for this course were received from POGO and SCOR, whilst costs for laboratory supplies and chemicals were borne by DEA.

In addition to these, there were costs for the use of laboratories and equipment as well as for the printing of manuals and these were covered by UCT's MCB and MaRe respectively.

It should be noted that the abovementioned support received from SCOR is only a part of a total grant that was allocated by the SCOR Capacity Building Fund for the participation of non-South African students.