

NEOMICS EXPERT WORKING GROUP

MINUTES OF THE FIRST EWG MEETING, 20 APRIL 2010

Medical School, University of Birmingham

In Attendance

Expert Working Group

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Research Council Observers

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Apologies

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Notes:

Participant views are presented for the most part on a non-attributable basis.

In a small number of instances, comments were relocated from one section of the discussion to another to appear in a more sensible topical arrangement.

The minutes were derived by the Chair from notes provided by N. Morrison, D. Field and S. Turner of the NEOMICS Team.

Welcome and Introduction – **Chairman Prof Thomas Meagher**

The Chair welcomed everyone to the first meeting of the NEOMICS EWG and invited a round of self-introductions.

It was noted that the NEOMICS Team has been formed to prepare a document for use by the NERC in developing a future strategy for 'Omics in environmental science. The role of the EWG is to provide information input into the process as well as to advise the NEOMICS Team on the content of the final report.

I. **Terms of Reference / the NERC challenge** – Dr Bill Eason, NERC Science and Innovation Manager, Swindon Office.

The following points were made by Dr Eason:

- NERC Environmental Genomics (EG) and Post-Genomics & Proteomics (PGP) programmes have consisted of a £28M investment since 2001 and are presently winding down.
- EG/PGP included the establishment of the NERC Environmental Bioinformatics Centre (NEBC) for data management and bioinformatics support.
- Some of the NEBC functions (eg bioinformatics support) have transferred to the NERC Biomolecular Analysis Facility (NBAF)
- Recognising the long-term need for 'Omics support NERC is now considering prospects for a bid to RCUK for an 'Omics facility
- In light of these developments NERC has commissioned the NEOMICS team, following a competitive tender, to develop options for a coherent 'Omics strategy for over a 5-10 year view.
- The NEOMICS Team had put together the present Expert Working Group to be independently led and informed by community needs as part of an open and transparent process. The terms of reference are published on the NERC website¹.
- The final report from the NEOMICS team should consider strategy options that are science-led, but that considers how new technologies can inform science direction as well as how NERC can respond to emergent technologies.
- The report should propose how to coordinate activity with other investments (e.g. BBSRC, MRC, charitable trusts etc.).
- NERC needs a 'roadmap' with a number of different routes that includes some consideration of capital set up and operational costs
- Dr Eason emphasised that the report from the NEOMICS team was the starting point for taking the process forward within NERC
- The report will feed into NERC's business cycle, with the expectation that a draft report would emerge by the end of July
- Although suggestions for delivery structure should be part of the report, the main objective was identification of NERC's long-term needs. NERC can identify details of delivery mechanisms at a later stage, but will need a clear statement of the science base requirements. Things need to be rationalized in terms of scientific advance.

A proposal was raised by EWG members that an additional meeting of the EWG in September to review the final report would be desirable. This would not prevent a draft

¹ <http://www.nerc.ac.uk/research/themes/biodiversity/events/omics-strategy.asp>

report being submitted to NERC in the meantime but would allow for further iteration between NERC, the NEOMICS team and the EWG.

ACTION (Dawn Field) – explore dates for an EWG meeting in September.

II. **Goal: An ‘Omics strategy for NERC** – Dr Dawn Field, co-PI NEOMICS team

Dr Field introduced herself as the co-PI for the NEOMICS project and filled in a few details from the preceding presentation by Dr Eason. The final report will be based on 9 sections of content required by NERC, as outlined in the NEOMICS project proposal circulated and set out in the EWG ToR. The present meeting is where EWG takes ownership of the consultation process.

Dr Field presented a draft survey to be used for registrants of the NEOMICS Town Meeting in May and other interested parties to collect community input. The EWG was invited to provide comment and suggestions for modification, to be collated at the end of the meeting

The following queries and comments arose:

- Should there be the opportunity to contribute to the survey anonymously?
- Should parts of the survey be rephrased to distinguish between respondent needs versus NERC needs?
- Can the results of the survey be made available for the BBSRC panel spending review?
- Respondents need to be encouraged to think of big issues, such as how organisms feed into and respond to biological processes or the how organisms moderate large-scale environmental interactions (e.g. SOLAS findings regarding the role of biofilm in gas exchange at ocean surface-atmosphere interface).

III. **The plan: community consultation** – Dr Peter Kille, co-PI NEOMICS team

Dr Kille outlined the overall logistics of a planned ‘Town Meeting’ on 19-20 May, to consist of a scientific symposium on day one followed by a day-long professionally facilitated workshop on day 2. One of our charges from today is to review the draft schedule for the May meeting (circulated at today’s meeting). It is anticipated that the outcome of this workshop will feed into deliberations of a planned meeting for the EWG on 5 July 2010.

IV. **Development of NERC ‘Omics strategy** – Prof Thomas Meagher to lead

Benchmarking

The purpose of this part of the discussion was to identify what the starting point for development of a NERC ‘Omics strategy might be.

Jason Snape was invited to provide a spontaneous overview of EG and PGP.

- EG was mainly a capacity building programme. At the outset, 15-20% of total budget was ring-fenced for informatics support, and the NEBC grew from this funding source.
- The EG program outputs have been summarized in the booklet ‘Genes in the environment’, circulated at the meeting. EG projects were retrospectively grouped

into the broad areas of biodiversity, environmental health (pollution), environmental health (disease), ecosystem services, and technology development.

- PGP, which followed EG, was more specifically targeted towards microbial metagenomics. Projects ranged from study of the impact of ocean acidification within a mesocosm experiment in Bergen, sediment microbiology, environmental toxicology, impact of chemicals on variety of species of fish at a population level, etc. A summary booklet for PGP, comparable to the one for EG, is currently in preparation.

In a free ranging discussion a number of issues were discussed:

Biological sample storage

The deposition of biological samples and materials collected over such projects, and their possible future use, was discussed. These were collected under EG/PGP but it was not clear how the long term security of such samples could be managed. This included the prospects for an environmental 'Omics BIOBANK, which could serve as a medium-term to long-term repository for annotated samples of biological materials. Points made in connection with this idea included:

- Novel uses for stored samples could be found as new technologies come online.
- Storage and reuse of samples could be cost effective.
- There would need to be clear guidelines or criteria for storage – there is no point keeping everything just for the heck of it.
- Materials collected as part of the Countryside Survey might be an example of a useful sample.
- Existing storage protocols were highlighted, such as major international repositories for crop species and wild relatives, the Millennium Seed Bank, herbaria, museum collections, etc.
- Maintenance of a BIOBANK could enable temporal investigation of change in response to changing environments.
- Given the heterogeneity of biological samples, archiving might be based on systems that work with heterogeneous records, such as the Global Biodiversity Information Facility (GBIF)
- A BIOBANK could consist of a central facility or a catalogue of samples available across different labs and sites.
- We need to articulate the science drivers for such a facility.
- Long term data sets and sample collections build up from one grant to another.

Other NERC or related activities are of potential relevance were noted, including:

- The NERC National Capability Advisory Group (NCAG) as the party responsible for NERC National Capability could play a role in development of a centralized facility.
- NERC is completing a review of taxonomy.
- Environmental Research Funders Forum (ERFF) is undertaking a review of the environmental monitoring in the UK.
- GBIF? is an international initiative to archive a heterogeneous database in biodiversity.
- ELIXIR is a European level initiative to generate bioinformatics infrastructure (BBSRC is the UK lead council).
- Responsive user access to services/support is key to advancing NERC interests.

- BRAG Biodiversity Research Advisory Group?
- LTER?
- International collaboration for UK scientists has major benefits for downstream and upstream parts of the project lifecycle.
- JGI Joint Genome Institute in the US identified as a mirror collaborator.
- NERC Facilities – Molecular Ecology, NBAF, etc.
- Living with environmental change (LWEC) – NERC is the lead partner.

Facilities

This discussion led into one of the ongoing deliberations of the day as to whether a centralized or distributed facility structure would best serve NERC 'Omics needs. Whether centralized or not, would use of such a facility be mandatory for NERC projects or subject to the open market? Would such a facility be able to access Responsive Mode funding and available on a merit basis across a broader community? Centres and facilities are science enabling and can also provide training across multiple levels (postgraduate to senior PI).

ACTION (NEOMICS Team) – EG and PGP Responsive Mode grants database investment figures need to be reviewed. Gathering a list of projects would be a good start, perhaps followed by quantitative assessment of outputs from the NERC OPM?.

ACTION (NEOMICS Team) – Survey EG and PGP PIs to assess co-funding or follow-on funding from NERC or other sources. The purpose would be in part to demonstrate 'joined-up' engagement across Research Councils and other funding bodies.

Gap analysis and horizon scanning

From which end of the technology stream is NERC environmental science feeding? Is NERC developing technology or riding on technology developed elsewhere? Two alternative ways to perceive development of 'Omics in environmental science include technology push (e.g. how can technical advances from other areas of science be integrated into environmental science?) and science pull (e.g. how can we develop novel technologies to address important environmental science questions?).

Technology pull:

- Genomics and 'Omics more broadly is a rapidly advancing technology. Even in EG, there were significant advances in the course of the programme; for example, at the outset of EG 'next generation' sequencing was not even on the table for discussion.
- Metabolomics – non-invasive sampling methods.
- Improvements in imaging.
- Improvements in Mass-Spectrometry (cheaper and better).
- *In situ* meta omics
- Robotics to get into inhospitable environments, remote sensing, etc.
- Measuring transcripts *in situ*.
- Real time measures of biological processes – taking omics into the field.
- Sequencing costs go down 2-fold every 6 months².

² Note added after the meeting. Cost savings may arise from getting a lot of sequence from a few samples rather than less sequence from a lot of samples. The latter is required by many aspects of NERC science.

- DNA Methylation, Histone Acetylation
- Relationship between the environment and the Epigenome.

What does NERC have to do to enable scientists to take up the novel technology? Investment in new technology as well as investment in and access to existing technology are key.

Science pull:

- Can we measure the collective genomics of an entire ecosystem assemblage for purposes of evaluating the potential flexibility of ecosystem services such as large-scale C or N cycles, etc?
- How do organisms adapt to their environment, functionally, socially, genetically?
- Genomics doesn't just feed biodiversity, it is part of it on multiple levels (diversity of common genetic functions across species, genetic diversity within species, etc).
- If you can measure a population you measure which genes are associated with a precise function.
- NERC SOLAS – gas exchange between the ocean and the atmosphere is biologically mediated. What is the genomic composition of the community that does this?
- Natural hazards – plant communities play a role in flood control.
- The NEOMICS Team needs to look across the 7 NERC Science Themes
 - Climate system
 - Biodiversity
 - Sustainable Use of Natural resources
 - Earth system science
 - Natural hazards
 - Environment, pollution and human health
 - Technologies
- How can 'Omics inform research into environmental tipping points and thresholds?
- How resilient will the biological community be to a particular perturbation?
- There was EWG discussion about the synergies between RCs-the common ground, the connection that 'Omics provides between different groups of researchers across disciplines within NERC, BBSRC and MRC.....

Cost/Benefit analysis

It was noted that there is a cost cycle to new technologies. Initially, they are expensive and are best managed in central facilities. As costs drop it becomes feasible for individual labs to develop capacity. As costs drop even further, it becomes cost-effective to send samples out for third-party processing.

Thus, a facility for uptake of new technologies could be critical. The functional services provided by such a facility are likely to evolve, requiring ongoing capital investment. In some instances, it may be feasible to tap into spare capacity elsewhere (e.g. Beijing Genomics or DOE?)

Centres need to deliver but also need to operate within an open market to ensure cost-effectiveness. There needs to be provision for responsive user access.

V. **Town Meeting Planning** – Dr Peter Kille & Dr Dawn Field

The 'Town Meeting' is to take place in Cardiff from the afternoon of 19 May through the end of the day on 20 May. Peter Kille has identified a venue that meets the conditions required by the professional facilitator (Ms Diana Pound - Dialogue Matters) for the workshop on 20 May.

The structure of the symposium on day 1 was discussed, and it was agreed that a smaller number of longer talks covering both technologies and scientific advances would be desirable, with a concluding Panel discussion involving the invited speakers.

The EWG was invited to propose speakers as well as invitees for the workshop. It is anticipated that the total participant list will add up to 50-60 people, including the EWG, the NEOMICS Team, and other invitees representing the broader scientific and stakeholder communities.

The EWG was called upon to discuss a series of potential proposed structures (Straw Models) to feed into the Town Meeting, outlined in a series of Powerpoint representations circulated separately by Pete Kille and summarized briefly below:

- Centre Model – NERC should invest in a strong central facility that would include service provision for 'Omics technology, bioinformatics catered to the NERC community, and a meeting facility for consolidation and development of novel scientific directions integrating 'Omics into environmental science. This latter function could be modeled on the successful application of visioning workshops by NCEAS? (USA) and the Sanger Centre.
- Distributed Facility – This could be built on the foundation of NBAF but would add to the current provision and could certainly include a remit to conduct workshops and undertake further training or support roles. [ADDED in response to EWG input after the meeting]
- Open Market Model – NERC investment in 'Omics would be done through existing structures, with technological facilities developed on site in different labs across the UK on a competitive basis, e.g. Responsive Mode funding. Rather than deliberately nurturing a NERC 'Omics community, the structure of a NERC 'Omics community would emerge from the way people interact over time.
- Training Model – NERC should encourage bioinformatics training at postgraduate level across all of NERC science.
- Multidisciplinarity Model – Those engaged in 'Omics science should look for integrative research as part of multidisciplinary teams addressing complex environmental issues from multiple perspectives. This approach also has implications for postgraduate training, institutional merit and evaluation mechanisms and career development.

It was noted that these were just potential models of supporting NERC 'Omics – they were not intended to be exhaustive and were the starting point for discussion at the Town Meeting.

ACTION (Dawn Field & Peter Kille) – Due to time constraints, it was agreed that final input into the invitee list and survey content would be coordinated by email correspondence post-meeting. The timetable included circulation of a final draft document for input by Wednesday, collation of EWG suggestions for invitees to be completed by Thursday, and

preparation for distribution of invitations to take place by Friday or early the following week (26 April).

VI. **Wrap up, thanks and future actions** – Prof Thomas Meagher

With thanks to the EWG, the NEOMICS Team, and invited observers, the meeting concluded at 16:10PM.