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BRAINSTORM REPORT

EPSO Brainstorm on Landscape Genomics 7 April 2009, Brussels (BE)

Twenty-five people attended the EPSO brainstorm on landscape genomics held on 7 April 2009 in Brussels (BE). Organised by Karin Metzloff (EPSO), Detfel Weigel (MPI developmental Biology, Tübingen, DE), Simon Owens (Royal Botanical gardens Kew, UK) and Rob Huxley (Natural History Museum London, UK), the brainstorm aimed to identify crucial areas of interactions between molecular biologists and ecologists. It stemmed from last year's workshop on natural history collection users organised by the SYNTHESYS network where it became obvious that there was a high demand for such interactions.

The meeting brought together ecologists, natural history collection experts and genomicists to exchange ideas and discuss their needs for future collaborations in a variety of topics, including linking herbaria to DNA sample collections, wild relatives of crop plants, domestication of novel crops from wild species, and ecosystem fluxes.

The brainstorm started with short presentations followed by an open discussion to identify areas of importance for future interactions and recommendations on what could be done to support such areas. These recommendations will be articulated after the meeting and made available to all brainstorm participants and EPSO will take them forward to advise on science policy in Europe.

Detfel Weigel, calling himself a reverse ecologist, briefly presented his studies of genetic variation in *Arabidopsis thaliana*. After identifying genes of importance for plant fitness in the lab, his team started collecting samples in different natural environments to characterise the genetic and genomic basis of naturally occurring variation. Consequently they became interested in collaborating with colleagues working with natural collections of wild plants and their genetic diversity. Following up, Simon Owens and Rob Huxley described the collection resources at the Royal Botanical Garden (RBG) Kew and at the Natural History Museum (NHM) of London. Beyond the traditional taxonomy field, these collections can be useful to a larger scientific community, such as for forensic scientists, petroleum companies (pollen collection) and ecologists. They presented the FP6-funded project SYNTHESYS that aims to improve access to European collections and make them more useful to the broader community.

The general introductions were followed by short presentations from several brainstorm participants. They showcased the diversity of approaches and the need to interact with colleagues of different expertise.

From genomics to ecology

Ian Baldwin (MPI Chemical Ecology, Jena, DE) deplored that today's biologists did not have a broad view of the organisms they study in the laboratory. He highlighted the need to bridge the gap between ecologists and molecular biologists in order for them to develop common tools and speak a common language. He suggested developing undergraduate exchange programmes to train "Victorian biologists using genetic tools" so that tomorrow's biologists could interact better. Stefan Jansson (Umea Plant Science Centre, SE) presented the advantages of studying *Populus*, which large population size make it a laboratory of diversity, and an ideal model for landscape genomics. Heinz Ruedel (RWTH Aachen, DE) presented the German Environmental Specimen Bank programme whose main goal is to monitor pollutants. About 200 plant species are archived within the programme and could be used for genetic characterisation. Titti Mariano presented the research projects at the Botanical Garden in Nijmegen (NL). She highlighted the various uses of the living collection and herbarium and stressed the need to have more international collaboration to keep the collection alive.

From ecology to genomics

Paul Smith (Kew, UK) presented the Millenium Seed Bank project that aims to provide plant-based solutions to the environmental challenges we face. The collection currently holds 22 000 species. The seeds are used

for research (such as development of germination protocols) and restoration programmes. Laura Rose (University of Munich) described how she uses the natural collections available worldwide for her studies of plant–microbe interactions at the molecular level and the genetic diversity of these interactions in the field. Jackie Mackenzie-Dodds (NHM London, UK) presented the tissue and DNA collections at London and Madrid natural museums, along with the techniques they develop to extract and store DNA samples. She supported the need to develop an EU commonality of research, which is currently underway within the framework of the SYNTHESYS project. Then, Stephanie Manel (University of Grenoble, FR) described her studies of landscape genomics, a new area of research defined as the integration of landscape ecology into population genetics. The goal is to better understand gene flow and selection, two processes responsible for genetic diversity and local adaptation. Niels Raes (National herbarium, NL) introduced the participants to the world of macroecology that studies relations between organisms and their environment at large spatial scales. By studying natural relatives of food crops, macroecologists can construct species distribution models that can be used to identify areas suitable for crops to grow under different environmental conditions.

Open discussion

The rest of the day was devoted to an open discussion in which all participants had the opportunity to identify their area of interest where interactions between ecologists and molecular biologists would be crucial. Several participants highlighted the need to train biologists with both expertises, i.e. to train the next generation of naturalists as “genome enabled field biologists”. Sharing of knowledge was also a key area identified, such as making use of conferences, workshops and summer schools where students and scientists can meet and learn from one another.

Next steps

At the end of the day, the participants decided to continue the discussion on these areas of interest and future collaboration by email in the coming weeks. A working group comprising Rob Huxley, Ian Baldwin, Karin Metzloff, Rainer Matyssek, Simon Owens, Niels Raes and Detlef Weigel will then draft a recommendation document summarising the views and the possible instruments to address them. After circulating the draft document among the brainstorm participants for comments and feedback, the working group will finalise a white paper at the latest by September 2009.

To continue the discussion and monitor progress in supporting the emerging areas, the participants agreed to meet again in 2010 at the EPSO Conference and possibly at a summer school under a similar theme in 2010 or 2011.

The brainstorm organisers closed the meeting and thanked the participants for the very interesting discussion.

More information:

Brainstorm webpage: www.epsoweb.org/Catalog/epso_workshops/Landscape_Genomics_BS.htm

Programme: http://www.epsoweb.org/Catalog/epso_workshops/LG_BS_Programme.pdf

Presentations: www.epsoweb.org/Catalog/epso_workshops/LG_BS_presentations.htm

Report: www.epsoweb.org/Catalog/epso_workshops/Landscape_Genomics_BS_report.pdf