

Conifer Reference Sequencing Steering Committee

Meeting Notes

August 26th 2008, Québec City

Participants:

Jean Beaulieu, Canadian Forest Service, Canada - JBo
Jean Bousquet, Laval Univ., Canada - JBe
Maite Cervera, INIA, SP - MC
Antoine Kremer (C. Plomion), INRA Bordeaux, FR - AK
Sonja Kujala (Outi Savolainen), University of Oulun yliopisto, Finland -SK
Martin Lascoux, Uppsala University, Sweden - ML
Ulf Lagercrantz, Uppsala University, Sweden - UL
Camille Lepoittevin (C. Plomion), INRA Bordeaux, FR - CL
Stéphanie Lord-Fontaine, Genome Québec, Canada - SLF
Catalina Lopez-Correa, Genome Québec, Canada - CLC
Walter Lorenz (Jeff Dean), UGA, USA - WL
John MacKay, Laval Univ., Canada - JM
Michele Morgante, Udine Univ., Italy - MM
David Neale, UC Davis, USA -DN
Kermit Ritland, UBC, Canada - KR
Jill Wegrzyn, UC Davis, USA - JW
Anne-Christine Bonfils, Canadian Forest Service, Canada - ACB

1) Overview of Committee History and Progress (David Neale)

Reviewed key elements and events which lead to the Banbury Meeting on Conifer Genome Reference Sequencing in March 2007.

- Several research groups active in conifer genomics: primarily the USA, Canada, EU each with several projects, in addition to Japan, Australia, New Zealand.
- Major challenges for conifer / gymnosperm genomic research: very large genome size, lots of repetitive sequences and high genome complexity
- Need for coordinated genome sequencing and related activities

Workshop in Cold Spring Harbor in March 2007, 1st workshop:

- Organized by D. Neale, J. Dean, G. Howe and M. Greenwood (of the USA).
- Participants mainly from the USA Europe, Canada, Australia, New Zealand.
- The focus of the meeting was on emerging opportunities for conifer genomics emphasizing conifer genome sequencing. Methods and strategies for conifer genome sequencing were discussed in detail. The group also addressed many issues relate to genome resource development, impacts of the conifer genomics and funding of large conifer genomics initiatives.
- D. Neale to put together meeting report.
- From this meeting came the idea of creating an International Conifer Reference Sequencing Steering Committee

PAG meeting in January 2008, San Diego

- The International Steering Committee met for the first time at the PAG meeting in 2008
- Attendees were mostly from North America, Europe and Australia. There were reports on new developments (research and funding) from each country and

- discussion about preparing a white paper that each participant could use to raise funds in their countries.
- It was agreed that it was too early to determine how many (one or several) and which species should be targeted for conifer or gymnosperm sequencing. Projects had been initiated or were planned in different pine and spruce species, to generate more preliminary information.
 - Note. At the outcome of these meetings, there appeared to be a need for more pro-active communication with scientific community to promote a strong sense of inclusiveness while ensuring coordination.

2) Report on Activities (this Meeting)

Europe (overview by Maria Teresa Cervera from Spain, list of European research groups at the end of report)

- In general, European partners will commit through support national programs and at the European level with support from multinational initiatives and European proposals. As an example, Spain has set up a platform with partners with complementary expertise to coordinate efforts, get support from diverse agents (private and national companies, regional governments, and several foundations and Ministries) and submit proposals. So far, support was obtained from the Ministry of Education and Science for exploratory research through a pilot project.
- The Spanish pilot project includes:
 - o Sequencing of approx 8 BACs from a library constructed by UMA from diploid tissue of *Pinus pinaster*, to analyze structure of conifer genomes. We may use the same set of full-length cDNAs that will be used to identify orthologous BACs (containing selected full-length cDNAs) between USA (*P. taeda*) and Canada (*Picea glauca*). This analysis will help comparative analyses among these three conifer species.
 - o Construction of a BAC library of *Pinus pinaster* from haploid tissue.
 - o We are organizing an International Symposium on "New frontiers in forestry genomics: sequencing and functional understanding of the conifer genome" funded by Ramón Areces Foundation.
- International funding:
 - o The proposal "SUSTAINPINE: Genomic tools in maritime PINE for enhanced biomass production and SUSTAINable forest management" was submitted to the 3rd joint call for transnational research projects within the framework of the trilateral activity (France, Germany & Spain) "Transnational Plant Alliance for Novel Technologies - toward implementing the Knowledge Based Bio-Economy (PLANT-KBBE) in Europe" focus on Scientific and Technological Cooperation in Plant Genome Research is going to be launched soon. All European teams involved (including Portuguese partner that will bring own national funding) are working on *P. pinaster*, which will be used as model species. The main objectives of the project are:
 - Isolation of novel maritime pine ESTs and FLcDNAs
 - Large-scale expression analysis, functional studies of selected candidate genes
 - HT mapping
 - Association analysis of selected candidate genes for growth and wood quality.

- R&D EU project: FP6 NoE EVOLTREE:
 - o EST identification & characterization
 - o Comparative mapping in Pinaceae (SNPs in genes transferred from D. Neale)
 - o Natural variability of European conifer model species
 - o *Pinus pinaster*, *Picea abies* and if possible *Pinus sylvestris* and *Larix* preliminary BAC sequencing. (Partial or total funding)
- A new topic will be proposed to the EC in the frame of the international initiative within FP7. Contacts with European officers have been established to follow recommendations. Participation of third countries is allowed. EC has bilateral agreements with industrialized countries to provide funds to travel to Europe and to facilitate the collaboration and there is provision for funding the participation of research partners from the ICPC countries from the FP7 budget such as LA countries. This is an important point since some groups from LA have already expressed their interest on the proposal.

Canada (J. Mackay, K. Ritland)

- Two large projects in Canada (Treenomix, Arborea) have developed resources that will aid genome sequencing: EST and full length cDNA analysis, databasing, genetic maps
- Grant proposals have been submitted or are in preparation for pilot studies that will more directly enable conifer genome sequencing, by addressing knowledge and technologies gaps, in addition to building links with international collaborators.
- Key objectives for these proposals are as follows,
 - o Genome sequencing using BACs and total genomic DNA to gather information on genome composition and organization. Different sequencing technologies will be compared. Spruce and pine sequences will be compared.
 - o Gene space sequencing based Cot-filtration and microarray enrichment.
 - o High throughput mapping of several thousand coding sequences (e.g. with Infinium chips from Illumina) with Canadian Forest Service full-sib family of 10,000 trees.
- A major funding opportunity exists within Genome Canada programs.
 - o International Consortium Initiative (ICI): 50 million project where GC provides 30% (15 millions) if researchers from Canada are the project leaders.

USA (David Neale)

- Several projects over the last decade have contributed gene sequence information, genetic maps, resequencing and SNP discovery (primarily in loblolly pine and douglas-fir) to that will help conifer genome sequencing. See Dendrome website for details.
- An arrayed loblolly pine BAC resources has been developed by D. Peterson (Univ. of Mississippi) and is estimated to represent a 7X coverage of the loblolly pine genome. Cot-filtration libraries have also been developed.
- Sequencing of around 10 of these pine BACs is ongoing in D. Neale's group.
- Recently, a project was approved to sequence 100 BACs in loblolly pine (led by D. Peterson) at the Joint Genome Institute (JGI).
- Others.

3) Discussion: Coordination of Efforts and Funding Opportunities

Several Key points were discussed and are summarized here.

- Again, it was agreed that it was too early to determine how many (one or several) and which species should be targeted. The general focus will remain conifer genome sequencing (with interest in other gymnosperms). More information is needed on genome sequence structure and composition, variation or similarity between genera or families, effectiveness and cost of new sequencing platforms. Such information could guide the decisions regarding the sequencing strategy, whether a decision is made to focus on a reference genome as a collective goal or to work on several genomes in parallel. It was agreed that the next year could be used to fill these gaps as much as possible, by continuing to work on the key conifer species listed above. Sequencing a smaller genome may have advantages.
- Not clear yet which is the best sequencing technology, these technologies are evolving very fast and new technologies expected to emerge in near future. Must be prepared to adapt/change approaches. Cost of sequencing is decreasing fast.
- Need to develop / implement of bioinformatic tools. Some components, such as bioinformatic tools, databases, should to be shared or developed jointly to support a large-scale international initiative
- The importance of comparative genomics was stressed, as a means to help effectively sequence conifer genomes and generate impacts that are useful to the scientific community and to society in general.
- Funding in different jurisdictions (local, national, international) will determine how much each group can contribute to the effort (e.g. EU funding for this type of project is capped at 6 million Euros), and will also influence which species are targeted for projects by different programs.
- Leadership at the international level is seen as an important driver in organizing the community. Canada potential leader, considering opportunity with Genome Canada's ICI program and importance of forestry for Canada. Similar arguments may hold true for other nations as well (e.g. Sweden).
 - o The group will have to select a mechanism to appoint a leader
- As a group, we must define short term and long term plans.
 - o Short term (Next 12 months)
 - Define clear strategic goals and conduct pilot projects around strategic goals
 - Meet in one year to evaluate pilot projects and results
 - Researchers in each country to start or continue working to secure large-scale funding: funding agencies, political lobbying, etc. This would be aided by a short statement of goals to present to funding sources.
 - Important to start now exploring the ICI opportunities from Genome Canada (time frame to prepare this type of consortium could go from 18 months to 2 years), get some preliminary results and prepare logistics to create the consortium. GQ has funds for preparation of an ICI (such as project management and support with logistics, web page creation, minutes, and pilot projects)
 - Develop a science plan
 - o Long term (1 to 5 year horizon?)
 - Define large-scale goals for conifer genome sequencing and secure funding

- Assemble an international consortium to carry out the work

4) Next Steps:

- DN: to produce report from Banbury meeting
- The group plans to reconvene and reassess the situation in about 1 year. Proposed time June 2009, at IUFRO Tree Biotechnology conference.
- Each participant will continue their pilot projects
- Preparation of a harmonized 2 pager to help convince potential funding partners –document to present to stakeholders, high level including economic outcomes, ecological importance, phylogenetic relevance -who? MC, DN, JM
- MC : Possible meeting in EU if funding is approved : target of March 2009 – Organized by Spain
- Creation of a web page hosted by DN (JW) that can be used as portal for the Sequencing Consortium:
- International Coordination: considering opportunities such as Genome Canada's ICI program, the group will need to contact and involve funding agencies in discussions to establish links and begin exploring the possibilities more concretely.
 - o JM: will seek further information on the ICI program and contact Karen Kennedy at Genome Canada to initiate discussion
 - o DN: will contact Jane Silverthorn at NSF to help coordinate funding with EU
 - o AK: solid funding agencies in Europe already supporting genomic projects in forestry are Genoplant (France), GABI (Germany) and Ministry of Education (Spain)

Meeting notes prepared by John MacKay (Sept 10, 2008).

5) Information

International Reference Sequence Steering Committee (formed following Banbury Meeting)

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Updated list of European research groups with interest in the International initiative for conifer sequencing (provided by MC):

- Austria: BFW (Dr. Berthold Heinze), PYCME (Dr. Silvia Fluch)
- Belgium: VIB (Dr. Yves Van de Peer)
- France: INRA (Dr. Christophe Plomion), FCBA (Dr. Luc Harvengt)
- Finland: University of Oulu (Dr. Outi Savolainen)
- Germany: Institute for Forest Genetics (Dr. Matthias Fandung)
- Greece: University of Thessaloniki (Filippos A. Aravanopoulos)
- Italy: University of Udine (Dr. Michele Morgante), CNR (Dr. Giuseppe Vendramin)
- Norway: Norwegian Forest Research Institute (Dr. Øystein Johnsen)
- Portugal: IBET (Drs. Margarida Oliveira and Célia Miguel)
- Spain (Spanish Platform):
 - INIA (Dr. María-Teresa Cervera)
 - Universidad de Alcalá -UAH (Drs. Carmen Díaz-Sala, Dolores Abarca)
 - Universidad de Málaga -UMA (Drs. Francisco Canovas, Francisco Cantón, Concepción Ávila, Fernando Gallardo, etc)
 - Universidad de Valencia -UV (Dr. Isabel Arrillaga)
 - Plataforma Andaluza de Bioinformática (Dr. Gonzalo Claros)
 - SERIDA (Dr. Juan Majada)
 - Life Sequencing (Dr. Jose Luis García)
 - SECUGEN (Dr. Julián Pérez)

- Sweden: Uppsala University (Dr. Martin Lascoux)
- Turkey: Middle East Technical University (Dr. Zeki Kaya)