

**“The Second International Conference on Duckweed Research and Applications”**  
**Rutgers, the State University of New Jersey, USA**  
**August 21 – 24, 2013\***

Prof. Dr. Eric Lam (Rutgers University and Conference Chair) and PD Dr. Klaus-J. Appenroth (University of Jena and Head of the International Duckweed Steering Committee) report about the meeting.

**a) Why was a meeting organised for the relatively small community of duckweed researchers and developers?**

The international duckweed community organized a meeting because the members strongly feel that this family of plants has a great potential for practical applications as well as basic research. There is a very good chance to use duckweed for cleaning wastewater, as has been demonstrated in the past. Also, several species of duckweed have been reported to be the fastest growing angiosperms and they can be grown in places that cannot be used for agriculture. The biomass can be used for producing energy – via starch fermentation, biogas production or by other conversion methods. Thus, duckweed can help solve urgent problems facing mankind: availability of clean water and sustainable energy production.

**b) Which are the highlights of results presented at this meeting?**

A key development for basic research involving duckweed will be the availability of genomic tools. Some important progress in this regard is several reports in the Conference that described sequencing and transcriptome studies that have been submitted for publication or are nearing completion. The genomic sequence of clone 7498 of *Spirodela polyrhiza* was selected in 2009 for sequencing by the DOE-JGI as a reference genome for duckweed. This work is now in review for publication and some of the characterization of the assembled genome scaffolds was reported by Wenqin Wang (group of Joachim Messing) from Rutgers University, New Jersey,

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\* The meeting was dedicated to Prof. Dr. Elias Landolt (1926 – 2013). See the Conference Program (<http://duckweed2013.rutgers.edu/duckweed-2013-conf-program.pdf>) for the full dedication.

USA. Doug Bryant (from the Danforth Center in St. Louis, Missouri) also reported results for 9 other clones of the same duckweed species that are being completed soon by a consortium of researchers from Rutgers and the Danforth Center. By 2014, these efforts should make available a rich set of genomic resource for the duckweed community that will enable many advanced molecular approaches in this system. Almudena Molla-Morales from the group of Robert Martienssen (Cold Spring Harbor, NY, USA) presented results about the genetic studies for biofuel production using *Lemna gibba*. In addition to reporting their progress in sequencing a reference genome for *L. gibba*, she also presented an update on their progress to optimize stable gene transfer protocols in duckweed. The efficiency of genetic transformation was enhanced from 10 % callus transformation (Yamamoto et al., 2001) to 40 % and the time for selection and regeneration was shortened from 7 to 5 weeks. This improvement should overcome a key bottleneck for research with duckweed in the near future, especially with the wealth of genomic information resulting from the various sequencing projects. In several reports from Japan the first results concerning the interaction of bacteria with the root system of duckweed were presented. The reported results now clearly demonstrated growth promotion and metabolic enhancement of duckweed upon co-culture with specific species of bacteria. In one case, the signalling compound has been identified to be a carbohydrate (Masaaki Morikawa, Hokkaido University, Sapporo, Japan) and it can stimulate growth of different duckweed species as well as other model land plants. These exciting findings suggest the first example of duckweed related research that may result in significant benefits to traditional agriculture.

**c) After the genome of *S. polyrhiza* is known - how to proceed with research?**

The completed sequences for multiple *S. polyrhiza* strains should pave the way for some key advances in duckweed research and applications. These include the following areas: 1) Mapping the sequence variation landscape in the duckweed genome should facilitate better understanding of the adaptation mechanisms for this family of aquatic plants; 2) creating better molecular techniques for rapid genotyping of closely related strains and species of duckweed; 3) determining the set of genes and enzymes present in the 3 genome of these plants will provide the foundation for detailed analysis of its metabolic pathways as well as their regulatory pathways

through enabling System Biology approaches; 4) a well annotated reference genome will enable rigorous transcriptomic approaches, such as RNA-seq, for gene discovery and functional genomic studies; 5) the genome sequence, together with a transcriptome database, should provide immediate access to various duckweed promoters and coding sequences for basic research as well as commercial applications.

**d) Which types of practical application will be most important in the next years?**

Some of the key applications/products from duckweed will be: 1) Systematic deployment of the duckweed platform to remediate wastewater from municipal and agricultural sources; 2) reliable production of feed and fuel products at different scales (from tons to thousands of tons per year); 3) development of duckweed-based biorefineries that can maximize use of the biomass for various renewable bioproducts such as bioplastics and high value oils.

**e) What is it about social networking and duckweed?**

As a new technology that is seeking to develop into a novel industry, it is essential at this juncture that we promote the system's unique qualities and benefits to the public-at-large, as well as to unite the nascent community's efforts in raising funds to support centralized, shared resources that will be critical for accelerated and sustainable development of research and applications. To help achieve these goals, adopting modern social media tools and channels as well as organizing the worldwide duckweed community through the International Duckweed Steering Committee are some of the efforts that are beginning to be implemented.