Functional Genomics and the Virtual Plant: A blueprint for understanding how plants are built and how to improve them

Executive Summary

Report

Appendix I - Roster of Participants

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1 Year Goal:

1) Predictable outcomes to directed experimental genetic changes

2) Directed genetic changes that accelerate domestication of wild species

3) Enhanced understanding of the genetic basis of phenotypic plasticity, which will have a profound impact not just in plants, but also in animals, including humans

4) Knowledge of "the minimum gene set" required for plant life.

5) Enhanced understanding of the genetic basis of plant evolution which will enrich our understanding of the diversity of life on earth.

6) Understanding of the genetic basis of plant adaptation which will enable us to understand how plants have evolved to survive in different environments.

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8) An understanding of interactions between plants and other organisms in their environment, up to the level of ecosystems.

Whole systems-based knowledge of the entire biology of a reference species confers predictive power that will enable the following:

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ambitious experimental layout incorporates the four axes into what will be the final expression of the virtual plant.

3-Year Goal:
- Identify species for genome sequencing based on an expanded definition of phylogenetic scales.

10-Year Goals:
- Survey genomes sequenced, and deep EST sampling from phylogenetic scale species.
- Design a production test for cosmidless versus cosmid-dedicated gene function.
- Within species genome sequence comparisons.
- Develop tools for whole genome population biology.

An Expanding Role for Bioinformatics

As the Arabidopsis community has developed into an excellent training ground for plant scientists, the changing paradigm of plant science will require new sorts of training to encourage and facilitate lateral, interdisciplinary approaches to problem solving. We still need traditionally trained doctoral and post-doctoral researchers with skills in the areas below. We also need to encourage interdisciplinary training which specifically seeks a systems based approach for both undergraduate and graduate level students. Three critical bioinformatics needs for plant biology is to educate biologists in the use of the tools that are in place and those that will be available in the future. It will be essential to attract computer science students and trainees to plant biology where they can participate directly in plant research initiatives and where their talents can be productively applied to bioinformatics.

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International Collaborators

The Multinational Arabidopsis Steering Committee and the North American Steering Committee have been, over the last ten years, important facilitators between the community of large and small labs in North America, Europe and the Pacific-Rim. In the 2010 Project, we will continue to work with partners in these areas, many of whom have already begun efforts like those described here. To date, the Arabidopsis community is a model of how these structures can facilitate duplication of effort and enhance research resources worldwide. An expanded role for the Multinational Steering Committee should be a part of the 2010 Project. International Workshops to monitor/advise on Project 2010 will be essential for international coordination of these efforts.

2010 Salk Workshop Participants

Observers

Dr. Mary Cullis, National Science Foundation
Dr. Heledd Dhalli, National Science Foundation
Dr. James Derocher, National Science Foundation
Dr. Greg Dure, Department of Energy
Dr. Proforma, U.S. Department of Agriculture

Participants

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Shane Hendrich, Fred Hutchinson Cancer Research Center
Rob Manners, Cold Spring Harbor Laboratory
Kiyokatsu Okada, Kyoto University, Japan
Natalie Rast, Michigan State University
Clinton Sansome, Carnegie Institute of Technology, Harvard University
David Wang, The Salk Institute for Biological Studies

Ongoing Goals:
- An explicit endorsement of the Salk Technology Center providing services and resources of scale for system-based data generation is not consistent with the traditional training of doctoral and post-doctoral researchers, and the traditional output measurement of publications. Therefore, we need to develop and test a new role for system-based technology centers as providers for these facilities. Valid and robust guidelines are often required for these positions for the successful generation of scientific data.
- We will need to develop a critical role for bioinformatics training. This will involve the development of a new role for training program in which some positions are assigned to these programs to ensure the development of new generations of experimentalists.
- We will need to develop new roles for the whole plant visualization tools. These will include both virtual tools to manipulate information-based data and new in vivo imaging systems which can be used in real-time or changes in genome expression which determine plant development.

Development of Human Resources

Ongoing Goals:
- Development of Human Resources
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