

Proposal Submitted to the US NSF Plant Genome Research Program
October 2006

TRPGR- Construction of a high-resolution physical map of the hexaploid wheat genomes: I: the D genome chromosomes

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Scientific Objectives and Approaches. Although wheat is one of the most important sources of food its large and polyploid genome poses a challenge for genomic analysis. Utilizing the extensive cytogenetic collection of wheat, we have devised a simple method of developing high-resolution physical map of the hexaploid wheat D-genome. The same approach can easily be applied to the A and B genomes. Thus, this project represents the first phase toward development of a complete hexaploid wheat physical map.

This project aims to develop a high-resolution radiation hybrid map of the hexaploid wheat D-genome chromosomes to study their gene distribution and organization. Existing BAC contigs and clones for this genome will be anchored to high-resolution radiation hybrid maps of Chinese Spring (reference hexaploid species) and *Aegilops tauschii* (AL8/78 used for previous physical mapping work) D-genomes. In a previous study, we demonstrated that radiation hybrid maps with resolution of 199 Kb are attainable and can be used to anchor existing BAC contigs. A high resolution physical map of D-genome will provide a valuable tool for analysis of a great number of biologically and agronomically important genes, comparison with the rice and maize genomes, and an unprecedented look at gene colinearity and chromosome evolution of these important crop plant genomes. Project database hosted by GrainGenes will provide up-to-date public access to tools and data generated from this project.

Broader Impacts of the Proposed Research. Complete sequencing of the large and complex genome of crop plants such as wheat and maize provide a daunting challenge to the genomics community. The tools, methodologies, and knowledge developed in this project can be applied to other crop species and will facilitate the construction of physical maps. These maps will provide easy access to genes of scientific and agricultural importance and the development of new strategies to manipulate crop plants to better serve the needs of a growing world population. Development of high-resolution radiation hybrid maps of wheat D-genome is part of, and will be fully integrated into, a larger effort by the international wheat genomics community to develop a global physical map and whole-genome sequencing information. Molecular genetic methods used in this project also provide an excellent tool for teaching students. Thus, our research activities and outcomes will be interfaced with our individual institutions' programs designed to recruit and train students at all levels. This project will also provide a glimpse into the evolutionary history of wheat, rice, and maize and the possibility to better manipulate these important crops to sustain an ever-increasing world population.