1. Introduction
Wheat price of 2008 jumps greatly. One of these causes is a bad harvest of the wheat in Australia by drought damage in 2007. Developing new crop varieties with the tolerance to various environmental stresses is required to avoid instability of crop production caused by the global environment change. However, in staple crops as rice and wheat having long history of breeding, the genetic resources have almost exhausted, and thus seeking of new genes is the most important subject in this task. One of the solutions to broaden genetic base of wheat is utilization of the genes in related alien species. The alien genes are transferred to crops by the wide hybridization technique. Another solution is use of transformation techniques. By this technique any genes of any species can be transferred to crops. In the Molecular Breeding Group of the Global COE Program, we aim to create new crop variations with tolerance to harsh environmental conditions in dry land. Further, we will evaluate the varieties in practical field in dry land. These studies are carried out in collaboration with following researchers; Drs. K. Tanaka, M. Oka, H. Tanaka, H. Kaminaka, and T. Inoue in Tottori University, Japan, and Drs. M. Baum, S. Rajaram in the International Center for Agriculture Research in the Dry Areas (ICARDA), Syria.

2. Strategy
In this group we mapped out four strategies to produce new crop variations (Figure).

1) Transfer of the chromosomes from related or far-related species to wheat by wide hybridization: In National Bioresource Project-Wheat Japan, we collected many strains of wheat with an alien chromosome(s) (Tsujimoto 2008). In this GCOE program, we evaluate the stress tolerance of the lines. Further, we will produce more wheat lines with the chromosomes of novel species including very far-related species as pearl millet. An example of successes of this strategy is seen in the breeding of fertilizer-saving wheat. Wheat-related beach grass, *Leymus racemosus*, has a trait to inhibit biological nitrification that is an activity of bacteria in soil to degrade ammonium compound given as fertilizer. The wheat line with a beach grass chromosome was found to have function of biological nitrification inhibition as seen in the original beach grass (Subbarao et al. 2007).

2) Transfer of salinity and/or drought stress tolerance-related genes to major crops by transformation technique: Now transformation is widely adopted as an important technique for crop breeding. Many crop varieties with resistance to insects, diseases and herbicide have been commercialized and cultivated widely in the world. We have isolated genes highly expressed after salinity and drought stresses. We have introduced the genes to tobacco, potato, rice and *Arabidopsis*. The transformed plants showed expected tolerance to the stresses (Eltayeb et al. 2007). In this GCOE program, we introduce these genes to wheat and other crops, and evaluate their performance.

3) Isolation and characterization of novel genetic factors from drought tolerant plants and halophytes: Important part of above transformation strategy is to find unique genes related to salinity and/or drought stresses tolerance. We seek valuable genes for breeding from halophytes, plants grown in salinity marsh, and stress-tolerant plant species.

4) Establishment of evaluation system for stress tolerance: Salinity and/or drought stress tolerance is a complex character resulted from many genetical and physiological factors. This makes breeding of stress tolerant crops difficult. We investigate physiological and molecular biological responses of crops in salinity and/or drought-stressed conditions, and resolve the characters into simpler factors.