Preface

During the last few decades, major progress has been made in increasing rice productivity. World rice production has more than doubled from 257 million tons in 1966 to 589 million tons in 2003. This has mainly been achieved through the application of principles of Mendelian genetics and conventional plant breeding methods. The present world population of 6.1 billion is likely to reach 8.0 billion by 2030. To meet the growing food need and overcome malnutrition, rice varieties with higher yield potential and multiple resistance to biotic and abiotic stresses with improved nutritional quality are needed. Recent advances in genetics offer new opportunities to achieve these objectives.

From being a poor cousin to maize, wheat, and tomato for genetic knowledge, as recently as the 1980s, rice has become a model plant for molecular genetic research. Numerous scientists in laboratories worldwide have helped make rice a favored higher plant for molecular and cellular genetic studies. Notable examples include genome sequencing of both indica and japonica rice and isolation and characterization of genes governing various agronomic traits. These advances covered in this book open new avenues to apply new tools of genomics and reverse genetics to understand the function of rice genes. Manipulation of such genes would be a breakthrough in rice genetics and breeding.

This book, *Advances in Rice Genetics*, is the supplementary volume of *Rice Genetics IV* and it contains 241 research papers presented at the 4th International Rice Genetics Symposium held in 2000 at IRRI. The book has been divided into seven sections: (1) genetics and breeding of agronomic traits, (2) genetic diversity, evolution, and alien introgression, (3) molecular markers, QTL mapping, and marker-assisted selection, (4) genomics, (5) gene isolation and function, (6) tissue culture and transformation, and (7) genetics of rice pathogens.

In the first section, 35 papers cover the genetic analysis and inheritance of various agronomic traits such as male sterility; fertility restoration; hybrid breakdown; resistance to bacterial blight, blast, and gall midge; and submergence and cold tolerance. Forty-six papers describe the use of molecular markers in the analysis of genetic diversity, the evolution of cultivated rice, monitoring of alien introgression, and identification of wild species alleles/QTLs for improving rice, including advances in rice cytogenetics through FISH techniques. More than 45 papers highlight the application of molecular markers in tagging major genes and in marker-assisted selection. Several papers deal with the identification of QTLs for heading date; blast resistance; tolerance of drought, flood, and cold; aluminum tolerance; ozone resistance; and amylose content. As many as 56 papers cover the advances made in genomics and isolation and function of genes. Some highlights include T-DNA, *Tos17*, and the *Ac-Ds* system as resources for functional genomics and isolation and characterization of DREB genes, MADS-box genes, transporter genes, a mechanism for defense signal transduction, biosynthesis of prolamins, and the genetic propensity for nodulation. Forty-seven papers describe advances in tissue culture and transformation of rice carrying genes for resistance to biotic and abiotic stresses, clean DNA transformation, and matrix attachment regions for stability of transgene expression. The last section covers in eight papers the genetic structure of blast populations.

We hope that this book will be a valuable reference for the scientific community engaged in genetics and breeding of rice, with emphasis on both forward and reverse genetics and to apply new tools of genomics in rice improvement.