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Systems level analysis of abiotic stress response and plant productivity

To dissect the complex interaction between plant productivity and abiotic stress factors, rice gene regulatory networks were developed to identify associations between transcription factors (TFs) and essential biological processes/pathways perturbed under abiotic stress. The TF HYR (Higher Yield Rice) was found positively associated with photosynthetic carbohydrate metabolism (PCM) and other key processes affected by environmental stress. Overexpression of HYR in rice enhanced photosynthesis and yield components, with higher grain yield under control conditions and drought or high night temperatures at critical reproductive stages. ChIP and gene expression analysis of HYR rice revealed a network of genes in the HYR regulated pathway determining productivity traits, supporting a role for HYR as a key regulator of genes involved in plant growth and grain yield under environmental stress. In other studies of stress responsive regulatory genes using knockout mutants, morpho-physiological analysis revealed a class of mutants compromised in growth under drought (GUD), showing reduction in yield under stress conditions and underlying networks of genes involved in PCM. To characterize the natural variation for drought response and grain yield in rice, a diverse population of rice genotypes were analyzed for their differential physiological and transcriptome responses to drought. Integration of the transcriptome data from mutants and overexpression lines of drought tolerance genes, as well as the diverse drought tolerant rice genotypes, is being used to construct integrated regulatory networks to identify regulatory networks determining yield and stress tolerance in rice.

Biography

Andy Pereira is the Anheuser-Busch Endowed Professor in Rice Plant Molecular Genetics at the University of Arkansas in Fayetteville. He completed his PhD from Iowa State University, with postdoctoral studies from Max-Planck Institute (Germany), and worked as a scientist in Plant Research International (Netherlands) and Virginia Tech before joining the University of Arkansas in 2011. He has published more than 100 publications in the fields of insertional mutagenesis, Arabidopsis and rice functional genomics, systems biology studies of drought stress in interaction with basic biological processes.

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