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Alternative splicing plays a crucial role for abiotic stress responses in plants

Plants are sessile organisms and they have to cope with various ever-changing environmental abiotic stress conditions such as cold, heat, and soil salinity. In an effort to identify and characterize key genes for plant abiotic stress responses, we performed several forward genetic screens for mutants with altered responses to abiotic stress conditions. Three of the genes we identified through the forward genetic analyses encode proteins that are part of the spliceosome for alternative splicing. First, Regulator of CBF Gene Expression 1 (RCF1) is a DEAD box RNA helicase. We showed that RCF1 is essential for pre-mRNA splicing and is important for cold-responsive gene regulation and cold tolerance in plants. Second, Regulator of ABA Response 1 (ROA1) is a close ortholog of the human splicing factor RBM25. Our results indicated that RNA splicing is of particular importance for plant response to the phytohormone ABA and that the splicing factor ROA1/AtRBM25 has a critical role in this response. Third, the U1 small nuclear ribonucleoprotein complex protein AtU1A has a critical role as a regulator of pre-mRNA processing and salt tolerance in plants. In summary, we showed in our genetic analyses that alternative splicing is crucial for plant response to abiotic stress conditions.

Biography

Jianhua Zhu has his expertise in plant molecular biology with a focus on elucidation of the molecular mechanisms that plants have evolved to cope with abiotic stresses such as drought, salinity, cold and heat. Most of my effort has been concentrating on the identification of key components in signal transduction pathways for plant responses to abiotic stresses, with the long-term goal of developing rational strategies to improve crop productivity and agricultural and environmental sustainability. In my lab, we use a combination of forward and reverse genetics in Arabidopsis thaliana, tomato, and other crop plants to study the roles of proteins and non-protein encoding regulatory small RNAs in plant abiotic stress responses.