The Role of TALE Homeodomain Proteins in the Haploid to Diploid Transition of the Fern Ceratopteris richardii

Uddin, Eva (School: The Bronx High School of Science)

TALE homeodomains (TALE-HD) are a large class of genes encoding proteins that act as transcription factors in eukaryotes to regulate major developmental and life cycle changes. Their ancestral role in the canonical land plants has been identified as the regulation of the organism's transition from the haploid to diploid phases of the life cycle. Interactions between the two subclasses of TALE-HDs, BELL and KNOX, have been observed to mediate this transition. Heterodimerization between BELL and KNOX homologs are found to serve this ancestral function in the unicellular green alga Chlamydomonas. Studying this interaction in the different land plant lineages is crucial to understanding the impact that duplication and diversification of function over evolutionary time had on these essential genes. Identification of similarities and differences in the structures and interactions of TALE-HDs between different groups of plants, such as angiosperms, bryophytes and ferns, would help us better understand plant diversity and the way molecular genetic pathways are co-opted from earlier organisms. Gene specific and whole gene primers were designed for the seven BELL-HDs in the fern Ceratopteris richardii, which were cloned to obtain fragments for use in downstream studies of gene expression, protein-protein interaction and studies of gene function. In silico studies consisting of the construction of phylogenetic trees for BELL homologs found across plant lineages, including the seven C. richardii BELLs, were performed; as well as protein structure modeling to identify conserved structural motifs across analyzed sequences. CrBEL8, CrBEL12 and CrBEL1 were identified as morphologically distinct from other Ceratopteris BELLs.

Awards Won:
Third Award of $1,000