PLANT HOMOLOGS OF GENES ASSOCIATED WITH HEREDITARY PREDISPOSITION TO BREAST AND OVARIAN CANCERS

Summary

Defects in DNA damage response and repair mechanism increase genome instability and predispose to cancer. Critical roles in the maintenance of genome stability play *TP53* and *BRCA1/2* genes, inherited germline mutations of which predispose to breast and ovarian cancers. BRCA1/2 are a breast tumor susceptibility factors with functions in maintaining genome stability through ensuring efficient double-strand DNA break (DSB) repair by homologous recombination. p53 protein known as a "guardian of the genome" is involved in maintenance of genomic integrity by several major DNA damage response mechanisms including cell cycle arrest, DNA repair or induction of apoptosis when damage is excessive. By a role in preserving genomic integrity, BRCA1, BRCA2 and p53 belong to the most thoroughly analyzed human proteins. Surprisingly, BRCA1 as well as BRCA2 homologs are also present in higher plants. The homology between human BRCA genes and their plant homologs is mainly conserved in the region of their functional domains. To date, functions of plant *BRCA*-like genes have only been studied for *Arabidopsis thaliana*. In the *Arabidopsis* genome two BRCA2-like genes (AtBRCA2) were found. Their products are essential for DSB repair in somatic cells and have a role in meiotic recombination. In the absence of functional AtBRCA2, plants were sterile owing to a failure to repair meiotic DSBs and chromosomal instability. Genetic studies of one *Arabidopsis BRCA1*-like gene (*AtBRCA1*) have shown their involvement in cell-cycle control and DNA repair. *Arabidopsis* mutant plants defective for the *AtBRCA1* or *BRCA2* are sensitive to DNA cross-linking reagents, such as mitomycin C, and to DSB inducing treatments, such as exposure to the radiomimetic bleomycin. Taken together, these studies provided the first physiological evidence that BRCA genes functions were conserved in plants. In contrast to *BRCA* genes, homolog of the p53 protein has not yet been identified in plants, suggesting that, if a p53 plant gene exists, it might share little sequence homology with its human counterpart.