The YRF1 genes are found in telomeric Y' elements and encode a DNA helicase known as Y'-Help1, which is induced in strains deficient for telomerase activity. Native Y' elements do not appear to be expressed in wild-type cells, probably due to the telomeric silencing effect. Thus, Y'-Help1 expression from shortened telomeres, in which silencing is no longer effective, seems to indicate the presence of a system for the compensation of telomeric loss by telomerase-independent mechanisms. It is proposed that the induction of Y'-Help1 promotes homologous DNA recombination among Y' elements, thereby facilitating their amplification, resulting in the lengthening of telomeric ends and prevention of chromosome loss and cell death. This amplification of Y' elements will further increase the production of Y'-Help1, establishing a positive feedback circuit for telomeric rescue in cells with shortened telomeres. The N-terminal region of Y'-Help1 is composed of motifs conserved in the DEAD/DEAHsubfamily of helicases, and the central region of the protein contains several tandem repeats of the serine-threonine-rich 12-amino acid sequence SXTXATTTXSXX, the number of which varies between the different Y' elements. Y'-Help1 also shares regions of homology with the RNA helicase eukaryotic translation initiation factor 4A, as well as the homologous DNA recombination protein RecG of the hyperthermophilic bacterium Aquifex.