

ĐURĐICA UGARKOVIĆ

Interplay between satellite DNA repeats within heterochromatin and euchromatin is indispensable for satellite DNA-mediated gene regulation*Isidoro Feliciello¹, Ivana Akrap¹, Josip Brajković¹, Đurđica Ugarković¹**1: Ruder Boskovic Institute, Zagreb, Croatia*

Satellite DNAs of the red flour beetle *Tribolium castaneum* such as a major satellite DNA TCAST1 and minor satellites TCAST2-TCAST10 are preferentially located within pericentromeric heterochromatin on all chromosomes. They are, however, in addition, partially dispersed as short arrays or single repeats in the vicinity of genes within euchromatin. The heterochromatin of *T. castaneum* is highly susceptible to heat stress which results in the increased expression of a major TCAST1 satellite DNA. Heat-stress induced TCAST1 transcripts in the form of siRNAs affect histone modifications at TCAST1 homologous regions not only at heterochromatin but also within euchromatin, and in this way transiently suppress expression of neighbouring genes (1). Such an interplay between satellite DNA repeats located within heterochromatin and euchromatin is indispensable for satellite DNA influence on genes and represents the first experimental proof for the gene-modulatory role of a satellite DNA. It is proposed that TCAST1 satellite DNA, by modulating the activity of the neighbouring protein-coding genes within a short period after long-term heat shock, might contribute to the recovery of cells and organism from harmful heat-stress conditions. Since this novel mode of gene regulation does not seem to be unique to the specific satellite DNA/gene, it is hypothesised that like TCAST1, other heterochromatic TCAST satellites partially dispersed within euchromatin, could also influence expression of associated genes by a mechanism of temporary heterochromatinization. The expression analysis of TCAST2-associated genes confirms this hypothesis. Similar dispersion profiles of different TCAST satellites reveal chromosomal regions with their significant enrichment indicating that influence on genes located in such regions might be either neutral or even beneficial. It is also evident that different TCAST families are associated with the same genes e.g. analysis of TCAST1-associated genes reveals that 70% of them have other TCAST elements in the close vicinity. It is proposed that parallel involvement of different TCAST families in the modulation of numerous genes, under the same or various conditions, could contribute to the refinement of complex gene regulatory networks and could possibly improve robustness and adaptivity of the organism.