more efficient *in vivo* than *in vitro*.[56] *Drosophila melanogaster* larva exposure to Epitalon exhibited the reduction of lipid peroxidation intensity and increase in catalase activity in adult flies.[39] A significant antioxidant effect of Epitalon was found in old rats administered with this compound. It significantly suppressed the formation of LP products in blood serum and brain.[57]

Long-term experimental administration of Epitalon to SHR and SAM mice caused decreased chromosome aberrations of bone marrow cells. The most remarkable effect was seen in SAM mutant mice with accelerated aging.[22] The frequency of chromosome aberrations in SAM mice was higher due to DNA damage with reactive oxygen forms, whose production in SAM mice was enhanced.[58] Administration of Epitalon to these mice resulted in statistically significant reduction (by 20–30%) of ChA frequency, which can be associated with activation of antioxidant defense.

The effect of Epitalon on the number of sister chromatid exchanges (SCE) in lymphocyte culture of humans aged 75–88 was studied by cytogenetic methods. Addition of Epitalon to lymphocyte culture resulted in a 1.4-fold increase in SCE frequency ($p < 0.001$), as compared to the control.[59] Vilon under similar conditions increased SCE frequency to a greater extent than Epitalon and showed a 1.9-fold increase as compared to the control ($p < 0.001$).[60] According to early studies, metabolic processes do not take place in the heterochromatin or heterochromatinized chromosome regions.[61] Thus, SCE frequency increase induced by Vilon indicates decondensation (deheterochromatinization) of the chromosome region condensed with aging followed by the release of functionally inhibited genes located therein.[62] The same research also discovered the ability of both short peptides to activate ribosome genes, as evidenced by the increase of nucleolar organizer regions (NOR) in acrocentric chromosomes, deduced by Ag-staining method,[63] as compared to the control.

Generally, the ability of short peptides to normalize or improve humoral and cellular immunity, reinforce antioxidant defense of the body and affect heterochromatinization—one of the aging factors—is an essential component of the geroprotective mechanism of the short peptides.

20.5 The Influence of Short Peptides on Gene Expression

In research based on DNA microarray technology, the impact of Vilon and Epitalon on gene expression has been observed. In this study, the levels of mRNA of 15 247 genes in mouse heart before and after Vilon and Epitalon administration were studied.[23] Epitalon modulated the expression levels of 98 genes; Vilon changed the expression of 36 genes. Combined treatment with Vilon and Epitalon changed the expression of 114 genes. Among the affected genes, there were genes involved in oncogenesis. Vilon and Epitalon inhibited the expression of genes such as mouse Mybl1 (myeloblastosisoncogene-like1) and proto-oncogene Bcl-3, respectively. Chronic administration