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«MODERN PROBLEMS OF GENETICS, RADIOBIOLOGY, RADIOECOLOGY, AND EVOLUTION»

Nor Amberd, 5–10 October 2021

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MEMORIES & DISCUSSIONS
LECTURES

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THE NATURE OF DIRECT RADIATION-INDUCED POINT GENE MUTATIONS IN *DROSOPHILA MELANOGASTER*

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The results of the classical radiation-genetic studies of N.W. Timofeeff-Ressovsky (early 30s of the past century) on the direct and reverse mutation of separate individual genes in *Drosophila melanogaster* should historically be considered as the first experimental substantiation of the new, in contrast to the then dominant Betson's "presence-absence" hypothesis, conception on the nature of X-ray-induced recessive gene mutations, which are based on intragenic changes. This new conception was supported and further developed in subsequent radiation-genetic studies on Drosophila, mice and other model test- systems, as a result of which spontaneous and radiation recessive gene mutations were isolated into an independent class of "*point*" mutations with intragenic changes. It is significant that according to the accumulating data of molecular genetics, "*point*" mutations account for almost half of human genetic diseases. The importance of this class of mutations is emphasized by the fact that they become one of the main genetic effects in assessing genetic hazard (risk) of ionizing radiation using the doubling dose method. The observed progress in DNA technologies opens up real opportunities for elucidating the molecular nature of "*point*" gene mutations. Started by us under the leadership of N.W. Timofeeff-Ressovsky (late 60s of the past century) experiments on the getting of γ -ray- and neutron-induced recessive "*point*" mutations at the five different individual genes, these studies have now been extended by analyzing of the molecular nature of such mutations using PCR and sequence methods. The main results obtained for the *black* gene will be presented, among which the main ones are following: (i) Unlike γ-rays which induce a variety of DNA changes with a predominance of base substitutions, neutrons induce mainly changes leading to gene conversion events resulting from interallelic homologous recombination in the first diploid cleavage nucleus. (ii) The gametic doubling doses for phenotypically *black* gene "*point*" mutations and for intragenic base substitution mutations were estimated as 5.8 and 1.2 Gy, respectively, showing that doubling dose at the molecular level can be much lower than that at the phenotypic level.