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Current state of research in the development of the genomic editing method: problems and prospects

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The possibility of using the CRISPR/Cas method of genomic editing has provided researchers with a powerful tool not only for targeted modification of genes that determine economically valuable traits in plants, but also for solving fundamental problems of their functioning. The most striking examples of the use of CRISPR/Cas9 to improve various plant species by knockouts of target genes or knockins of expression cassettes, including genes that change the biosynthesis of important plant metabolites, obtained by foreign research groups, are presented. We discuss our own results on the directed change in the functioning of genes encoding photosystem II carbonic anhydrases, as well as genes involved in plant responses to stress in the *Arabidopsis thaliana* model. Examples of the use of the genomic editing method to improve the characteristics of plant cell cultures as bioproducers of pharmaceutically valuable recombinant proteins are given. Methodological issues related to plant genome editing are considered — the problems of chimerism, obtaining homozygotes and biallelic knockout mutations, knockout of regulatory and structural genes, as well as repair features in the regions of integration of expression cassettes in knockins. The main directions for further development and improvement of the CRISPR/Cas genomic editing method aimed at optimizing the efficiency of delivery of target genetic constructs and editing tools to the nuclear and chloroplast genomes of plants using single-walled carbon nanotubes are summarized.

Keywords: CRISPR/Cas9; knockouts of target genes; knockins of expression cassettes.

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