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Editorial

Third International Conference "Genetically modified organism: the history, achievements, social and environmental risks"

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ABSTRACT
From October 3 to October 5, 2023, the Third International Conference "Genetically modified organism: the history, achievements, social and environmental risks" was held at St. Petersburg State University as part of the implementation of the Program for the creation and development of a world-class Scientific Center "Agricultural Technologies for the Future. "This issue is dedicated to the 300th anniversary of St. Petersburg State University and presents materials from selected conference reports.

Keywords: GMO; agriculture; medicine; basic research.

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Редакционная статья

Третья Международная конференция «ГМО: история, достижения, социальные и экологические риски»

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АННОТАЦИЯ
С 3 по 5 октября 2023 г. в Санкт-Петербургском государственном университете в рамках реализации Программы создания и развития Научного центра мирового уровня «Агротехнологии будущего» прошла Третья Международная конференция «ГМО: история, достижения, социальные и экологические риски». В этом выпуске представлены материалы избранных докладов конференции, посвященной 300-летнему юбилею Санкт-Петербургского государственного университета.

Ключевые слова: ГМО; сельское хозяйство; медицина; фундаментальные исследования.

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The Third International Conference on "GMOs: History, Achievements, Social and Environmental Risks" was held on October 3rd, 2023 to October 5th, 2023 at St. Petersburg University within the framework of the program for the creation and development of the World-class Scientific Center "Agrotechnologies for the Future." The conference was attended by researchers from Russia, China, Germany, Spain, India, Moldova, Tajikistan, and Belarus [1].

In modern biology, genetic engineering is one of the most rapidly developing fields of research. Genetically modified organisms (GMOs) have applications in agriculture, medicine, veterinary medicine, food processing, and basic research. All of these topics were discussed extensively at the conference.

Viva-voce reports and poster presentations were organized under six sections: GMOs for Basic Research [2–12], Plant Genomic Editing Technologies [13–19], GMOs for Medicine [20–24], GMOs for Agriculture [25–33], GMOs and the Environment [34–40], and GMOs and Society [41–45]. The proceedings of selected conference papers are presented as full-length articles in this thematic issue.

Genetic engineering has enormous potential to modify the hereditary material of living organisms. It can be used both for point editing of genomes [11–17, 28, 37, 46] and for introducing whole gene cassettes into the genome [26, 47]. Although research using genetic engineering methods has been conducted for decades, there are still many unresolved problems. Most of these were highlighted at the conference.

The ability to make point mutations in genomes holds great promise for basic and applied science. It can change the sequence of genes using seamless methods (without leaving traces of the genetic constructs used) to study their possible functions in forms carrying mutations in homo- and heterozygous states. An example of such studies is the work by Khusnutdinov et al. [46], aimed at investigating the effect of gene regulators of flavonoid synthesis in Arabidopsis on plant phenotype.

Genomic editing methods are routine for only a few model organisms. For many crop species, optimization is necessary before the desired results can be obtained. An example of research in this area is the study by Kantsurova et al. [48], aimed to improve CRISPR/Cas9-editing of the genome of the pea, an important agricultural crop. Changes in the regenerative capacity of the legume plants were widely discussed at the conference, not only in the context of genome editing, but also in the context of transgenesis [4, 7, 19]. Although there are currently no effective protocols for obtaining transgenic regenerants for this group of plants, research in this area is ongoing. Transgenic tissue cultures with valuable properties have been developed, as described in the article by Timina et al. [47].

Before genetically engineered products can be practically used, they should be comprehensively characterized. Characterization involves a detailed description of the introduced changes at the DNA level. While Sanger sequencing of the modified fragment is sufficient to confirm the successful editing of a particular gene, transgenic products require more resource-intensive research technologies. This primarily involves determining the site of integration of the genetically engineered construct into the genome. The location of the transgenes will largely determine their fate. Therefore, many methods have now been developed to study insertion-boundary sequences. The review by Okulova et al. [49] is focused on the systematization of this information.

Genetic engineering methods are a powerful tool for basic research. They are widely used in plant developmental genetics. An example of such studies is the article by Kuznetsova et al. [50].

Unlike in plants, there are objects in microorganisms that can be used with great success both for practical purposes (as producers of food additives, enzymes, proteins for therapeutic purposes) and for solving fundamental problems. The review by Virolainen and E.M. Chekunova [51] presents data on modern achievements in the field of genome modification of the unicellular green alga *Chlamydomonas reinhardtii,* including design principles of transgenic constructs, methods of transformation of nuclear and chloroplast genomes, selective markers used, and approaches to genome editing using the CRISPR/Cas9 system.

Thus, the already traditional conference "GMOs: History, Achievements, Social and Environmental Risks" is an important platform for sharing experiences in the field of genetic engineering and interaction of key specialists in this field.

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