BioSpectrum the business of Bio & Health Sciences
Azadi Ka Amrit Mahotsav

The road ahead for genome editing

26 June 2018 | Features | By Dr. Supriya Shivakumar

From the introduction of Zinc Finger Nucleases and TALENs, to the current technology of CRISPR, the rise of genome editing has been rapid in all areas of research.

Genome editing has dominated the headlines as the “future of biology” over the past few years. This transformative technology can provide the ability to cure diseases at the genomic level. It is accomplished by enabling permanent modifications of genomic DNA through the use of so-called “genetic scissors” that remove, replace or change an existing gene with an unprecedented combination of flexibility, efficiency and accuracy. An apt simile is comparing a word processor that edits text to the process of genome engineering which involves the cutting and pasting of DNA into the genome. From the introduction of Zinc Finger Nucleases and TALENs, to the current technology of CRISPR, the rise of genome editing has been rapid in all areas of research. The newest tool in the technology toolbox, CRISPR, has been shown to be precise, inexpensive and easy to use and has been rapidly adopted worldwide. There is no doubt about the promise that CRISPR holds for therapeutic, agricultural and research applications.

India has recently entered the world stage in genome editing by a recent publication (Kaur, N., Alok, A., Shivani et al. Funct Integr Genomics (2018) 18: 89. https://doi.org/10.1007/s10142-017-0577-5;) illustrating the functional disruption of two PDS genes via genome editing to modify banana plants. This use of genome manipulation in agriculture is bolstered by the recent statement from the USDA that they will not regulate plants (with some restrictions) that could have otherwise been developed through traditional breeding techniques (https://www.usda.gov/media/press-releases/2018/03/28/secretary-perdue-issues-usda-statement-plant-breeding-innovation).

According to the 2017-2018 report from the National Science and Technology Management Information System under the Department of Science and Technology, there has been a steady increase in research and development expenditure, patent filings and publications (http://www.nstmis-dst.org/statistics-Glance-2017-18-2.pdf). With these trends, India is poised to apply genome editing to a variety of applications in agriculture and human health. The most useful therapeutic and agricultural solutions start at the research bench, before being optimized for the clinic or agriculture. Genome-editing technology is not yet as common a laboratory research tool in India as in other parts of the world, but adoption is well underway, especially with CRISPR.

As India transitions CRISPR into the standard toolbox for biology research and explores the multitude of applications including animal health, disease prevention and treatment, and plant breeding, a number of ethical and societal questions will arise. Demand for therapies will increase the pressure to move quickly and India should endeavor to have a clear regulatory path to deal with the desire for rapid approvals. Regulations that help guide the path to safer and predicted outcomes should be put in place proactively.

CRISPR technology, despite its rapid rise to prominence, is still in its infancy. Creating an infrastructure that allows for checks and balances for robust reproducible research and applications requires widespread education and discussion to allow the technology to reach its potential. From higher yield crops capable of feeding more people, to better health and cures, India is well-positioned to help CRISPR deliver its promise of transforming possibilities into realities.

Dr. Supriya Shivakumar, Head of Strategy, Gene Editing & Novel Modalities, the Life Science business of Merck