

Biosafety Issues in Laboratory Research^δ

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Advancements in Research

With the ever increasing knowledge and innovative techniques in molecular biology and biotechnology, scientists can now isolate any gene of interest from any species and incorporate it into a small self-replicating extrachromosomal genetic element for multiplication as well as expression of the gene. The recombinant DNA molecule thus produced can be introduced into host cells such as bacteria or yeast to grow large vats or fermentors full of the recombinant organism. Not only this, today scientists can cut apart and paste together the DNA molecules almost at their will, regardless of the sources of DNA. These have empowered scientists to tailor-make genes and have them expressed in living organism to produce the desirable product. Some of the achievements of biotechnological research include production of life-saving drugs in micro-organisms, development of the golden and the iron-rich rice, biofertilizers, biopesticides, use of plants and animals as bioreactors for producing enzymes and chemicals for industrial uses, production of biodegradable plastics, biosensors, superbug etc. for tackling some of the environmental problems. Genetically modified organisms (GMOs) were developed and used successfully during early 1970s under contained conditions, and since mid 1990s they are being used for commercial applications in the open environment. However, it is widely recognized that the use of GMOs should be subject to adequate safety measures because of apprehensions about their potential risk to human health and the environment. Consultations on safety in use of GMOs have resulted in a number of national and international recommendations, guidelines and legislation. Thus, the use of GMOs warrants special attention on biosafety.

What is Biosafety?

The term biosafety is used to describe the procedures and policies adopted to ensure the environmental and personal safety. Biosafety refers to the containment principles, technologies and practices that are implemented to prevent unintentional exposure to pathogens and toxins, or their accidental release into the environment. A fundamental objective of any biosafety program is the containment of potentially harmful biological agents.

Why Biosafety?

With the increasing number of countries adopting molecular tools and techniques in their life science research and development activities especially in the areas of agriculture and medicine, the biosafety issues are gaining importance to ensure biological safety for the public and the environment. To conduct research in a safer manner is not only a personal requirement but essential collective efforts to ensure biological safety for a clean and safe environment. This certainly requires rules, regulations, monitoring bodies and awareness among the public. Thus, biosafety *per se* is an integral part of the laboratory research, and requires awareness among the researchers so that biological safety can be well taken care at the grass root level.

GMOs have got commercial applications in agriculture and healthcare industry, often for a better value and quality of the products. However, there are key differences between these two sectors. Healthcare industry is a highly regulated and the products are generally

life-saving drugs where certain minor risks can be easily compromised with the life-saving benefits. The key players of the healthcare industry (medical practitioner, drug industry and the regulatory authorities) are often well aware of the latest biosafety concerns. The GMOs and the purified products are handled under contained environment. Thus, there is minimized public concern associated with the use of GMOs in healthcare industry. On the other hand, agriculture deals with the crop and animal husbandry; protecting them from insect pests and diseases; improving their taste, quality and acceptability to the consumers, and studying their nutritional and associated effects. With the adoption of GM crops in 29 countries grown over 160 million hectares world over, the concerns associated with GMOs are widely discussed. However the concerns differ greatly, depending on the particular gene-organism combination. Therefore, a case-by-case approach would be required for assessment of the associated biosafety concerns. The safety concerns in agriculture not necessarily associated with the characteristics of the products but the way it is produced, particularly in case of human food. European Union has been the opponent of the GM technology based on the associated biosafety concerns. However, the studies conducted during 2011 in Europe confirmed that GM crops are safe as animal feed. Since GM crops and animals are grown under open environment and they can interact with other organisms in the surrounding environment, GMOs in agriculture have become a more sensitive issue than they are in the healthcare industry. The potential risks of growing GMOs and using their products may be associated with (i) human health, (ii) environmental concerns, and (iii) social and ethical issues.

Steps Forward

Though there has been increasing awareness about biosafety all over the globe, there is lot to be understood and followed in laboratory research, particularly at grassroot level in the developing countries. Many countries have put into place effective regulatory procedures that are much more rigorous for GM than non-GM food. However, formulation of basic guidelines with multilevel regulatory bodies is required for compliance of biosafety measures. Though biosafety regulatory bodies may exist, their effective functioning is a big question in many of the countries using GMOs and their products. The need of the day is to strengthen internal regulatory body and create awareness among the research managers, scientists and students about the biosafety requirements. The internal regulatory body at research institute level includes an Institutional Biosafety Committee (IBSC) or its equivalent body consisting of experts from different relevant disciplines. The IBSC

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Received May 23, 2012; Accepted May 25, 2012; Published May 29, 2012

Citation: Kumar S (2012) Biosafety Issues in Laboratory Research^δ. Biosafety 1:e116. doi:10.4172/2167-0331.1000e116

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must ensure (i) existence of the basic biosafety equipments required according the safety level of the experiments conducted, organize trainings for the researchers to make new comers aware of the biosafety measures as well as to update their knowledge of biosafety.

The Journal of Biosafety, an open access journal, will play very important role in creating awareness among the researchers and common people by making research and review articles readily available to the global readers. The efforts made by the OMICS Publishing Group, USA, towards publishing open access journals, organizing international conferences on such pertinent issues is appreciable and will generate awareness among the researchers, administrators, policy makers, environmentalists and general public.

Finally, it is now well clear that the modern life science research promises to enhance the quality of human life, if used wisely. On the other hand, if used haphazardly and carelessly, it may have negative

impacts also. Therefore, research in the area of molecular biology and biotechnology do need to be continued, but the safety of laboratory workers must be ensured, and doubts related with general risks and hazards, long term safety to health, nutrition, environment and sustainable agriculture must be properly dispelled. Biosafety issues are important not only from the safe product development point of view but also for safe utilization of the technology. Biosecurity and bioterrorism are the associated concerns emerging rapidly, and need to be taken care in the interest of the sustainable research, human health and the environmental safety. So let us promise to ourselves on this 'World Environment Day' to sincerely follow the biosafety regulations at every step of research in our laboratory to keep our environment clean, green and healthy.

⁸The views expressed are those of the authors only. These may not necessarily be the views of the institution/organization the author is associated with.