Panel I Summary

New Research Techniques and Diagnostic Tools for Biosafety Evaluation

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Introduction

The panel offered an insight into various approaches that have been chosen to investigate genetically modified organisms (GMOs) meant for deliberate release or food production.

These approaches to the biosafety analysis of GMOs operate at different levels: 1) to forecast the potential of an impact on human health or the environment; 2) to detect the effects on human health or the environment; 3) to develop methods to remove the GMOs from the environment if necessary.

Presentations and discussion

The contributions of the two first speakers, Dr. Lehrer (USA) and Dr. Shinmoto (Japan), illustrated the problem of food allergenicity. Since more than 30 different plants genetically engineered are predicted to be in the marketplace in the next few years, the assessment of the allergenic potential is an important task (Fuchs and Astwood, 1996). Most of the food allergies are caused by e.g. wheat, rice, legumes, tree nuts, eggs, milk, and seafood. Of the many proteins of these foods only a few were found to account for the allergenicity. It was pointed out that these known allergens allow a straightforward safety evaluation by applying *in vitro* techniques like immunoblotting, radioallergosorbent test (RAST) and enzyme-linked immuno-sorbent assay (ELISA). These techniques were successfully applied also in three very recent examples of transgenic plants, two soybean and corn plants, demonstrating that known food allergens can be evaluated effectively. But it was stressed also in the discussion that there are difficulties in the assessment of genes coding for proteins of unknown allergenicity.

Therefore, several molecular methods have been proposed to address this problem: comparison of the proteins in question with known proteins of known allergenicity

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regarding the same physicochemical properties and amino acid sequences. This may help to identify the relevant epitopes. Better approaches were also discussed: the analysis of TH2-lymphocyte stimulation and IgE antibody production stimulated in animals.

Dr. Shinmoto outlined an alternative new approach to the problem of forecasting the allergenic potential of even new proteins. The gene usage of the variable heavy chain of IgE antibodies needs to be checked thoroughly to find out if there is a possible preference for specific IgEs in the cause of allergies. The construction of a specific library stock of immortalized B-cells may help to address this problem.

In the discussion it was again mentioned that serum banks and specific data bases are necessary to forecast the allergenic potential of new or newly transferred proteins in plants used for food production.

The importance of plant taxonomy for the analysis and forecast of the potential impact of transgenic plants on the environment was presented by Dr. Warwick (Canada). She demonstrated that the new molecular methods used in biosystematics may help to evaluate the problem of weedy relatives of cultured transgenic plants. There is often a confusion regarding the taxonomic assignment of crops and related weedy plants. Biosystematics can help to evaluate the phylogenies of all important crop plants and the related weeds. The escape of transgenic traits into the environment resulting in new weedy plants is often quoted by opponents of genetic engineering as a major disadvantage of transgenic plants. But during the discussion it was stated that the environmental impact of e.g. herbicide resistant weeds is often overestimated.

Once a transgenic plant or a product derived from a transgenic plant is on the market it is (also for the concerned consumer) often important to be able to follow it. Dr. Schiemann from Germany described a PCR-based method for the detection of food produced by genetic engineering that is already part of the official compilation of methods for food analysis in the German Food Law. A major topic of Dr. Schiemann's presentation was the research accompanying field release experiments of transgenic plants. He reported about refined molecular methods that were developed to detect heteroencapsidation or recombinations as a result of the release of virus-resistant plants. Since the microbial environment may also be influenced, in this release-accompanying research, new methods were applied and thoroughly tested for 1) the detection of gene transfer from the transgenic plants into the soil microbial population (PCR with specific primers), 2) detection of changes in the composition of the microbial population (genetic and metabolic fingerprinting).

The release of genetically modified microorganisms for use in bio-remediation was the topic of the lecture of Dr. Ramos from Spain. He presented a biological containment system that can be applied when it is necessary to remove (or at least to reduce) the released bacteria from the environment. This system based on the killing function of porin-like proteins was successfully tested in two release experiments in Spain. Several other systems for biological containment offer the possibility of a flexible application of these containment methods for the respective microorganisms (Molin *et al.*,

1993). This may then increase the deliberate releases of genetically modified microorganisms, especially in the case of bioremediation, biocontrol and biofertilization (see also Panel II, this volume).

Conclusion

Panel session I showed convincingly that there is a large number of methods available to evaluate and forecast potential biosafety problems derived from the use of transgenic organisms. It was also indicated that possible horror scenarios often presented to the public by the opponents of genetic engineering are greatly exaggerated. Many studies were undertaken to consider as many potential risks as possible before releasing GMOs into the environment. Due to the refined methods available, the security of the consumer has reached a very high level. Nevertheless, it was stressed several times during the discussions that a case-by-case evaluation of GMOs is still required.

References

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2) Molin, S., Jensen, L. B., Kristensen, C. S., Grivskov, M., Ramos, J. L. and Bej, A.K. (1993) : Suicidal genetic elements and their use in biological containment of bacteria. Annu. Rev. Microbiol. **477**: 139-166.