Report on a Round Table Discussion

Isolated Plant Protoplasts in Genetics and Plant Breeding

Bad Honnef (Federal Republic of Germany), February 12-14, 1979

Isolated plant protoplasts have been used to study problems of developmental physiology and phytopathology, to clone higher plants in vitro, to isolate mutant cell lines, and to obtain intra- and interspecific somatic hybrids. Furthermore, they may be ideal receptors in DNA transplantation experiments. It is evident that geneticists and plant breeders are deeply interested in experiments with isolated protoplasts.

The Deutsche Forschungsgemeinschaft (German Research Council) has given financial support for several years to research programmes with isolated protoplasts. Scientists who are using isolated plant protoplasts in their research were recently invited to take part in an informal round table discussion. Twenty-eight participants came from the Federal Republic of Germany, three from Switzerland, two from Israel and one from Hungary. Three scientists were invited to present surveys on somatic cell genetics in animals and on genetic engineering. Collegues from the GDR did not join the meeting. The following topics were discussed:

1 Isolation and Regeneration of Plant Protoplasts

It is evident from the limited number of plant species in which plant regeneration has been achieved that much more detailed information must be accumulated on appropriate conditions and procedures (review: Eriksson 1978). The participants dealt with their experiences with different plant material, on preparation of protoplasts and on culture conditions. The question as to which types of cells are suitable for obtaining viable protoplasts was most extensively discussed with respect to the limited success in monocotyledons (review: King et al. 1978).

2 Isolated Protoplasts and Mutagenesis

Isolated protoplasts are single cell systems and so should be most appropriate for obtaining mutants. The question was investigated as to why mutants, especially auxotrophic ones, have not been found in populations of protoplast regenerants.

3 Markers and Methods for Isolation, Selection and Identification of Particular Cells and Clones

Differential characteristics of protoplasts and their regenerants are especially important in experiments aimed at achieving recombinant types following protoplast fusion and transplantation of cell organelles or DNA. The peculiarities of the several established selection systems have been discussed with respect to particular experimental programmes (review: Cocking 1978).

4 Protoplast Fusion and Organelle Transplantation

The number of successful experiments on the regeneration of fusion products is rather low despite well worked out fusion procedures (review: Constable 1978). Factors which impede regeneration and the fates of cell organelles and chromosomes were extensively considered. K.-H. Grzeschik presented a paper on comparable investigations in animal cell cultures and also covered the field of organelle transplantation in animals. Experiments on organelle transplantation in plants have been less satisfactory.

5 Transfer of Genophores and DNA

Chromosome transplantation has been obtained only in animal cell cultures (Willecke 1978). K. Willecke had been invited to report on chromosome and DNA transplantation in animal systems. In plants, isolated protoplasts are supposed to be excellent receptors. During the last few years it has become evident that transplantation of particular DNA segments is most feasible if they are propagated and transplanted as complexes with plasmids or other equivalent carriers. The tumour-inducing plasmid (*ti* plasmid) of *Agrobacterium tumefaciens* and some other microbial genophores are supposed to be excellent receptors in experiments with plant cells (review on the ti plasmid: Schell 1978). A lecture by J. Schell was devoted to this topic.

6 Isloated Protoplasts and Plant Breeding

The incorporation of protoplast technologies into plant breeding programmes was considered very intensively during the meeting. Potato breeding was specially emphasized since all prerequisites for somatic genetic breeding, such as haploidization, tissue culture and protoplast regeneration, are already established in this important crop (Wenzel 1979; review: Thomas et al. 1979).

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