

Chloroplast Metabolism and Its Inhibition by Herbicides

International Workshop at Omiya Sonic City, Saitama, Japan, August 26–28, 1992

Preface

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The majority of commercial weed control chemicals interfere with hormone-induced cell elongation, cell division and with chloroplast metabolism. Within these three domains of action the chloroplast is the target site of unrivaled importance. Most of the plant-specific reactions for which active and specific inhibitors are known are located in this organelle. Its electron transport, the carbon dioxide fixation and photosynthate allocation, pigment biosynthesis, or the build-up of essential amino and fatty acids can be inhibited or deregulated. Older, established herbicides like atrazine, metribuzin, bentazone, propanil, or glyphosate are prominent inhibitors. Also more recent developments, like the sulfonylureas, imidazolinones, the phenoxyphenoxypropanoates or oxime-type cyclohexanediones are addressed towards plastidic reactions. The same holds for the peroxidizing herbicides like nitrodiphenyl ethers, cyclic imides or certain pyrazoles. The “classic” bleaching herbicide norflurazone has been followed by more recent xenobiotics attacking the phytoene desaturase, the membrane-bound key enzyme of carotenogenesis.

As has been emphasized previously, herbicidal compounds are not only of interest for the agrochemical industry. They are valuable tools to elucidate basic biochemical reactions and are used as specific probes to block certain plant-specific pathways. Photosynthesis or carotenogenic inhibitors are well-known examples. Today a plethora of compounds is available all targeting the chloroplast. So, meetings dealing with phytotoxic compounds generally attract scientists from both the industry and universities.

Originally, photosynthetic electron transport was the major inhibition site, particularly the D1 protein of the photosystem II core. Accordingly, the International Congresses on Photosynthesis have been accompanied by satellite meetings dealing with mode of action of compounds affecting reactions in the chloroplast*. The meeting in Omiya Sonic City north of Tokyo on “Molecular Regulation of Chloroplast Functions” had the same purpose and brought together colleagues from universities interested in functional and basic understanding of photosynthesis as well as experts from the industry where the development of a promising herbicide is the prime concern. These different interests, of course, resulted in a mix of contributions covering a wide array of aspects.

During the two and half day meeting 24 plenary lectures and 53 posters were presented to an audience of about 150 participants, the majority coming from Japanese chemical companies and universities. The contributions have been grouped in six sections:

- I. Inhibitors of Photosystem II
- II. The Inhibitor-Binding Site of Photosystem II
- III. Functional Aspects of Photosystem II
- IV. Carotenoid and Lipid Biosynthesis
- V. Peroxidizing Herbicides
- VI. Amino Acid and N-Metabolism; Miscellaneous Topics.

Papers on photosystem II inhibition dominated due both to the following 9th Intern. Congress on Photosynthesis in Nagoya as well as to the advanced studies and understanding of this part of photosynthesis. One afternoon was assigned to

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structure/activity studies in honor of Wilfried Draber, a pioneer in this field who has retired in 1992. It should be noted that emphasis on development of new inhibitors and herbicides has shifted to metabolic pathways other than photosynthesis, like amino acid build-up, pigment biosynthesis or fatty acid formation. Many potent inhibitors are produced for these fields at the moment, and studies are actively conducted in industrial laboratories from which results are published reluctantly. This is an accepted although regrettable situation. Nevertheless, the editors are confident that the papers presented are a timely compilation of original contributions to herbicide mode of action and chloroplast functions, and a valuable source of information for our colleagues.

The well-organized meeting was sponsored under the auspices of the Institute of Physical and Chemical Research (RIKEN), the Japanese Socie-

ty for Chemical Regulation of Plants, and the Science and Technology Agency of Japan. Additional support came from an impressive number of Japanese companies. The list of sponsors is published in the Abstract brochure. We express again our sincere gratitude. Thanks also relate to the local organizing and working committee. Our Japanese colleagues managed a smooth and broad program arrangement, and supported colleagues from abroad with a substantial share of their air travel costs. Eventually, we are grateful to *Zeitschrift für Naturforschung* for publishing this book.

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