Herbicides Affecting Chloroplast Functions

International Workshop at Lake Placid, N.Y., USA; August 17–20, 1986

Preface

In recent years, interest and research in the mode of herbicide action have been steadily increased. More knowledge about inhibitory function and target site(s) of xenobiotics will permit the use of appropriate model species and enzymic assays, thus corroborating and extending the greenhouse random screening for new active compounds. Such bioassays, in turn, will offer a promising rational strategy for the development of new inhibitors by relating their chemical structure with biological activity at known sites and targets. An additional reason to study mode of action comes from the expectations of being able to modify enzymes and reaction sites by genetic manipulations. Cloning of genes, *e.g.* to achieve herbicide resistance, is only feasible once the target of a herbicide is known and characterized. Environmental considerations are also of growing importance. New herbicides will be developed that are more active than older ones, affecting specifically plant processes only. Growing concern of the public about chemical plant protection has to be taken into account. Reliable data on mode of action are part of the information required to establish confidence in responsible chemical weed control. Eventually, interest in herbicide action also comes from basic plant research. Investigators are becoming aware that many herbicides are excellent tools for blocking specific reactions and pathways. Such inhibitors can be used as probes to study plant biochemistry.

In herbicide research the chloroplast still is the most important organelle. Plant-specific processes are located here, which have been shown to be attacked by many herbicides and new experimental compounds. Active inhibitors are well known for the photosynthetic electron-transport system and carotene biosynthesis, but are also known for light-induced peroxidation processes leading to degradative breakdown of plastidic constituents and membrane leakage. Biosynthesis of essential amino acids and part of the N-assimilation takes place in the plastid. Considerable research has been focused on these latter subject which are, however, excluded from this issue since our focus herein is directed to the photosynthetic process.

This Workshop was patterned after those of 1979 and 1983 at Konstanz, Germany, and Wageningen, The Netherlands, respectively.* Colleagues from universities and the industry met to share interest in physiology, biochemistry and genetics of photosynthesis and chloroplast metabolism with respect to inhibitors. Most participants had attended either the 7th Int. Congr. Photosynthesis in Providence, R.I., or the 6th Int. Congr. Pesticide Chemistry in Ottawa, Canada. Both congresses had met concurrently in the previous week. About 70 participants gathered at Lake Placid in upstate New York for this Workshop. Over 2½ days, 16 talks and 30 posters were presented and discussed at length. The relaxed and informal atmosphere was highly productive.

Photosynthetic electron transport, the historically oldest herbicide realm within the chloroplast, is still the most advanced. Deep insights have been obtained recently into the molecular interactions of photosystem-II inhibitors with their binding site, the 32 kDa "herbicide-binding protein". Papers on that peptide dominated in connection with herbicide (triazine)-resistant mutants. Blue-green algae are becoming increasingly important for cloning and site-directed mutagenesis in order to study herbicide-binding sites and the function of thylakoid peptides in photosynthesis. Other contributions dealt with uncouplers, inhibition of carotenogenesis, peroxidative effects, and approaches to influence the assimilatory pathways of photosynthesis.

From the collection of papers of this issue the reader will obtain an up-to-date view on herbicide mode of action research with respect to photosynthesis, its pigment apparatus, and light-induced degradations. Undoubtedly, chloroplast biochemistry

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will expand in the future to cover additional reactions and biosynthetic pathways under the category of site-specific inhibition.

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The Organizers

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