Preface for the ESP series in photochemical and photobiological sciences

"Its not the substance, it's the dose which makes something poisonous!" When Paracelsius, a German physician of the 14th century made this statement he probably did not think about light as one of the most obvious environmental factors. But his statement applies as well to light. While we need light for example for vitamin D production too much light might cause skin cancer. The dose makes the difference. These diverse findings of light effects have attracted the attention of scientists for centuries. The photosciences represent a dynamic multidisciplinary field which includes such diverse subjects as behavioral responses of single cells, cures for certain types of cancer and the protective potential of tanning lotions. It includes photobiology and photochemistry, photomedicine as well as the technology for light production, filtering and measurement. Light is a common theme in all these areas. In recent decades a more molecular centered approach changed both the depth and the quality of the theoretical as well as the experimental foundation of photosciences.

An example of the relationship between global environment and the biosphere is the recent discovery of ozone depletion and the resulting increase in high energy ultraviolet radiation. The hazardous effects of high energy ultraviolet radiation on all living systems is now well established. This discovery of the result of ozone depletion put photosciences at the center of public interest with the result that, in an unparalleled effort, scientists and politicians worked closely together to come to international agreements to stop the pollution of the atmosphere.

The changed recreational behavior and the correlation with several diseases in which sunlight or artificial light sources play a major role in the causation of clinical conditions (e.g. porphyrias, polymorphic photodermatoses, Xeroderma pigmentosum and skin cancers) have been well documented. As a result, in some countries (e.g. Australia) public services inform people about the potential risk of extended periods of sun exposure every day. The problems are often aggravated by the phototoxic or photoallergic reactions produced by a variety of environmental pollutants, food additives or therapeutic and cosmetic drugs. On the other hand, if properly used, light-stimulated processes can induce important beneficial effects in biological systems, such as the elucidation of several aspects of cell structure and function. Novel developments are centered around photodiagnostic and phototherapeutic modalities for the treatment of cancer, artherosclerosis, several autoimmune diseases, neonatal jaundice and others. In addition, classic research areas such as vision and photosynthesis are still very active. Some of these developments are unique to photobiology, since

the peculiar physico-chemical properties of electronically excited biomolecules often lead to the promotion of reactions which are characterized by high levels of selectivity in space and time. Besides the biologically centered areas, technical developments have paved the way for the harnessing of solar energy to produce warm water and electricity or the development of environmentally friendly techniques for addressing problems of large social impact (e.g. the decontamination of polluted waters). While also in use in Western countries, these techniques are of great interest for developing countries.

The European Society for Photobiology (ESP) is an organization for developing and coordinating the very different fields of photosciences in terms of public knowledge and scientific interests. Due to the ever increasing demand for a comprehensive overview of the photosciences the ESP decided to initiate an encyclopedic series, the "Comprehensive Series in Photochemical and Photobiological Sciences". This series is intended to give an in-depth coverage over all the very different fields related to light effects. It will allow investigators, physicians, students, industry and laypersons to obtain an updated record of the state-of-the-art in specific fields, including a ready access to the recent literature. Most importantly, such reviews give a critical evaluation of the directions that the field is taking, outline hotly debated or innovative topics and even suggest a redirection if appropriate. It is our intention to produce the monographs at a sufficiently high rate to generate a timely coverage of both well established and emerging topics. As a rule, the individual volumes are commissioned; however, comments, suggestions or proposals for new subjects are welcome.

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Volume Preface

The photochemistry and photobiology of flavins is a field which has important implications for chemistry, biology, and medicine. In view of its interdisciplinary diversity a monograph covering the major aspects on this subject must by necessity be a multiauthored book. Therefore, it has been one of our fundamental motivations to secure contributions from experts who would provide the necessary broad coverage. Each one of the chapters provides an overview of historical developments, state-of-the-art, and future perspectives in different areas of interest related to flavins.

The first part of this book is devoted to the properties and applications of flavins in solution, with chapters dealing with the general properties of flavins, their photochemistry in aqueous and organic solvents, the interaction of the excited states of flavins with amines and their application to the initiation of vinyl polymerization. The following chapters address topics which underline the important role performed by flavin-promoted photoreactions in biological systems, such as riboflavin as a visible light sensitizer in the aerobic photodegradation of ophthalmic and sympathomimetic drugs, the antiviral and antibacterial effects observed in solutions exposed to light in the presence of riboflavin and their applications to blood safety and transfusion medicine. The possible role of flavins in light-induced toxicity with special focus on the eye lens is also discussed in depth.

The final part of the book deals with the special class of flavoproteins, for which the properties of the photoexcited states of the different redox states of their flavin cofactor are essential for their biological activities. There is one chapter dealing with the blue-light initiated DNA repair by photolyase, and three chapters devoted to the flavin-based photoreceptors in plants, bacteria and eukaryotic photosynthetic flagellates, respectively. The mechanisms of light activation in flavin-binding photoreceptors are analysed in the last chapter.

The editors remain very grateful to the individual contributors for their effort and enthusiasm in preparing their chapters. We also wish to thank Giulio Jori for his encouragement and for giving us the opportunity to coordinate the publication of this monograph. We also thank Manuela for her patience, help and understanding in the different steps of the preparation of the book.

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