Preface

Bioinorganic photochemistry is a new branch of modern science dealing with the interaction of light with inorganic matter, which has a huge impact in all forms of life on the Earth from its origin up to the present: it is responsible for the origin and maturation of biosphere, its environment, and sustainable development.

The photobioinorganic interactions may be found not only now and here but also in the Universe far from Earth and in times dated more than 4 billion years ago, when the first hints of life probably emerged on Earth.

Small inorganic molecules under the influence of light are able to convert and assemble to form a variety of organic compounds, which not only are a life supplement but also may be treated as responsible for primordial life forms. Photochemistry of the inorganic species made its contribution to the creation of the world and played a fundamental role in the evolution of life. Both primordial and present life are protected from the destructive action of the high-energy part of solar radiation by the stratospheric photochemical processes involving oxygen and ozone.

The maintenance of life on Earth is possible only as a result of photosynthesis, which takes place in green plants and did in the past, when it was followed by decomposition and formation of deposits of coal, oil, and natural gas, currently used as fossil fuels. One of the future developments of bioinorganic photochemistry appears to be a pathway to enable the creation of new sources of energy that are both cheap and environmentally friendly.

A lot of photoreactions occurring in the atmosphere, hydrosphere, and soils ensure the health, comfort, and welfare of human beings, creatures, and the environment. These processes are mostly driven by coordination compounds of transition metals, which play the role of (photo)catalysts or (photo)sensitizers. There is also increased understanding of the role of supramolecular inorganic systems in their interaction with light and the great variety of processes that may ensue.

Development of artificial light sources, and especially the introduction of lasers, brought about an enormous increase in research on light–biomatter interactions. Thus the application of inorganic photochemistry and photophysics generates challenging new areas in bioscience and biotechnology.

Recently, nanotechnology and nanomaterials have been revolutionizing important areas in biomedical photonics, especially diagnostics and therapy at the molecular and cellular levels. Once again, inorganic species offer unique possibilities for practical applications.

Despite the rapidly growing knowledge in bioinorganic photochemistry, there is no single book devoted to this new interdisciplinary branch of science. The information of some specific problems from bioinorganic photochemistry is spread throughout various books devoted to bioinorganic chemistry, inorganic photochemistry, photobiology, environmental photochemistry, or bioanalytical and biomedical applications. Therefore the goal of this book is to provide a comprehensive overview of bioinorganic photochemistry taken as a new interdisciplinary branch of science. We hope that the book that arose from the review paper published in Chemical Reviews (2005;105:2657–94) will serve as a guide for newcomers in the field, as well as the first source of information for more involved readers. After introductory remarks on bioinorganic photochemistry as a new area of interdisciplinary science, the second part contains essential information from the field of photochemistry and especially inorganic photochemistry. The next part of the book is devoted to bioinorganic solar photochemistry, from the origin and maturation of the biosphere to the sustainable development of its environment. Parts IV and V focus on artificial light interactions with biomatter both in the context of application (medical, biomedical, environmental) and as models of important biochemical and biophysical phenomena.

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