

A CHEMIST'S PERSPECTIVES IN PHOTOSENSORY BIOLOGY

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Recently, I heard Nobel Laureate James Watson say that the structure of DNA would have been solved considerably sooner if he had known chemistry. Chemistry is powerful in identifying biologically active compounds and elucidating their structures and properties. My 35-year scientific career began with the study of one of the most investigated photosensory biological problems ; namely, phototropism in higher plants. I soon discovered that my chemistry confined me to the periphery of the photosensory biology and its study. Even an average chemist is bound to encounter some new things in the periphery of photosensory biology. This lecture will describe a couple of such encounters which led to my current interest in the structure and function of the photosensory receptors phytochrome and stentorin.

Phytochromes are red/far-red light sensors and switches (Quail et al, 1995;Shinomura et al, 1996) for photomorphogenesis in plants. How these cytosolic photoreceptor molecules initiate signaling cascades for the regulation of light-responsive gene expressions involved in the photomorphogenesis still seems to be obscure. As a possible molecular trigger for the initiation of light signaling cascade, we thought about the conformational change induced by the Pr \rightarrow Pfr phototransformation and, lately, posttranslational modification. For this purpose, we used deletion and site-directed mutagenesis, CD, proteolytic mapping and peptide-mass spectrometry. Results are used to identify "non-silent" light- and phosphorylation-modulated conformational changes in phytochrome A.

The chemical structures of the stentorin blepharismine chromophores in the photosensor pigments of protozoan ciliates *Stentor coeruleus* and *Blepharisma japonicum*, respectively, were elucidated by NMR, mass spectrometry and optical spectroscopy. We are investigating the possible mechanism of the primary photoprocess that leads to the generation of an early cellular signal (for example, transient intracellular pH change). Specifically, electron transfer from the excited photoreceptor molecules to an electron acceptor has been studied by means of dynamic fluorescence quenching and EPR spectroscopy.

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