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N. E. Belikov[1], O. V. Demina[1], I. A. Melnikova[1], A. Yu. Lukin[2], L. E. Petrovskaya[3], S. D. Varfolomeev[1], A. A. Khodonov[1]

[1]N. M. Emanuel Institute of Biochemical Physics RAS,
119334, Russia, Moscow, Kosygina St., 4,
[2]MIREA – Russian Technological University,
119571, Russia, Moscow, Vernadsky Ave., 86,
[3]Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry,
117997, Russia, Moscow, Miklukho-Maklaya St., 16/10,
khodonov@gmail.com

PHOTOCHROMIC LABELS AS A NEW CHALLENGE FOR NANOBIOTECHNOLOGY*

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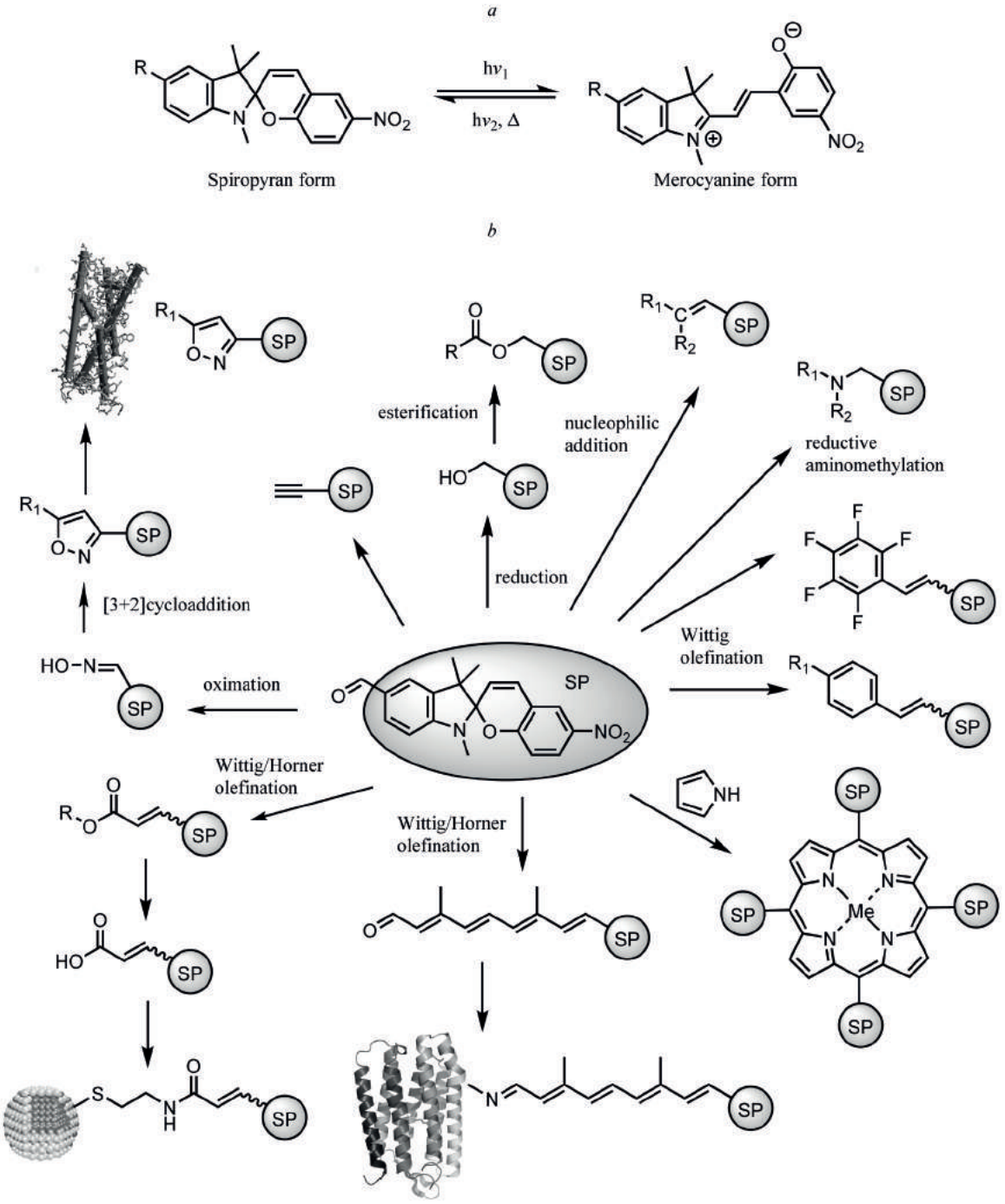
A promising way for the new hybrid photoactive/photocontrollable systems and materials design consists in the covalent binding of the photochromic probes via their covalent “immobilization” on various substrates, e. g. polymers, lipids, proteins and quantum dots. Developing the new generation of photochromic probes containing substituents with appropriate functional group type will be required for the implementation of this procedure. Indoline spirobenzopyrans are one of the most studied photochromic compound classes. The structure of possible target substrates defines the nature of the reactive anchor group. Spectral properties and photochemical parameters of spirobenzopyrans depend significantly on the nature of the substituent present in the defined part of the molecule, hence, the targeted variation of substituents’ nature allows to search directly for new photochromes with given photochemical properties and various stimulus-responsive structural elements.

Previously we have developed a new synthetic method for the key carbonyl precursor – 5’-formyl-6-nitrospiropyran derivative by direct formylation of 6-nitrospiropyran, in one step with 86 % yield under the Duff reaction conditions. The synthetic application potential of these precursors for targeted modification of the photochrome molecule at 5’-position has been significantly broadened by the application of well-known synthetic procedures (Wittig and Horner-Emmons group olefination; nucleophilic addition to the carbonyl group with a family of reagents, possessing an active methyl or methylene groups; reductive amination; [3+2] cycloaddition reaction and others).

We developed a number of new photochromic probes and labels on the 5’-substituted spirobenzopyran scaffold. All the types of labels were prepared by the effective synthetic approach which included the direct modification of spiropyran

molecule. The choice of the target reactive group or "molecular address" was determined by type and nature of the target structure.



The following conjugation procedure variants were used: a) covalent binding of the probe molecule with target binding site by self-recognition principle (bacteriorhodopsin); b) noncovalent binding of the probe molecule with target by the recognition of "molecular address" part, which was introduced in label (TxA_2 receptor inhibitors); c) covalent binding of the probe molecule with target by terminal selectively reactive group (HS-group for CdSe Quantum Dots); d) covalent binding of the probe molecule with target by terminal reactive.

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