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Photocaged Carbohydrates: Versatile Tools for Biotechnological Applications

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Abstract : Light absorbing chromophoric systems are important optogenetic tools for biotechnical and biophysical investigations. Processes such as fluorescence or photolysis can be triggered by light-absorption of chromophores. These play a central role in life science. Photocaged compounds belong to such chromophoric systems. The photo-labile protecting groups enable them to release biologically active substances with high temporal and spatial resolution. The properties of photocaged compounds are specified by the characteristics of the caging group as well as the characteristics of the linked effector molecule. In our research, we work with different types of photo-labile protecting groups and various effector molecules giving us possible access to a large library of caged compounds. As a function of the caged effector molecule, a nearly limitless number of biological systems can be directed. Our main interest focusses on photocaging carbohydrates (e.g. arabinose) and their derivatives as effector molecules. Based on these resulting photocaged compounds a precisely controlled photoinduced gene expression will give us access to studies of numerous biotechnological and synthetic biological applications. It could be shown, that the regulation of gene expression via light is possible with photocaged carbohydrates achieving a higher-order control over this processes. With the one-step cleavable photocaged carbohydrate, a homogeneous expression was achieved in comparison to free carbohydrates.

Keywords : bacterial gene expression, biotechnology, caged compounds, carbohydrates, optogenetics, photo-removable protecting group
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