Selective chemosensors in bioimaging applications

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Introduction

Molecules which spectral characteristic is dependent on properties of their environment are called molecular probes. Under biological conditions and the influence of enormous quantities of chemical compounds, many chemosensors may undergo both non-specific reactions and changes in their structure, triggered by local environment. Such complex conditions cause problems with selectivity and stability of different groups of fluorescent probes[1]. Fluorescent probes for bioimaging can be divided into two main groups. Sensor which fluorescence depend on microenvironment properties (such as pH, micropolarity, microviscosity) and sensors which spectral properties depend on highly selective biological reactions (especially enzymatic reactions)[2]. Based on the choosen method of the develompent of fluorescent probes, different moieties are needed to be built-in to the structure of a sensor. Probes which fluorescence characteristics depend on pH of the solution, must contain a specific moieties such as amines or hydroxyls[1]. This groups can reversibly change their structure, depending on acid-base equilibrium in a solution. This transformation provides changes in electronic structure of the whole molecule, also in fluorescence and absorption spectra. Spectral properties of fluorophores can depend also on spatial arrangement of moieties. Conformational changes can be obtained for example by placing a tertiary amine group with free electron pair conjuncted with aromatic structure in plenary, but disengaged after convolution. Fluorescent probes which spectra abilities depend on more specific structural changes, or peculiar chemical reactions, were much more complicated to design and obtain. Development of such structures requires knowledge of specific entities existing in biological environment. New structures exhibiting selective bondability to biological structures were most desirable not only as fluorescent probes, but also in different uses in medical sciences[1,3].

Results and Discussion

Purpose of research was assessment of the possibility of penetrating biological membranes and visualization of structures using compound derivatives of 2-amino-3-cyano-4,6-diphenyl-pyridine and their inclusion complexes with (2-Hydroxypropyl)-β-cyclodextrin. During research line of non-small-cell lung carcinoma (A549) have been used. The test compounds showed the ability to penetrate the cells and emit fluorescence. The test compounds are safe for cells and do not affect their physiological properties after 3 hours of incubation, and also after 24 hours.

Conclusion

In the view of the fact that biological systems are the most complicated of known environments, new fluorescent probes should be designed, investigated and developed on different levels – from common spectral measurements, through cell penetration, to cytotoxicity and pharmacokinethics. Despite great properties in synthetic conditions, most fluorophores were unsuitable for biological uses due to being prone to undergo side reaction or decomposing. Part of probes also shows influence on metabolism of investigated biostructures and due to this in those cases results of measurements are disrupted. Variety of parameters must be taken into consideration on every step of developing of new fluorescent sensors[2,3].

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