

# Fluorescence Spectroscopic Investigation of Various Photophysical and Dynamical Phenomena inside Biologically Relevant Environment

## Abstract

Fluorescence spectroscopy and time-resolved fluorescence are considered to be primary research tools in biochemistry and biophysics and it is now extensively used in the field of biotechnology, flow cytometry, medical diagnostics, DNA sequencing, forensics, genetic analysis etc. More importantly, this technique is highly sensitive and fluorescence imaging can reveal the localization and measurement of intracellular molecules even at the single molecular level.

Fluorescence measurement can provide information on a wide range of molecular processes, including the interactions of the solvent molecules with fluorophore, rotational diffusion of the biomolecules, conformational changes, and distances between sites on biomolecules, interactions of small ligand with fluorophore and binding interaction. Complex photoreactions observed in nature consist of all these phenomena, but in very ambiguous way. This ambiguity perhaps arises due to the presence of interfacial or confined reaction centers. The immediate cellular environment of the fluorophore imposes restrictions on its degrees of freedom. For basic understanding of such complex photoreactions under restricted environment, one should employ organized assemblies formed by lipids, surfactants, etc. that provides heterogeneous environment and have different polarity, viscosity, pH compared to bulk medium. These systems are considered as “heterogeneous” in the “microscopic” level. There are various types of confined media available depending upon the nature of constraints. Some of them are molecular aggregates formed in polar liquids (e.g. micelles) or nonpolar liquids (e.g. reverse micelles). There are also some cage like hosts like cyclodextrins or calixarenes which are soluble in many liquids. Such self assemblies mimics the extremely efficient chemical and biological processes that occurring in nature. Thus the study of different kinds of photophysical processes and their dynamics in such confined media could provide several useful informations on the chemical processes that occurring in nature.