GFP-like structures in the PDB – Natural Function & Cavity Effects

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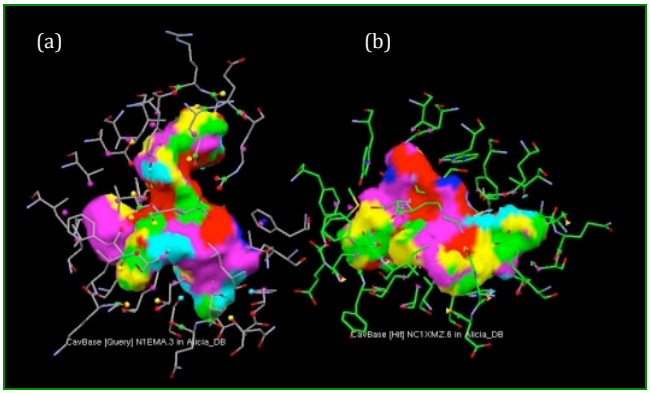
The RCSB protein databank contains 266 crystal structures of green fluorescent proteins (GFP) and GFP-like proteins. We have used the structures in the pdb to undertake the first systematic analysis of the GFP-like structures in order to examine the function of fluorescent proteins (FP) in nature and the effect of the protein matrix on deformations from planarity of the chromophore. In most GFP-like proteins, the protein matrix exerts a significant strain on planar chromophores, forcing most of them to adopt non-planar chromophores. These chromophoric deviations from planarity play an important role in determining the fluorescence quantum yield. The chemospatial characteristics of the chromophore cavity determine the isomerization state of the chromophore. Though there are many synthetic mutants with other aromatic residues that make up the tripeptidic chromophore, the central tyrosine is conserved at that position in all species. It is thus of paramount importance in the primary/ancestral function of GFP-like proteins; perhaps its original function may well be to aid in light induced electron transfer, which requires the phenolic group found in tyrosine.



(a) cis Chromophore *(b) trans Chromophore*