Detection of $^{1}L_{b}$ emission of tryptophan in proteins

The absorption band of indole at approximately 280 nm comprises two overlapping transitions to the $^{1}L_{a}$ and $^{1}L_{b}$ excited states. Upon excitation, $^{1}L_{a}$ emission is observed except when the indole is excited in the gas state or when dissolved in fluorinated hydrocarbon. We reported for the first time $^{1}L_{b}$ emission can also be observed for Trp embedded in an extremely rigid and apolar proteineous environment (1,2). Several mutants of domain 1 (D1) of the transhydrogenase protein from *Rhodospirillum rubrum*, show $^{1}L_{b}$ emission and also feature the bluest emission maximum reported for Trp in a protein ($\lambda_{\text{max}} = 304$ nm) (Figure 4). Quantum mechanical/molecular mechanical calculations indicated the $^{1}L_{a}$ state is minimally stabilized by the rigid protein matrix, surrounding the Trp, making $^{1}L_{b}$ the emitting state (1).

![Normalized emission spectra of apo-azurin (black) ($\lambda_{\text{max}} = 306.5$ nm), Wt dl (red) ($\lambda_{\text{max}} = 308.0$ nm) and dl.M97V (blue) ($\lambda_{\text{max}} = 303.5$ nm) in buffer, pH=7.4, at room temperature. Only mutant dl.M97V shows $^{1}L_{b}$ emission.](image)

Figure 4. Normalized emission spectra of apo-azurin (black) ($\lambda_{\text{max}} = 306.5$ nm), Wt dl (red) ($\lambda_{\text{max}} = 308.0$ nm) and dl.M97V (blue) ($\lambda_{\text{max}} = 303.5$ nm) in buffer, pH=7.4, at room temperature. Only mutant dl.M97V shows $^{1}L_{b}$ emission.

References
