Electronic Supporting Information (ESI)

Emissive Dual-Sensitized Bimetallic Eu_2^{III}-Bioprobe: Design Strategy, Biological Interactions, and Nucleoli Staining Studies

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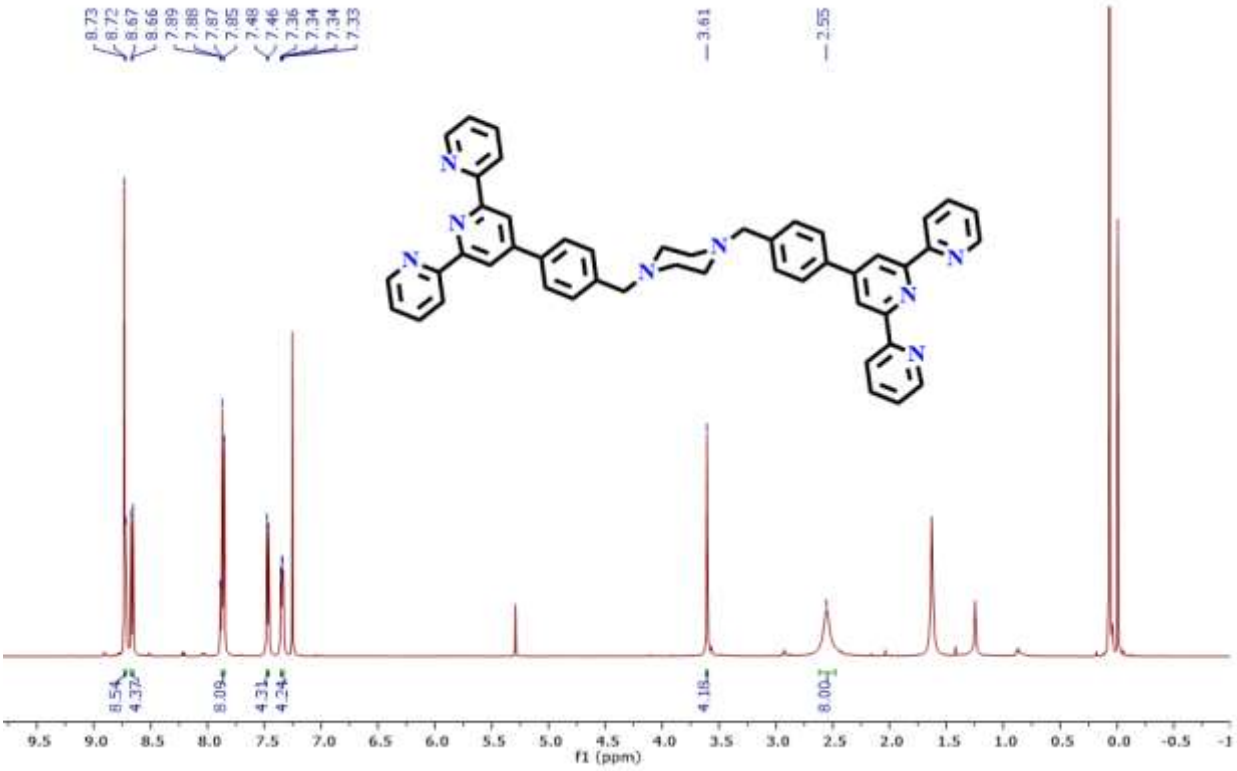

Figure S1: ^{1}H NMR (500 MHz, Chloroform-*d*) spectra of [μ-pz(tpy)$_2$] (**L**).

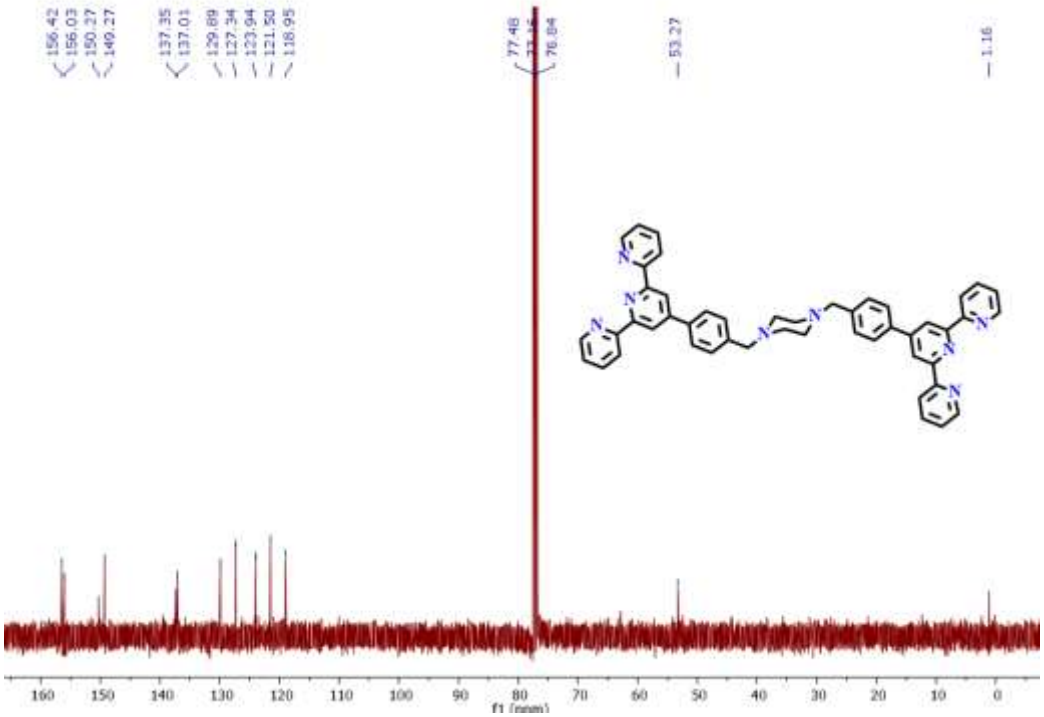

Figure S2: ^{13}C NMR spectra (101 MHz, Chloroform-*d*) spectra of [μ-pz(tpy)$_2$] (**L**).

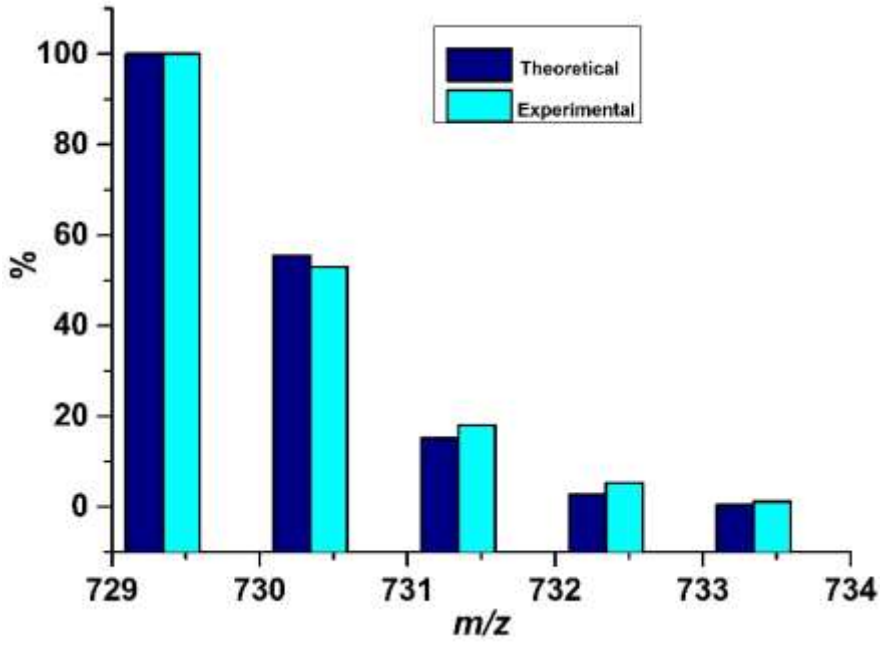

Figure S3: ESI-MS spectra of [μ-pz(tpy)$_2$] (**L**) showing their theoretical and experimental pattern.

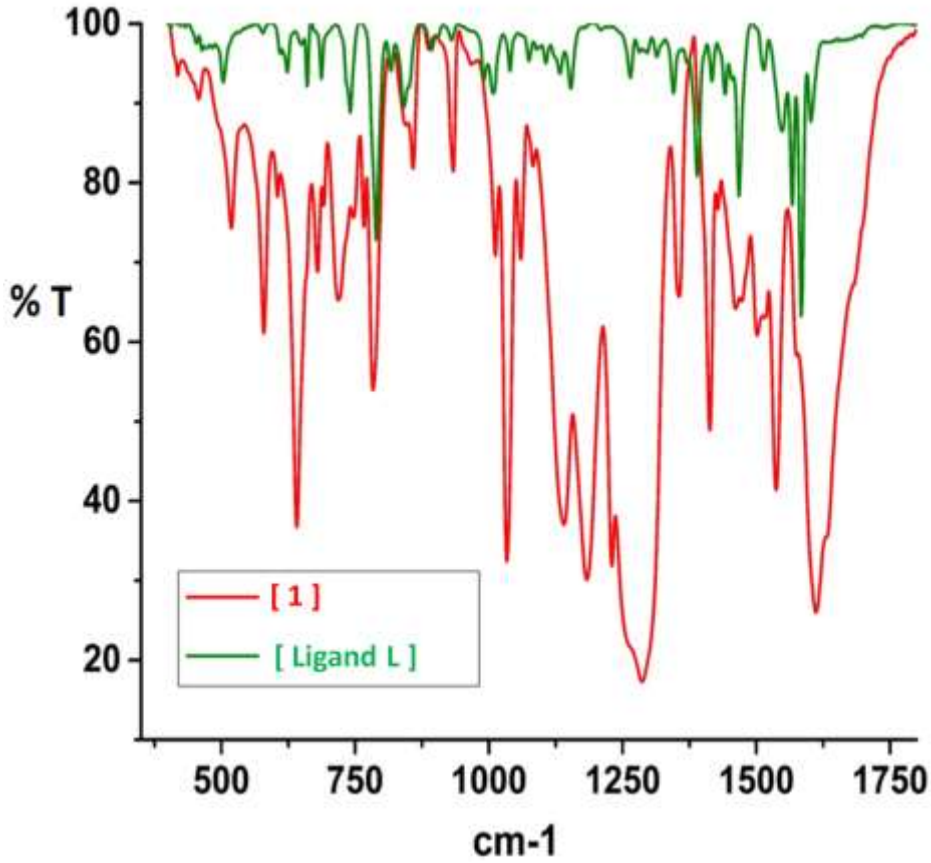

Figure S4: FT-IR spectra of Eu_2^{III}–bioprobe (**1**) and [μ-pz(tpy)$_2$] (**L**) were recorded in solid-state.

Table S1: Selected FT-IR frequencies (KBr disc) of **1** and bridging ligand **L**		
($\tilde{\upsilon}$ in cm-1)	[**1**]	[ligand L]
Eu-N	519	-
Eu-O	457	-
C-N	1183	1265
C=N	1428	1584
C=O	1611	-
C-F	1140	-

Table S2. Selected crystallographic data and structure refinement parameters of [μ-pz(tpy)$_2$] (**L**) ligand.

Parameter	[μ-pz(tpy)$_2$] ligand (**L**)
Empirical formula	$C_{48}H_{40}N_8$
Formula weight	728.88
Crystal system	Monoclinic
Space group	$P2_1/c$
a Å	15.167(8)
b Å	8.833(5)
c Å	15.473(10)
α (deg)	90.00
β (deg)	118.39(3)
γ (deg)	90.00
Volume Å^3	1823.6(19)
Z	2
D_x *(Mg m^{-3})*	1.327
μ *(mm^{-1})*	0.080
F(000)	768.0
T(K)	100(2)
θ range for data collection(deg)	2.766 to 28.874
Limiting indices	-20 ≤ h ≤ 20, -11 ≤ k ≤ 11, -20 ≤ l ≤ 20
Reflections collected	4511
Unique reflections	3180
R(int)	0.0573
T_{max}/T_{min}	0.746/0.690
Data/restraint/parameter	3180/0/253
GOF on F^2	1.033
R_1[a] and wR_2[b] [$I>2\sigma(I)$]	0.0552 and 0.1321
R_1 and wR_2 (all data)	0.0877 and 0.1550
Largest diff. peak and hole (e.A^{-3})	0.33 and -0.29
CCDC deposition number	2129638

[a] $R_1 = \Sigma||F_0| - |F_C||/\sum|F_0|$.

[b] $wR_2 = \{\sum[w(F_0^2 - F_C^2)]/\sum[w(F_0^2)^2]\}^{1/2}$

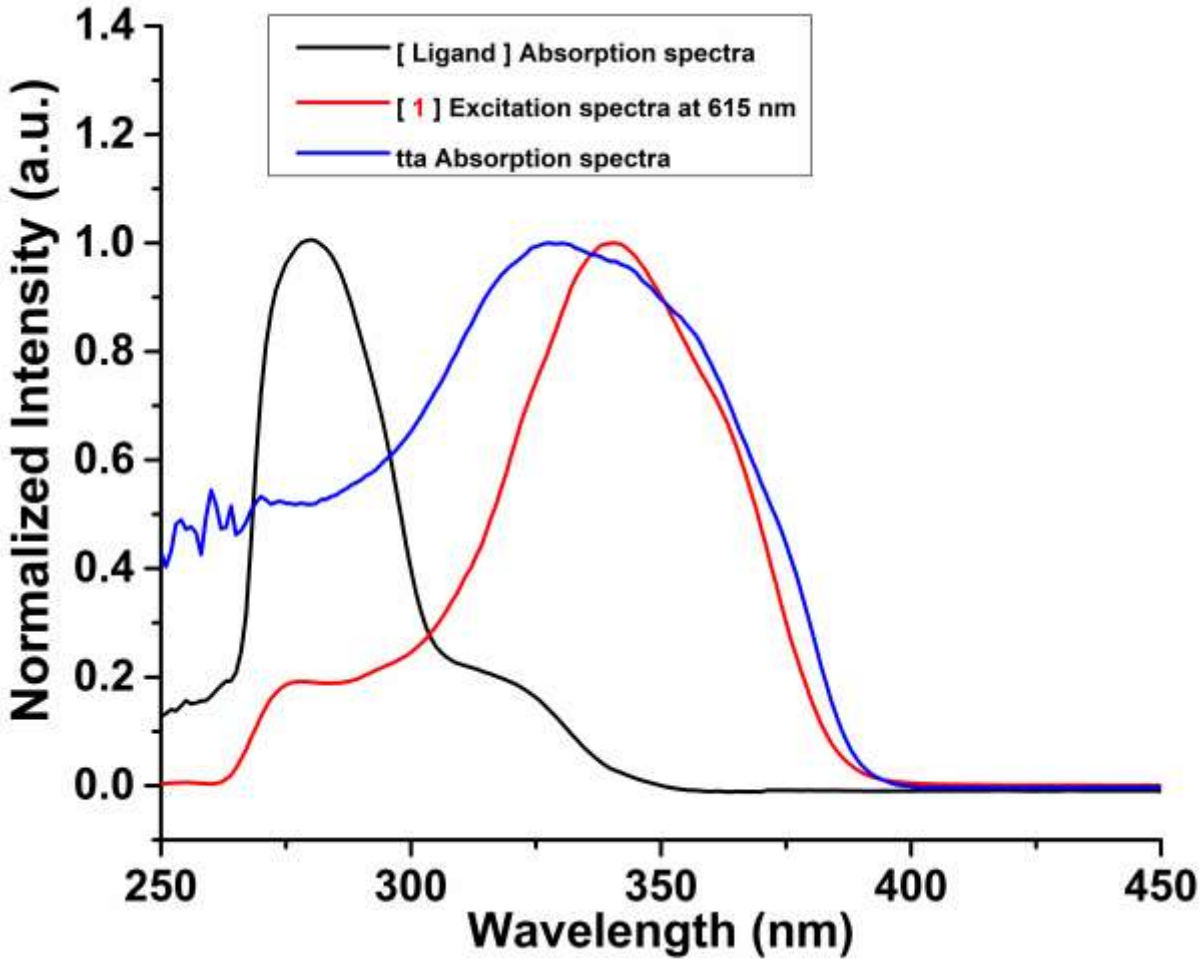

Figure S5: Absorption spectra of the bridging ligand **L** and tta along with the excitation spectra of Eu_2^{III}-bioprobe (**1**) in DMF. (T= 298K, [**1**] = 4 μM, [tta] = 20 μM, [ligand L] = 20 μM. Ex. and Em. slit = 5×5 nm)

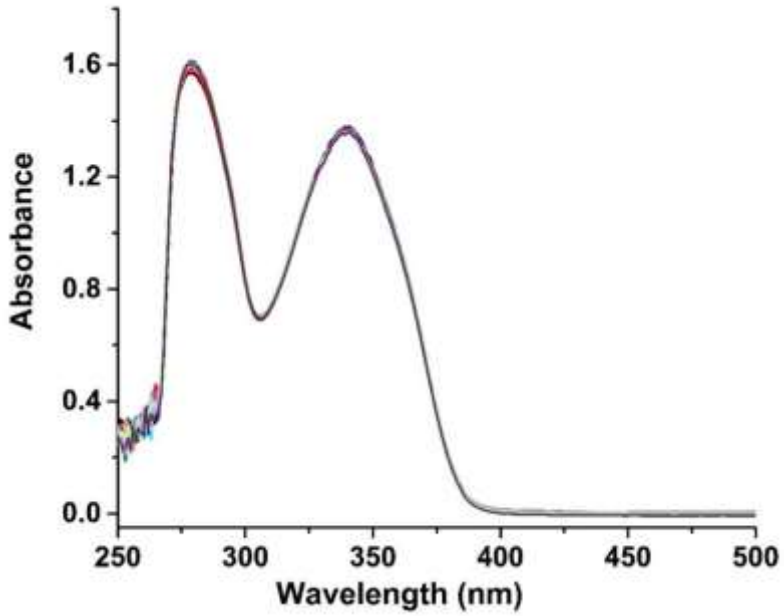

Figure S6: Time-dependent variations in absorption spectral of Eu_2^{III}-bioprobe (**1**) in DMF at 298 K for 4 h to access the stability of the respective complex in the solution-state. [**1**] = 20 μM.

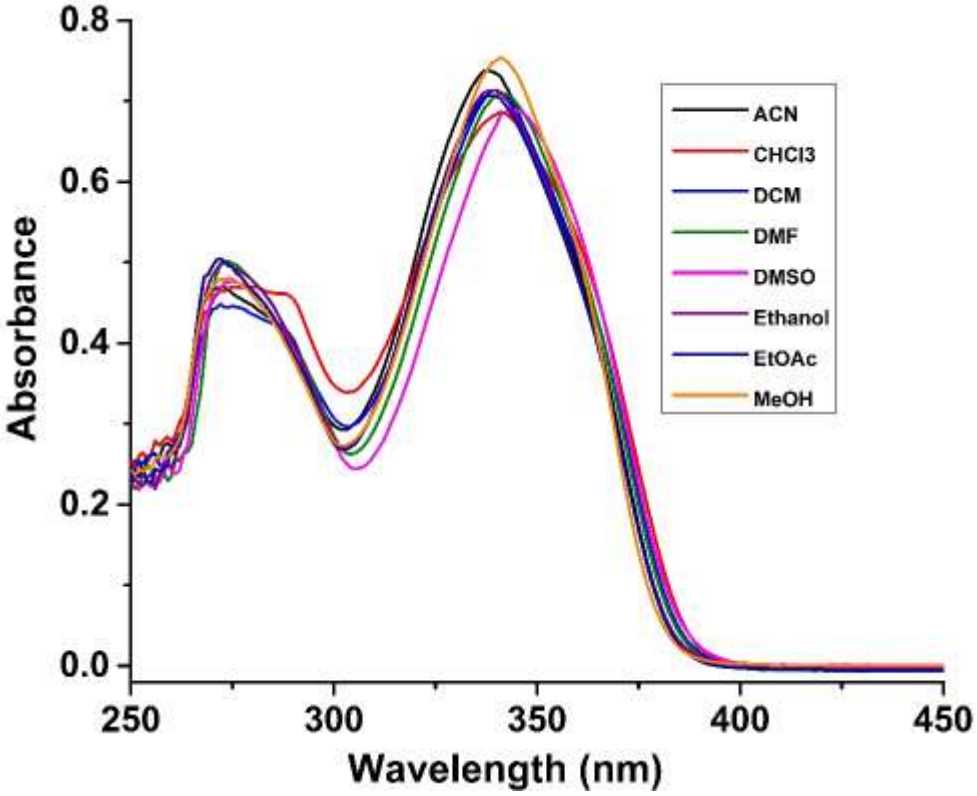

Figure S7: Solvent screening of Eu_2^{III}-bioprobe (**1**) in different solvents system using UV-Vis spectral study. (T = 298 K, [**1**] = 10 μM).

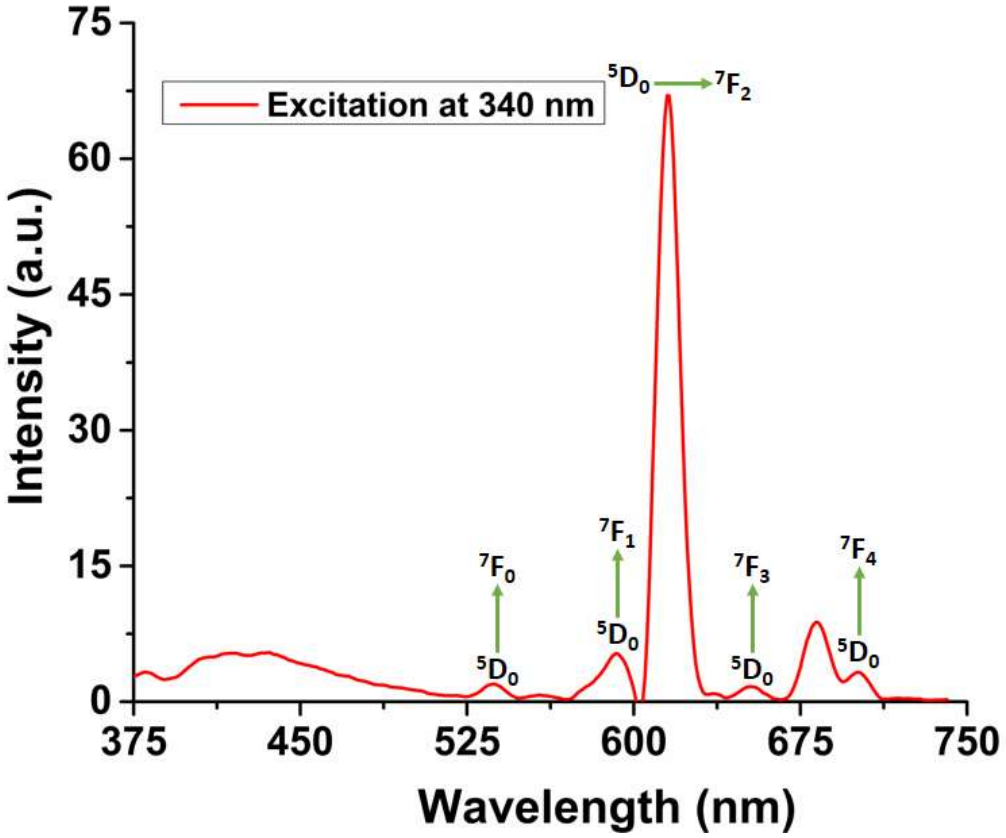

Figure S8: Steady state luminescence spectra of Eu_2^{III}-bioprobe **1** in DMF. (T= 298 K, λ_{ex} = 340 nm, **[1]** = 4 μM, Ex. and Em. slit = 5×5 nm).

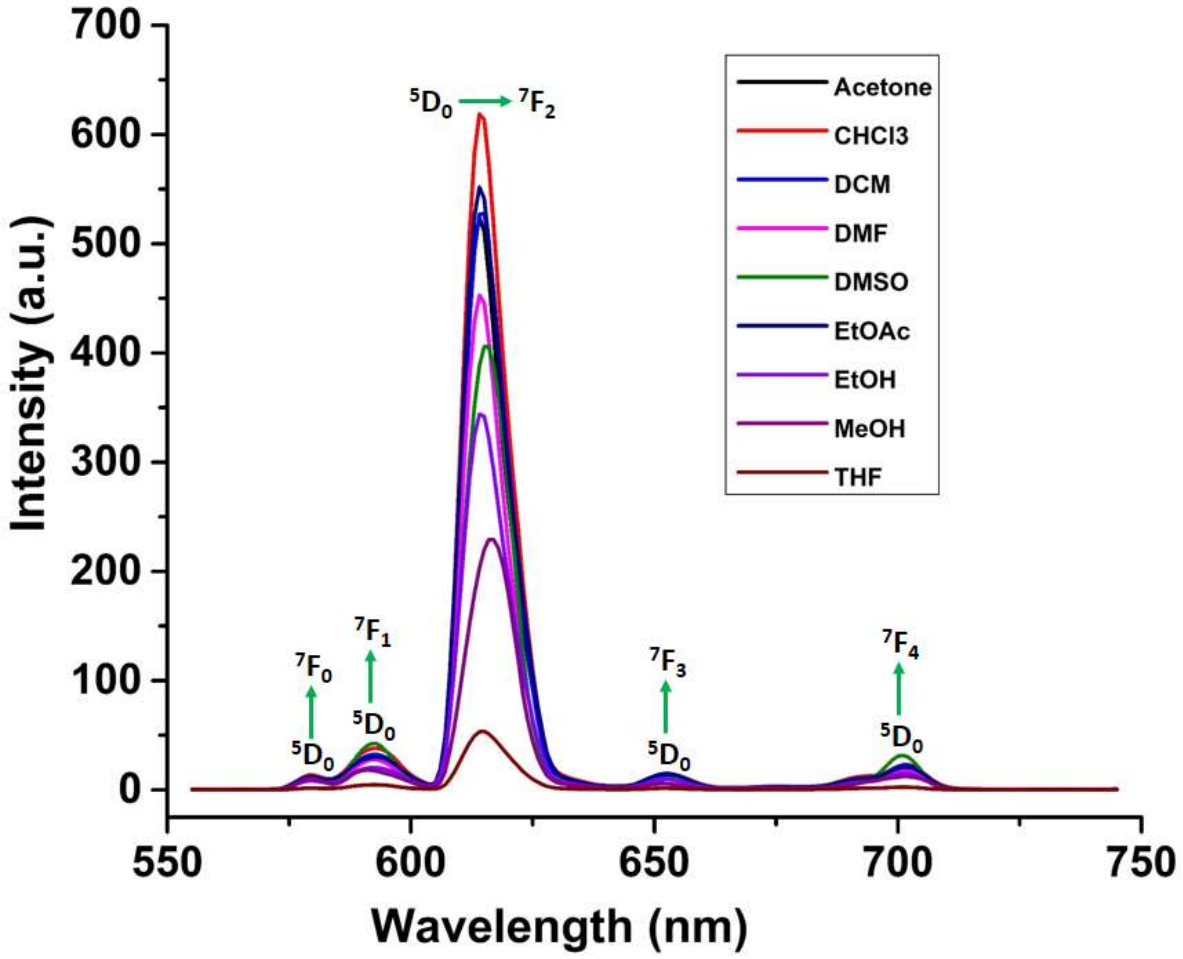

Figure S9: Time-resolved luminescence spectral variations of Eu_2^{III} -bioprobe (**1**) in the presence of different solvents showing the major changes in the spectral form (T= 298 K, λex = 340 nm, [**1**] = 8 μM, delay time = 0.2 (ms), and gate time = 0.2 (ms), Ex. and Em. slit= 2.5×5.0 respectively).

Table S3: Luminescence decay lifetime & rate constant of the complex in respective solvent system (T= 298K, λex = 340 nm, [**1**] = 8 μM, delay time = 0.2 (ms), Ex. and Em. slit= 2.5×2.5 respectively)

Parameters	**DMF**	**DMSO**	**MeOH**	**ACN**	**$CHCl_3$**	**EtOAc**	**THF**	**Acetone**
τ(ms)	0.502	0.586	0.399	0.517	0.519	0.294	0.249	0.417
κ (s^{-1})	2.0	1.7	2.5	1.9	1.9	3.4	3.4	2.4

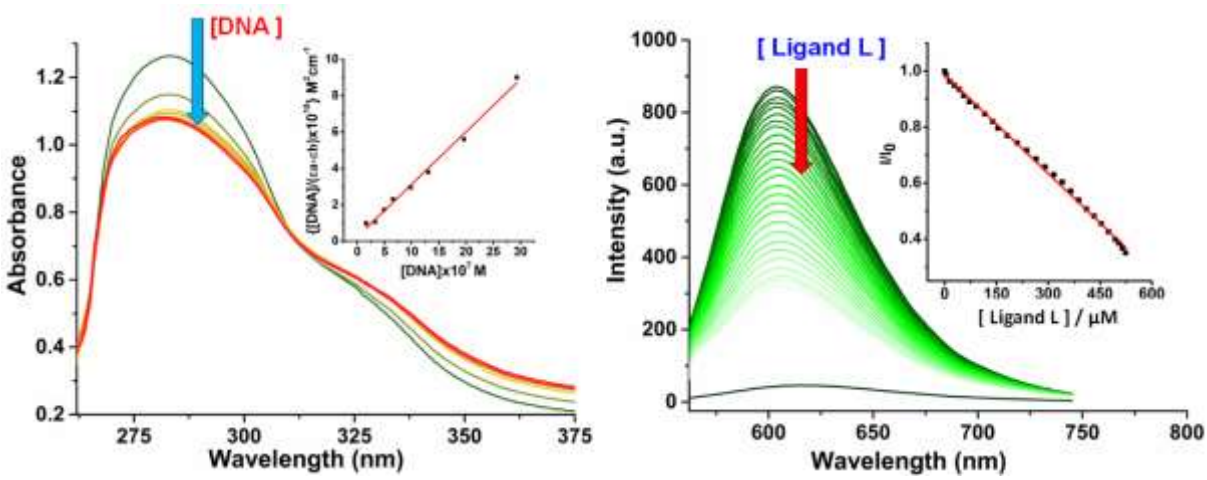

Figure S10. (**a**) Absorption spectral traces of [μ-pz(tpy)$_2$] (**L**) with gradually increasing of [CT-DNA] in 5.0 mM Tris buffer (pH 7.2). Inset: $\Delta\lambda_{af}/\Delta\lambda_{bf}$ vs. [DNA] plot for ligand **L** (**b**) Fluorescence emission spectral traces of EB-bound CT-DNA with increasing concentration of ligand **L** in 5 mM Tris-buffer at λ_{ex} = 546 nm, λem = 603 nm, [EB] = 55 μM. Inset: plot shows the relative emission of I/I_0 *vs.* [μ-pz(tpy)$_2$] (**L**).

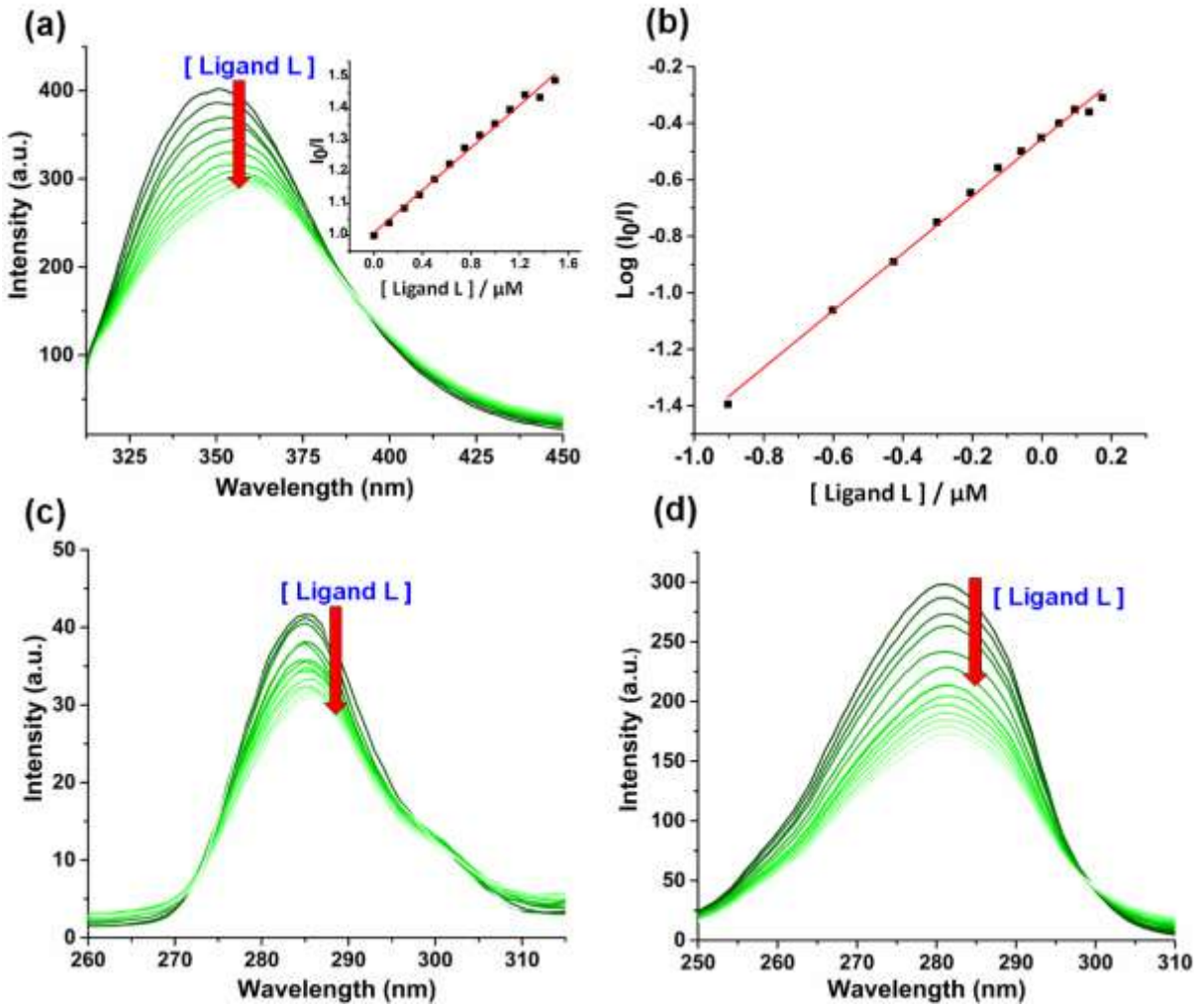

Figure S11. (**a**) The effect of the addition of [ligand **L**] in BSA solution in 5 mM Tris buffer (pH 7.2) at 298 K. The inset plot the plot of I_0/I *vs.* [Ligand **L**], λex = 295 nm, λem= 345 nm, [BSA] = 2 μM. (**b**). Modified Stern-Volmer plot of log $[(I_0 - I)/I]$ *vs.* log [Ligand **L**] for determining the binding constant (*K*), quenching rate constant (k_q), and the number of binding sites (n) for BSA to the [ligand **L**] interaction. Emission profile of synchronous emission spectra of BSA showing the quenching of emission after gradual addition of [ligand **L**] (**c**) with $\Delta\lambda$ = 15 nm and (**d**) with $\Delta\lambda$ = 60 nm in Tris–HCl buffer (pH 7.2) at 298 K.