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## **Electronic Supplementary Information**

## Fluorescent gold-cluster containing new three-component system for white light emission through a cascade of energy transfer

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## Instrumentation

**UV-Vis spectroscopic analysis:** We used a Cary Varian 50 scan UV-Vis optical spectrometer equipped with 'Cary Win' UV software to elucidate the optical properties of solutions.

**MALDI-TOF MS analysis:** MALDI-TOF MS analyses were performed by using Applied Biosystems MALDI -TOF/TOF Analyzer.

**Fluorescence spectroscopy:** Fluorescence studies of the solution in a sealed cuvette were carried out in a Perkin Elmer LS55 Fluorescence Spectrometer instrument.

Actual quantum yields have been generally measured relative to an optically dilute standard fluorophore solution that exhibits a well-known quantum yield ( $\phi_s$ ). The quantum yield of an unknown fluorophore ( $\phi_u$ ) has been determined using the parker-rees method.

 $\phi_{\rm u} = (A_{\rm s}F_{\rm u}n_{\rm u}^2 / A_{\rm u}F_{\rm s}n_{\rm s}^2) \times \phi_{\rm s}$ 

Where,  $A_u$  denotes the absorbance of the unknown sample at the excitation wavelength,  $F_u$  represents the total integrated fluorescence intensity for the unknown sample, when it is excited at the same excitation wavelength of the unknown sample,  $F_s$  is the integrated fluorescence intensity of the reference sample, when it is excited at the same excitation wavelength of the known sample. Refractive index of solvent in which the unknown and the standard samples have been prepared, are given by  $n_u$ and  $n_s$  respectively. To determine the quantum yield of gold clusters, stillbene was taken as the reference. Alexa fluor 488 and Alexa fluor 647 were taken as the reference for the determination of quantum yield of Riboflavin and Rhodamine B respectively.

**Time-Correlated Single Photon Counting (TCSPC) study:** TCSPC measurements were performed by means of Horiba Jobin Yvon IBH having MCP PMT Hamamatsu R3809 detector instrument and all data were fitted using Data Station v2.3. NANO-LED source was used for excitation of samples at 340 nm, 375 nm and LASER source for excitation of samples at 440 nm.

**Transmission Electron Microscopy:** Transmission Electron Microscopic (TEM) experiments were carried out to investigate Au clusters. TEM images were recorded on a JEM 2100 electron microscope at an accelerating voltage of 200 KV. STEM-HAADF image and EDS line scanning were recorded on a JEM 2100F electron microscope.



**Fig. S1:** Comparison between UV-Vis absorption spectrum and fluorescence excitation spectrum for gold cluster-Riboflavin (B2) pair of donor-acceptor.



**Fig. S2:** Comparison between UV-Vis absorption spectrum and fluorescence excitation spectrum for Riboflavin (B2)-Rhodamine B pair of donor-acceptor.



**Fig. S3:** (a) Transmission electron microscopic image of blue emitting gold quantum cluster after the addition of Riboflavin showing the stability of the gold clusters. (b) Fluorescence emission spectra of blue emitting gold-cluster, Riboflavin and gold cluster-Riboflavin mixture ( $\lambda ex = 346$ nm). These results show that there is a peak at around 825 nm for the as-prepared gold clusters and during energy transfer process from gold cluster to Riboflavin, only the intensity of the peak at 425 nm decreases with an increase in intensity of the peak at 530 nm. The peak at 825 nm remains unchanged, that does not contribute anything to the energy transfer process. The inset figure shows the specific enlarged view of the emission peak at 825 nm.

Table S1: Details of TCSPC study and average fluorescence lifetime

								A1=[B1/	A2=[B2/	A3=[B3/	<t></t>	
NAME	T1	T2	T3	B1	B2	B3	SumB	SumB]	SumB]	SumB]	(ns)	$\chi^2$
Gold clusters	0.57	2.7	4.77	0.006	0.015	0.018	0.0387	0.15504	0.37985	0.46512	3.33	1.04
Riboflavin	0.43	3.98	5.78	-0.03	0.124	0.018	0.112	-0.26786	1.10714	0.16071	5.22	1.016
Rhodamine B	0.24	1.37	3.42	0.014	0.125	0.006	0.145	0.09655	0.86207	0.04138	1.34	1.074
Au clusters +												
Riboflavin	0.44	2.26	6.11	0.021	0.025	0.005	0.051	0.41177	0.49020	0.09804	1.89	1.124
Riboflavin +												
Rhodamine B	0.4	2.72	4.5	0.027	0.035	0.072	0.134	0.20150	0.26120	0.53731	3.21	1.016

Where  $\langle T \rangle = A1T1 + A2T2 + A3T3$  and  $\chi^2$  is the accuracy factor.