

## Supporting information

### Graphene quantum dots based “switch-on” nanosensors for intracellular cytokine monitoring

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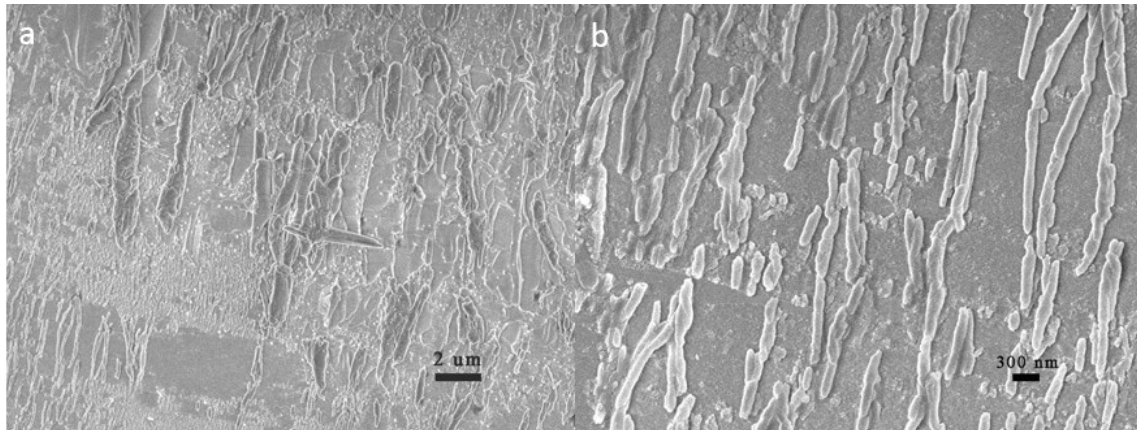
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##### 1. Preparation of Graphene Quantum Dots (GQDs)

The GQDs were prepared at Yang's Group (Jilin University, China). 300 mg graphite powder (or nano-graphite powder, graphene oxide, highly-oriented pyrolytic graphite, single/multi-walled carbon nanotubes or fullerene) was dispersed in mixed acid (containing concentrated HNO<sub>3</sub> 20 mL and concentrated H<sub>2</sub>SO<sub>4</sub> 60 mL). The solution was then put into a 100 mL round-bottomed flask, and stirred at 120 °C for 10 h. After the reaction, the solution was diluted by pouring it into 300 mL deionized water, followed by neutralizing the acid with Na<sub>2</sub>CO<sub>3</sub>. The solution was concentrated and then put into the refrigerator to remove the

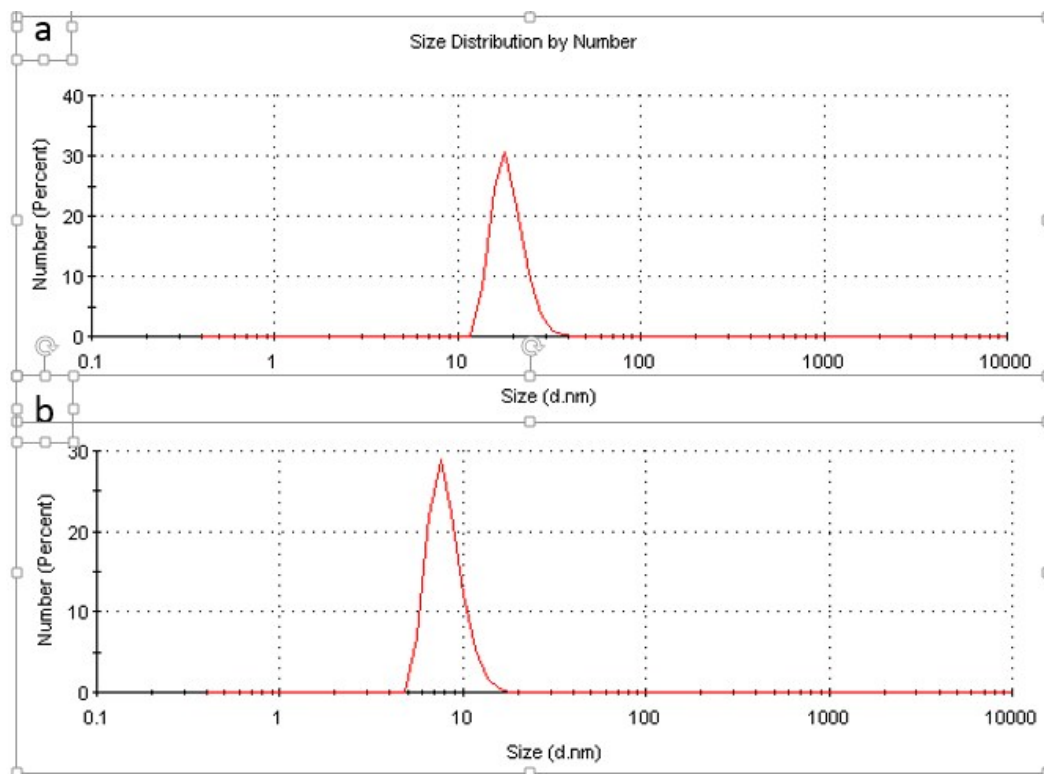
Na<sub>2</sub>SO<sub>4</sub> and NaNO<sub>3</sub> salt from the solution as much as possible (this was repeated three times). Aggregation in the solution was then excluded using a filter membrane of 220 nm. Finally, a 3500 dialysis bag was used to further purify the sample.

## 2. SEM images of the conjugates of Ap-GQDs and Ep-GQDs



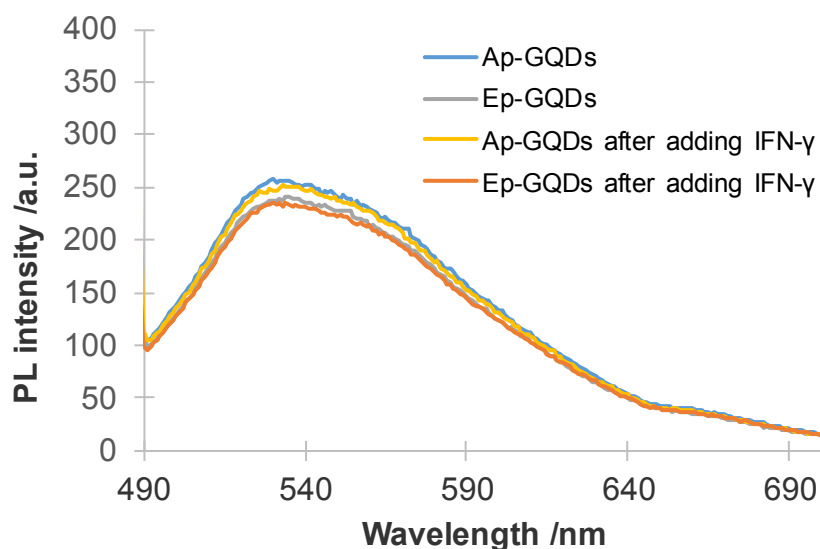
**Fig. S1** SEM images for the conjugates of Ap-GQDs and Ep-GQDs at different magnifications.

## 3. The particle size distribution as determined by DLS for the nanosensor (conjugates of Ap-GQDs and Ep-GQDs) before and after addition of INF-γ.



**Fig. S2** The particle size distribution as determined by DLS for the nanosensor (conjugates of Ap-GQDs and Ep-GQDs) before (a) and after (b) addition of INF- $\gamma$ .

**4. The life time GQDs and the modified GQDs at 488 nm excitation and probed at different wavelengths.**



**Fig. S3** Photoluminescence studies of Ep-GQDs, Ap-GQDs, and Ep-GQDs and Ap-GQDs before and after adding 50  $\mu\text{g mL}^{-1}$  IFN- $\gamma$ .

**5. The fluorescence parameters of Ep-GQDs, Ap-GQDs and the conjugation of Ep-GQDs and Ap-GQDs.**

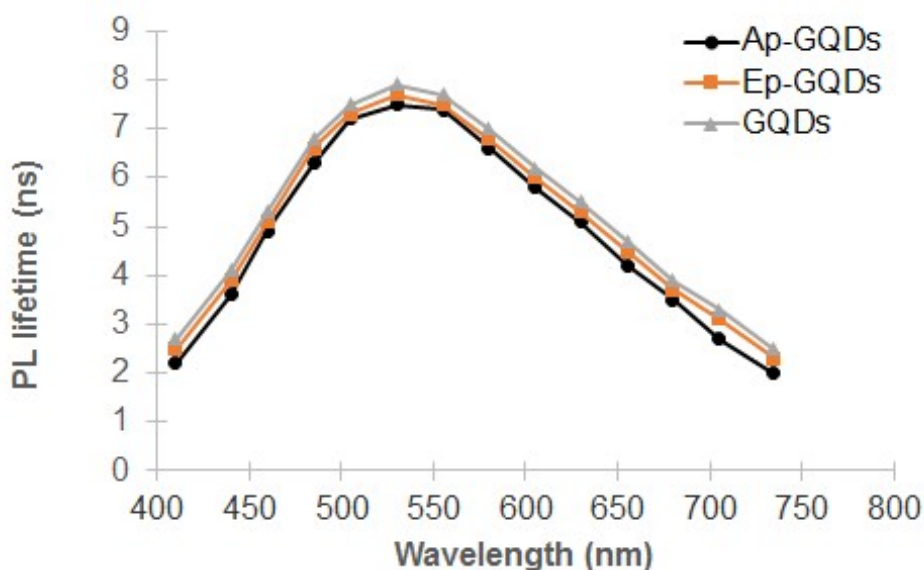
**Table S1** The fluorescence parameters of GQDs, Ep-GQDs, Ap-GQDs and the conjugation of Ep-GQDs and Ap-GQDs.

	$\lambda_{\text{ex}}^a$ (nm)	$\lambda_{\text{em}}^b$ (nm)	$\phi_c^c$ (%)	$\tau_d^d$ (ns)
GQDs	480	529	5.7%	7.4
Ap-GQDs	480	534	5.8%	7.5
Ep-GQDs	480	534	5.8%	7.5
Conjugates of Ap-GQDs and Ep-GQDs	480	531	0.3%	0.2

<sup>a</sup> Optimal excitation wavelength. <sup>b</sup> Optimal emission wavelength.

<sup>c</sup> Quantum yield determined by absolute quantum yield measurement. <sup>d</sup> lifetime.

**6. The life time of GQDs, Ep-GQDs, and Ap-GQDs**



**Fig. S4** The average PL lifetime of GQDs, Ep-GQDs, and Ap-GQDs at different probed wavelength (375 nm excitation, the concentration of the related GQDs is 0.5 mg/mL).

## 7. The comparison of sensing performance between different fluorescence biosensors for detection of IFN- $\gamma$

**Table S2** Comparison of the performance of representative biosensors for detection of IFN- $\gamma$  in last 5 years.

Biosensors	Performance		
	Detection signal	Linear range	LOD
GQDs based aptamer nanosensors (Sensor in this work)	Fluorescence	5-100 pg mL <sup>-1</sup>	2 pg mL <sup>-1</sup>
G-quadruplex-selective iridium(III) complex based assay <sup>1</sup>	Luminescence	0.4-300 ng mL <sup>-1</sup>	2 ng mL <sup>-1</sup>
Aptamer modified gold electrodes <sup>2</sup>	Electrochemistry	1-100 ng mL <sup>-1</sup>	10 ng mL <sup>-1</sup>
Aptamer modified gold electrodes <sup>3</sup>	Electrochemistry	1-500 ng mL <sup>-1</sup>	1.3 ng mL <sup>-1</sup>
Aptamer modified gold electrode <sup>4</sup>	Electrochemistry	0.2-200 ng mL <sup>-1</sup>	0.01 ng mL <sup>-1</sup>
Gold nanoparticles modified optical fibre <sup>5</sup>	Surface Plasmon Resonance	2-500 pg mL <sup>-1</sup>	1 pg mL <sup>-1</sup>

## References

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