

Literature Report

VIP *Fluorescent Probes* *Very Important Paper*

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Sterically Shielded Heptamethine Cyanine Dyes for Bioconjugation and High Performance Near-Infrared Fluorescence Imaging

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Reporter: Chen Jie

2020-05-28

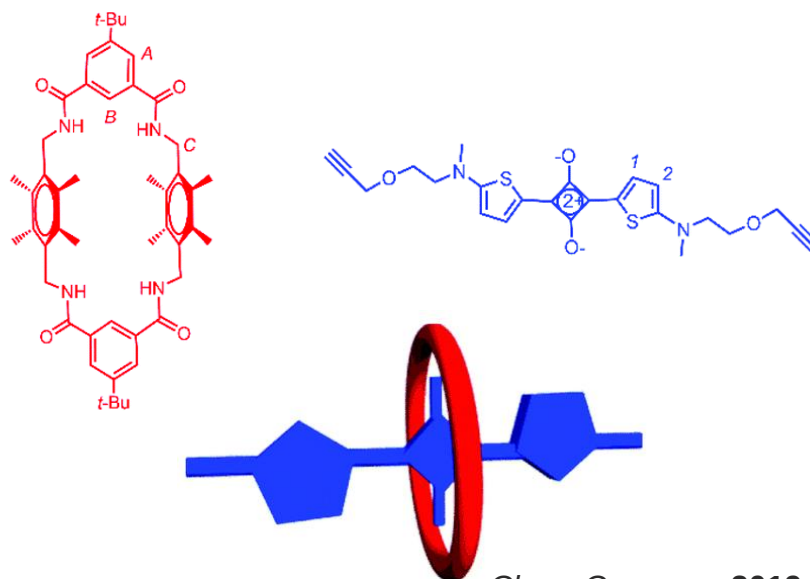
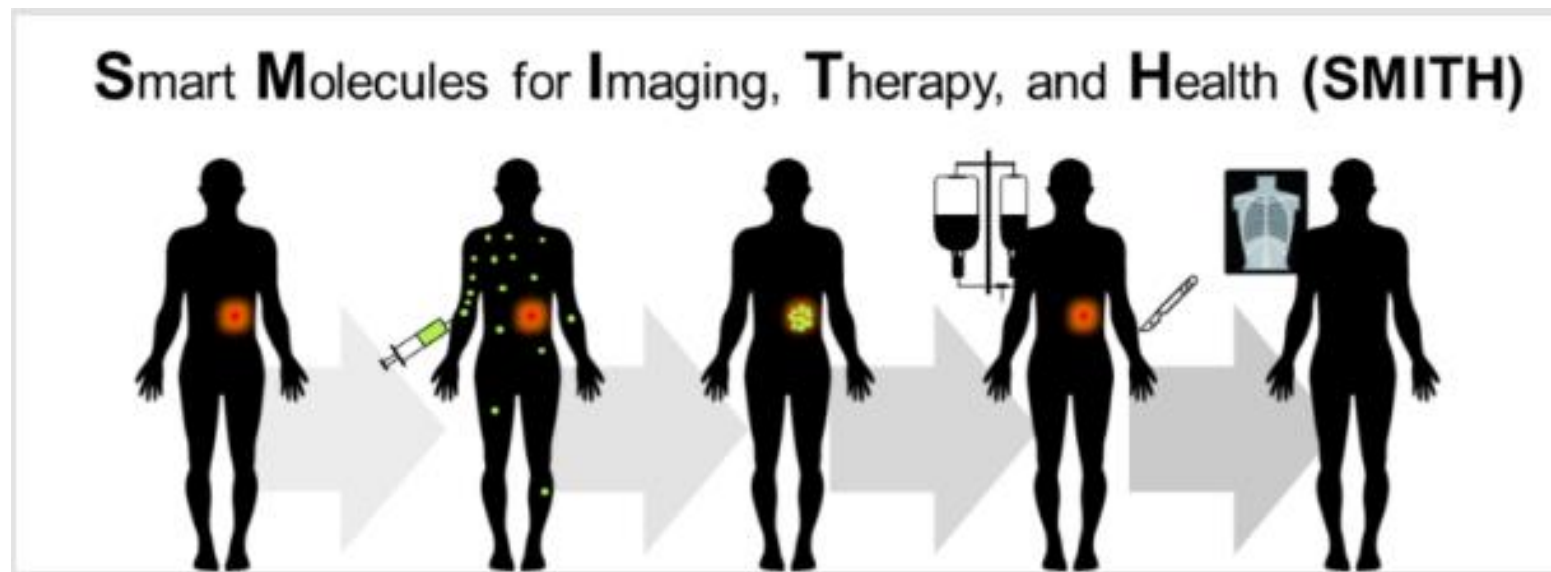


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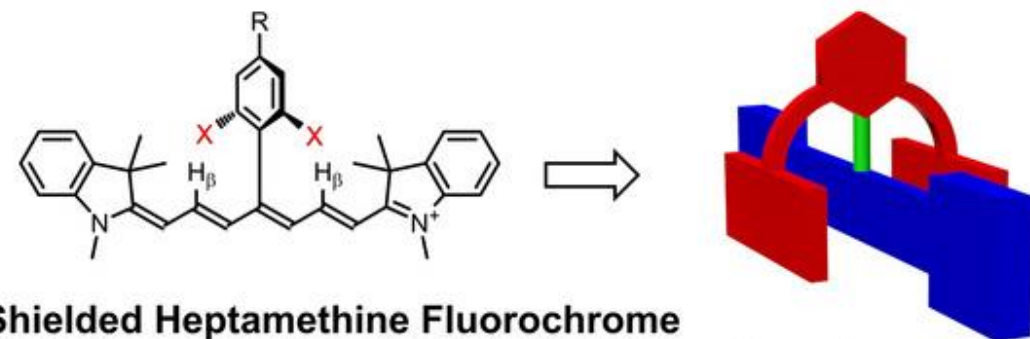
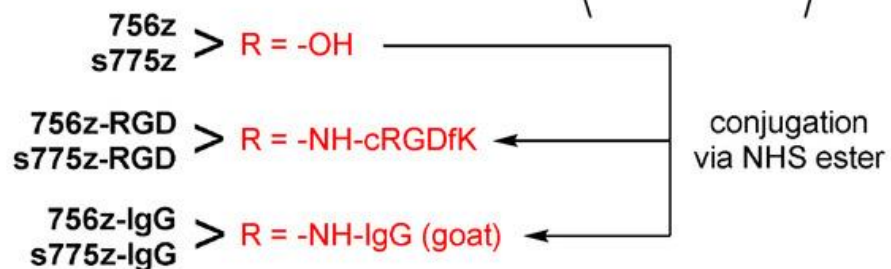
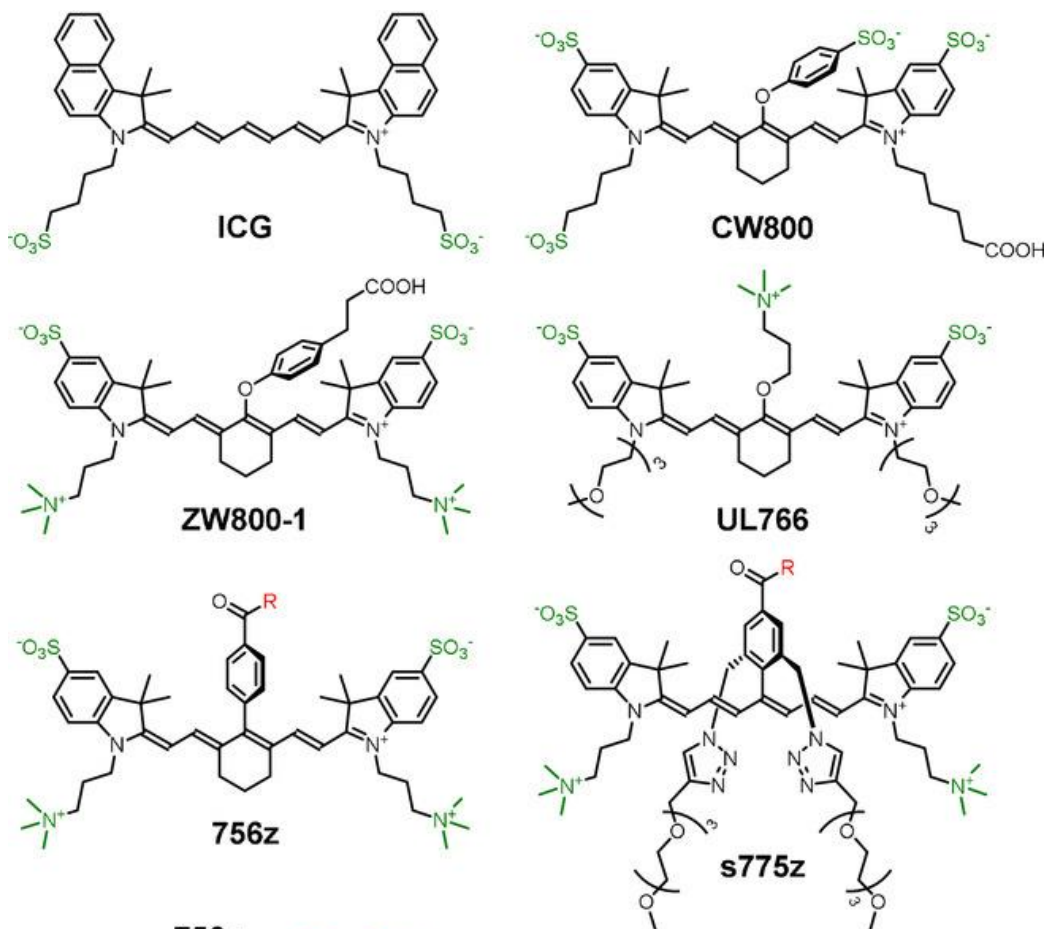


- Fundamental Studies
- Disease Diagnostics
- Drug Delivery



Structural modification of cyanine

- non-specific interaction
- chemical stability
- photostability

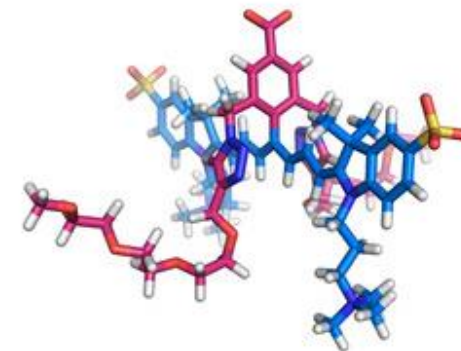


Shielded Heptamethine Fluorochrome

Central cyclohexyl ring is absent and the polyene is protected by two arms (X) directed over each face, which prevents: dye self-aggregation, interaction or reaction with other molecules.

Molecular Model of s775z

The red-colored shielding arms, with triethyleneglycol chains, project over both faces of the polyene section of the blue-colored fluorochrome.





Spectral Properties

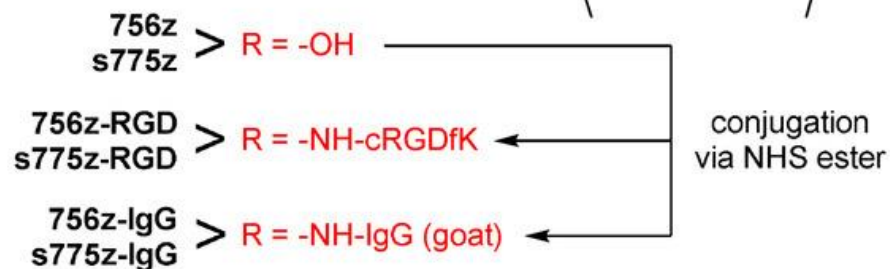
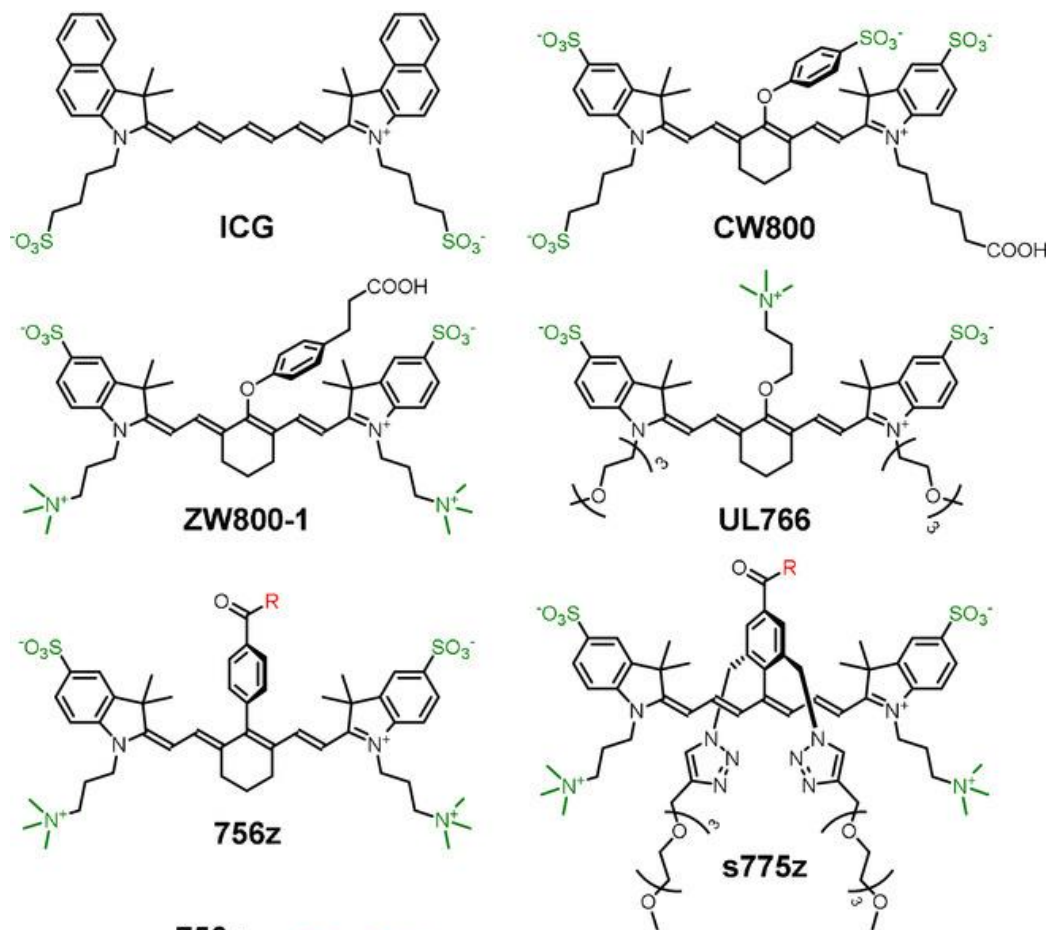


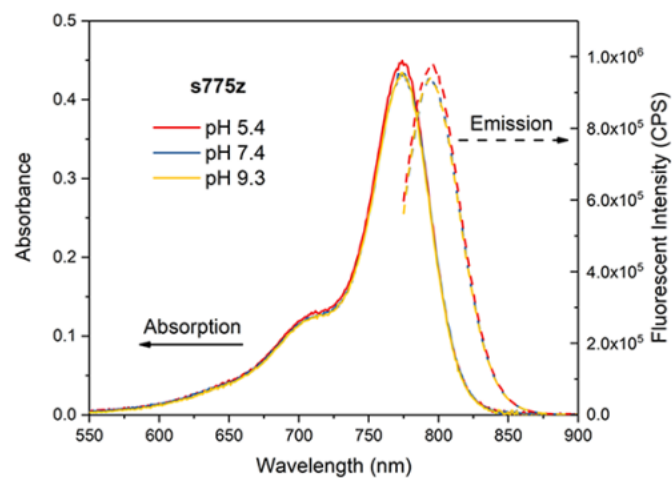
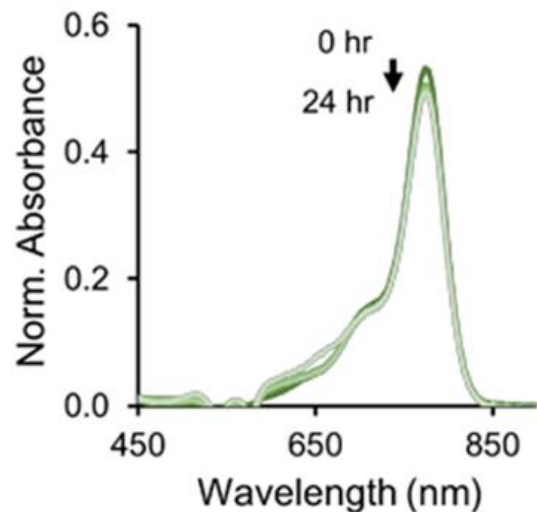
Table 1: Spectral and reactivity properties of dyes in PBS (pH 7.4).^[a]

	756z	s775z	UL766 ^[g]	ZW800-1 ^[g]	CW800 ^[g]
$\lambda_{\text{max}}^{\text{abs}}$ [nm]	681 (a) ^[f] 756 (m) ^[f]	775	766	770	775
$\lambda_{\text{max}}^{\text{em}}$ [nm]	773	794	789	788	796
ϵ [M ⁻¹ cm ⁻¹]	99 000	201 000	229 000	246 000	242 000
(R ²) ^[b]	(0.942) ^[b]	(0.999)			
QY ^[c]	0.097	0.090	0.095	0.135	0.090
Brightness ^[d]	9600	18 000	22 000	33 000	22 000
Stable to nucleophiles ^[e]	Yes	Yes	Yes	No	No

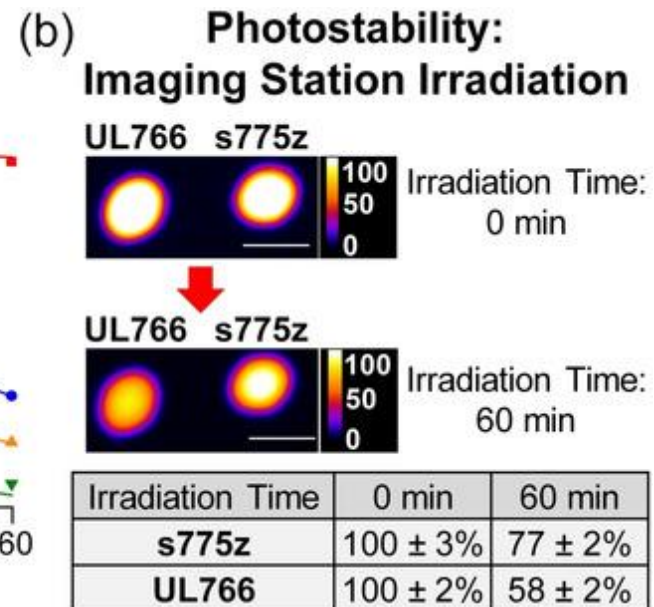
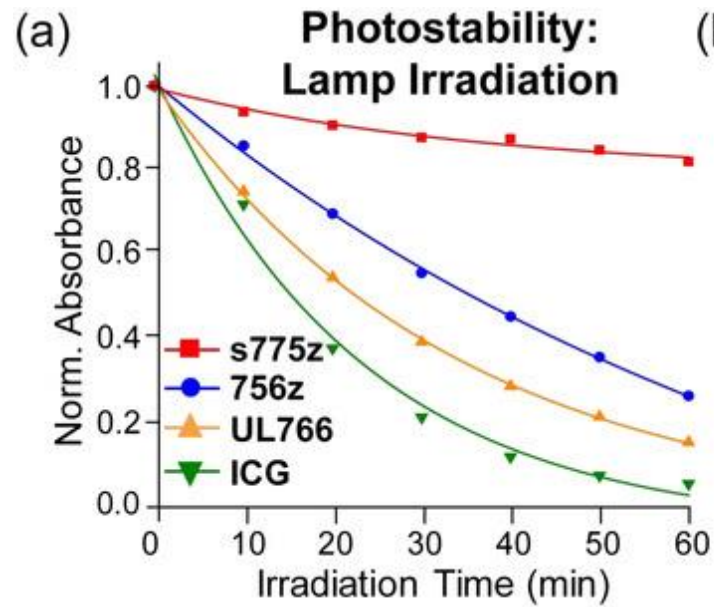
[a] Concentration range of dyes is 0–5 μM . All measurements were made at room temperature. [b] Molar absorptivity of monomer band, nonlinear relationship with concentration due to dye self-aggregation. [c] Quantum yield relative to UL766, error is $\pm 10\%$. [d] ϵ , QY, error is $\pm 15\%$. [e] Meso linkage is not cleaved by biological amines or thiols.^[10,12] [f] a = aggregate; m = monomer. [g] Spectral data from reference.^[10,23]

Stability

➤ Chemical stability



➤ Photostability

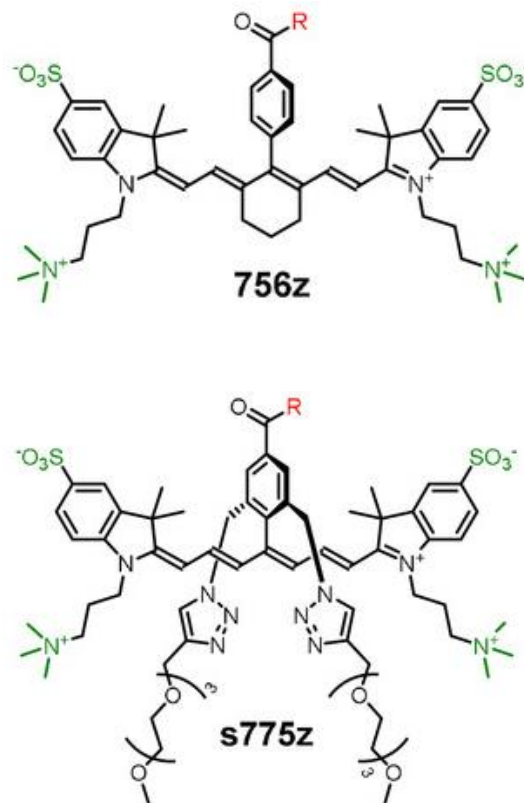


R = -OH

降低甲川链电子云密度
减少了 $^1\text{O}_2$ 对甲川链的进攻
降低了 $^1\text{O}_2$ 反应中间体稳定性



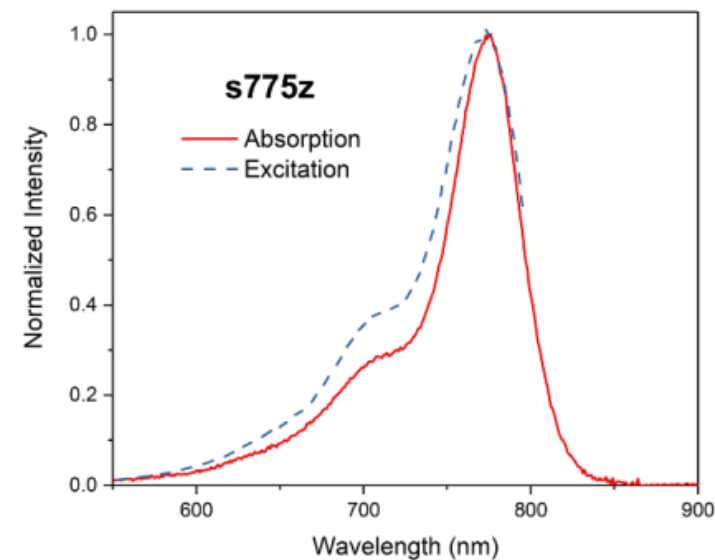
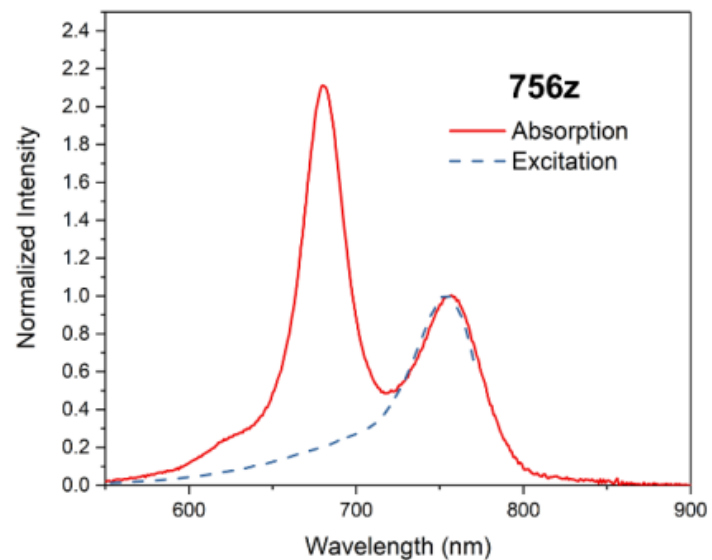
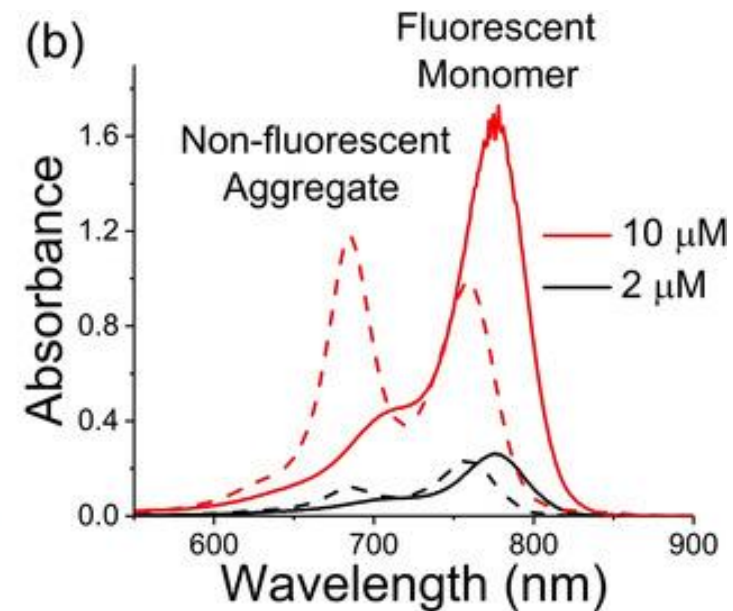
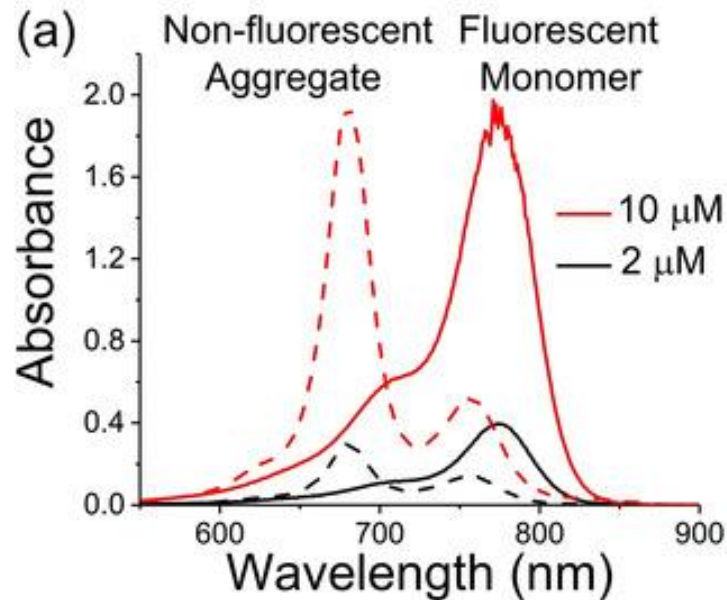
Aggregation of Dyes



756z > **R = -OH**
s775z

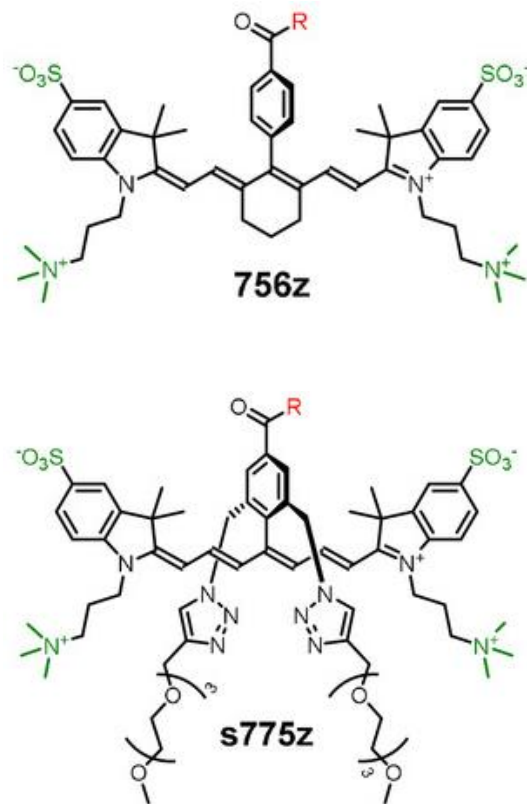
756z-RGD > **R = -NH-cRGDfK**
s775z-RGD

756z-IgG > **R = -NH-IgG (goat)**
s775z-IgG





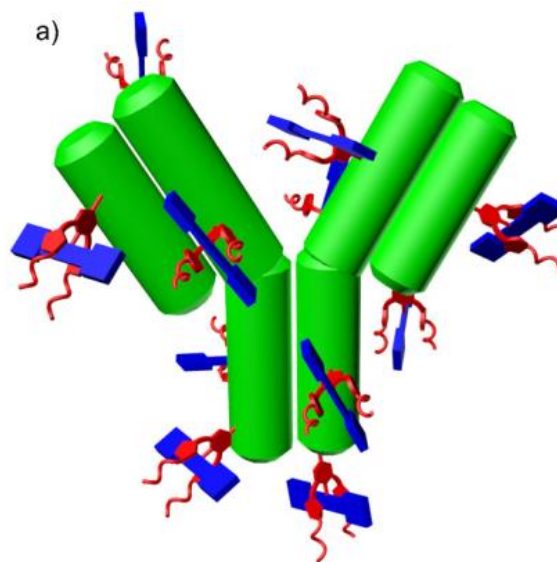
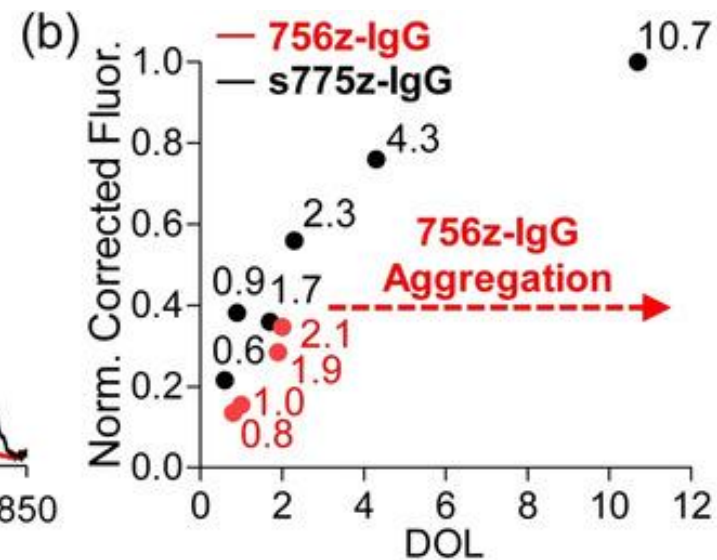
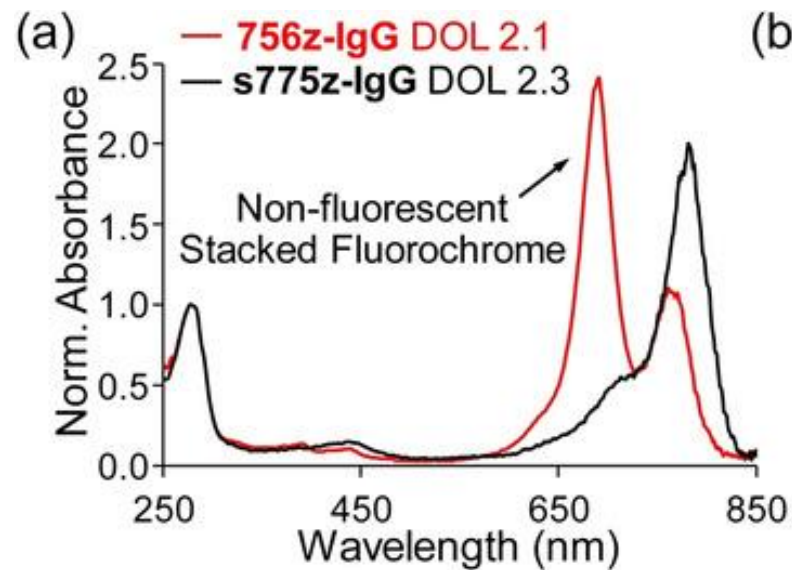
Aggregation of Dyes



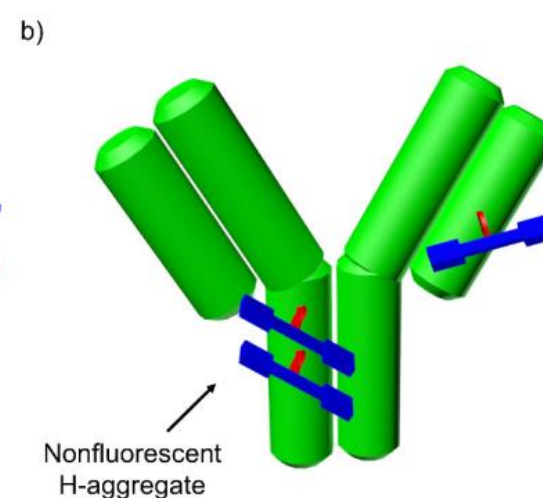
756z > s775z $R = -OH$

756z-RGD > s775z-RGD $R = -NH-cRGDFK$

756z-IgG > s775z-IgG $R = -NH-IgG \text{ (goat)}$



s775z-IgG DOL=11

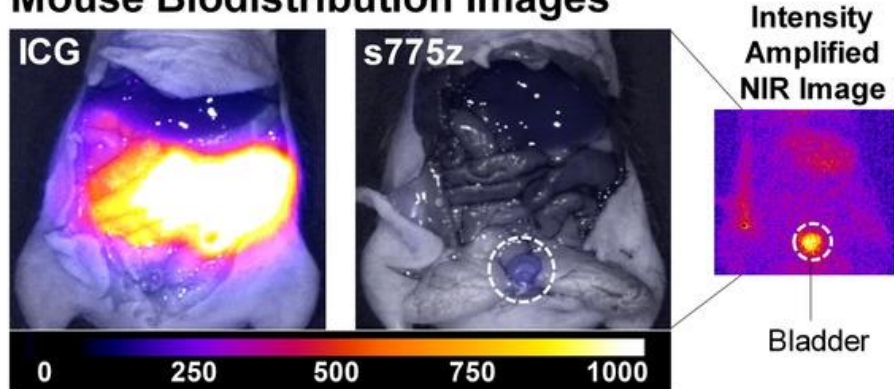


756z-IgG DOL=3

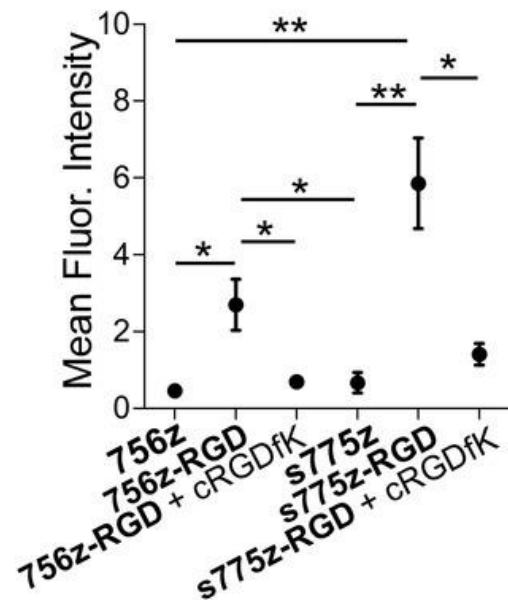


Biological Imaging

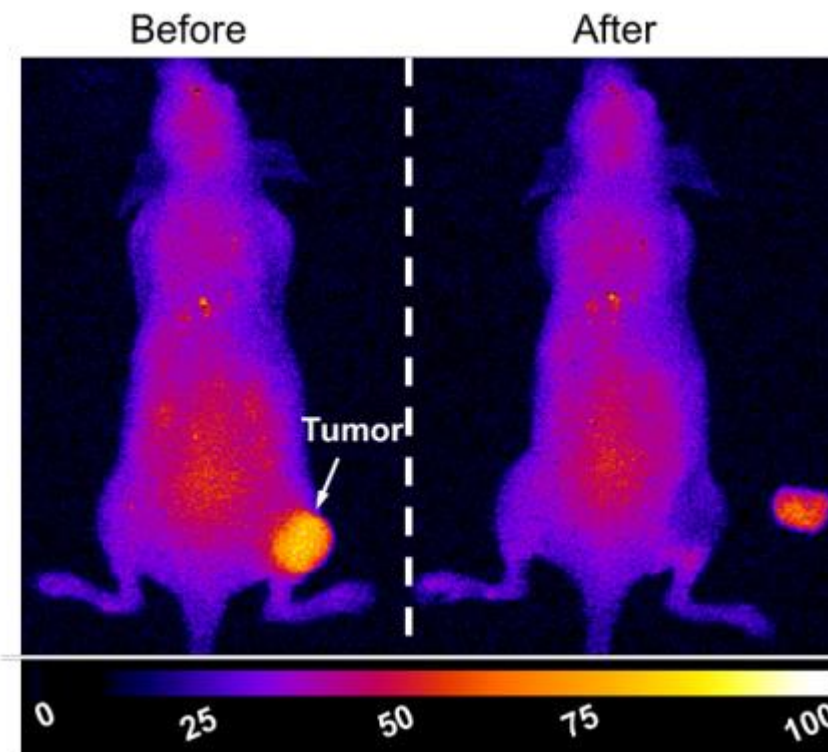
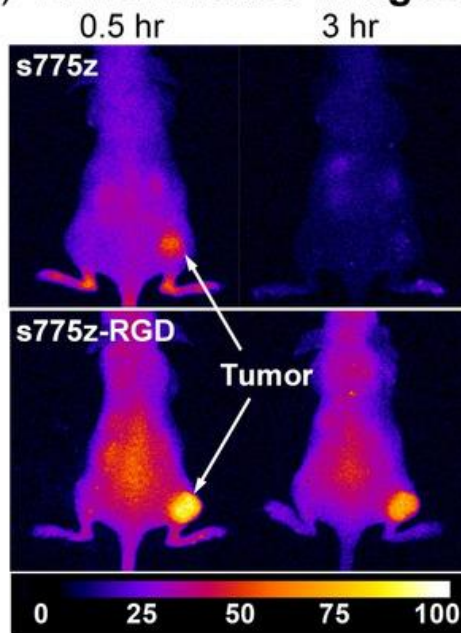
(a) Mouse Biodistribution Images



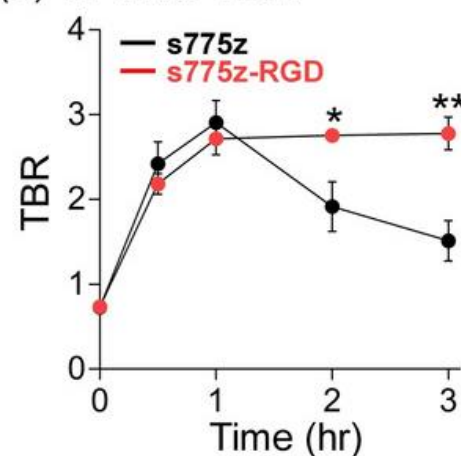
(b) Cell Microscopy



(c) Tumor Mouse Images



(d) In Vivo TBR



(e) Excised Tumors

