Supporting Information for

Strategies for designing organic fluorescent probes for biological imaging of reactive carbonyl species

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Table S1. Interpretation of professional terms in this review

PET	Photoinduced Electron Transfer
ICT	Intramolecular Charge Transfer
BODIPY	Dipyrromethene Boron Difluoride
RCS	Reactive carbonyl species
FA	formaldehyde
GO	glyoxal
MGO	methylglyoxal
CO	carbon monoxide
MDA	malondialdehyde
CORM-2	Dichloro Tri-Carbonyl Ruthenium (II) Dimer, a CO release reagent
CORM-3	(OC-6-44)-Tricarbonylchloro(glycinato)ruthenium, a CO release reagent

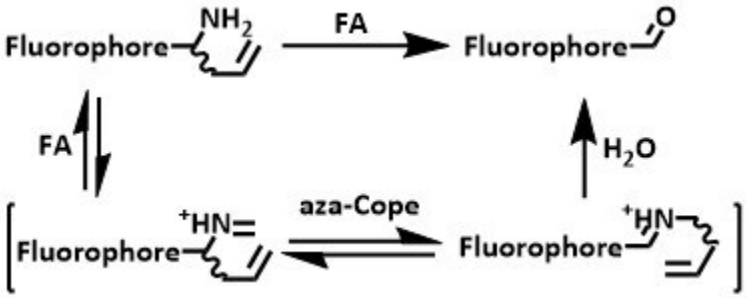

Fig. S1. The FA fluorescent probes based on the aza-Cope rearrangement mechanism

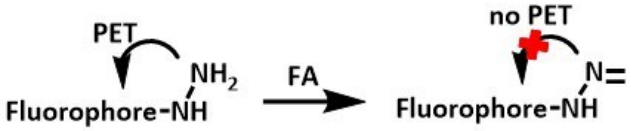

Fig. S2. The FA fluorescent probes based on the methylenehydrazine mechanism

Fig. S3. The FA fluorescent probes based on the formimine mechanism

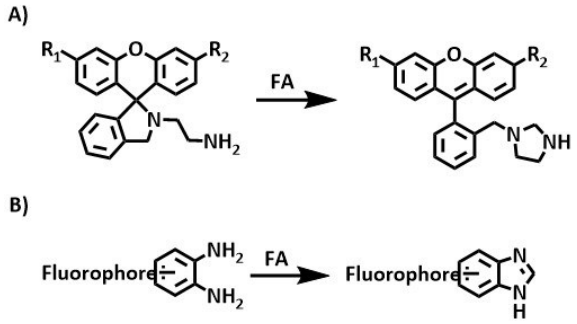

Fig. S4. The FA fluorescent probes based on the other mechanisms

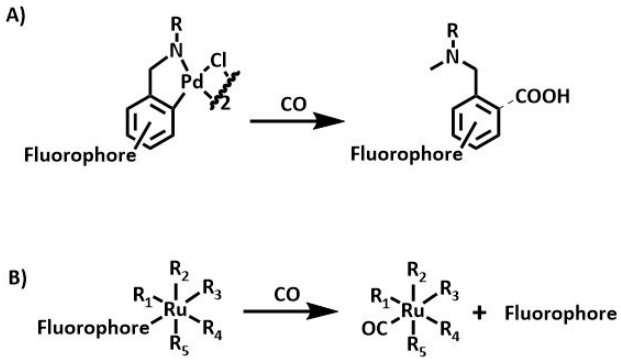

Fig. S5. The CO fluorescence probe based on the carbonylation reaction mechanism

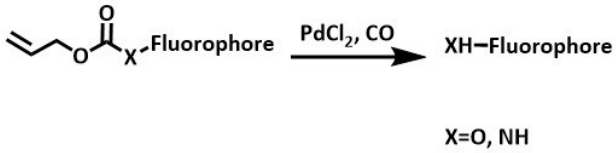

Fig. S6. The CO fluorescence probes based on the Tsuji-Trost reaction

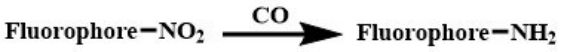

Fig. S7. The CO fluorescence probe based on the nitro reduction reaction mechanism

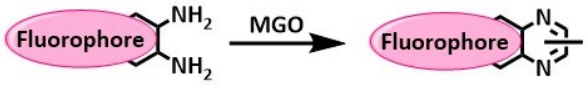

Fig. S8. The design strategy of fluorescent probe for MGO.

Fig. S9. The design strategy of fluorescent probe for MDA.

Table S2. Properties of the developed fluorescent FA probes

Probes	Response mechanism	Type	λ_{em}/nm	Detection limit/μM	Imaging application
FAP-1	Aza-Cope rearrangement	Turn-on	662	5.0	Endogenous FA in Hela cells
FP1		Turn-on	649	10	Endogenous FA in HEK293T cell
RFFP		Ratiometric	359/451	18.7	Exogenous FA in HeLa cells
Lyso-TPFP		Turn-on	506	3.0	*in situ* track FA levels in tissues
Naph-FA		Turn-on	544	220	Endogenous FA in the living cells
PBD-FA		Turn-on	563	0.0435	Endogenous FA in the living cells
FAP385	2-aza-Cope rearrangement and*β*-elimination linker	Turn-on	495	/	Endogenous FA in the living cells
FAP498		Turn-on	510	/	Endogenous FA in the living cells
FAP555		Turn-on	570	/	Endogenous FA in the living cells
FAP573		Turn-on	580	/	Endogenous FA in the living cells

Na-FA	Methylenehydrazine	Turn-on	543	0.71	endogenous FA in living liver and lung tissue
Na-FA-Lyso		Turn-on	543	5.02	Endogenous FA in the living cells
Na-FA-ER		Turn-on	543	5.24	Endogenous FA in the living cells
MT-FA		Turn-on	539	4.9	Imaging FA in living liver tissue
Na-FA-Cancer		Turn-on	541	/	Imaging FA in cancer and normal tissues
PFM		Turn-on	500	0.4	Imaging FA in mice
BOD-NH_2	Formimine	Turn-off	515	0.05	Imaging FA in organs
R6-FA	Other mechanisms	Turn-on	560	0.77	Detecting FA in the dried mushrooms and the indoor FA gas
L		Turn-off	642	8.3	Imaging of FA and MGO in living cells.

Table S3. Properties of the developed fluorescent CO probes

Probes	Response mechanism	Type	λ_{em}/nm	Detection limit/μM	Imaging application
COP-1	Carbonylation reaction mechanism	Turn-on	507	/	Imaging CO in the cells
CC-CO		Turn-on	477	0.65	Imaging exogenous in mouse liver tissue
ACP-1		Turn-on	512	/	Imaging exogenous CO in living cells
ACP-2		Turn-on	512	0.72	Imaging exogenous CO in living cells
1-AC		Turn-on	660	0.05	Imaging endogenous CO in zebrafish embryos and mouse tissues
Ru-CO		Turn-on	500	/	Imaging CO in the cells
PCO-1	Tsuji-Trost reaction	Turn-on	460	0.008	Imaging CO in the cells
Naph-CO		Ratiometric	545	0.058	Imaging CO in the cells
HD-CO		Turn-on	710	0.003	Image CO in both living cells and animals
LysoFP-NO_2	Nitro reduction reaction	Turn-on	525	0.6	Imaging CO in the cells

Table S4. Properties of the developed fluorescent MGO probes

Probes	Type	λ_{em}/nm	Detection limit/μM	Imaging application
[Ru(bpy)$_2$(DA-phen)](PF$_6$)$_2$	Turn-on	605	0.78	Imaging exogenous MGO in the *D.magna*
[Ir(ppy)$_2$(DA-phen)](PF$_6$)	Turn-on	600	1.15	Imaging exogenous MGO in the *D.magna*
NP	Turn-on	555	1.47	Imaging MGO in living cells, tissues and zebrafish

Table S5. Properties of the developed fluorescent MDA probes

Probes	Type	λ_{em}/nm	Detection limit/μM	Imaging application
MDAP-1	Turn-on	553	0.6	Imaging MDA in living cells
Mito-FMP	Turn-on	554	0.45	Monitoring endogenous MDA in HeLa cells and onion tissue