

Energy Transfer in Aminonaphthalimide–BODIPY Dyads upon One and Two-photons excitation



Y. Vida, F. Nájera, E. Pérez-Inestrosa, D. Collado
Department of Organic Chemistry, University of Málaga

P. Remón, U. Pischel
Department of Organic Chemistry, University of Huelva

Lisbon
June 29th to July 2nd
2014

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4JIF
Jornadas Ibéricas
de Fotoquímica

Bioimaging

Fluorescent labelling

One photon fluorescence
microscopy

Two photon fluorescence
microscopy



Leica SP5 AOBS MP

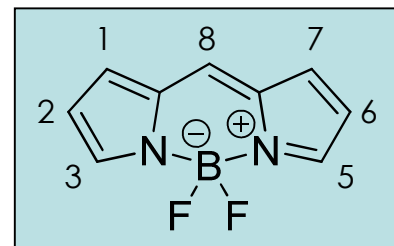
**Laser scanning confocal and
multiphoton microscopy imaging**

bionand
equipment

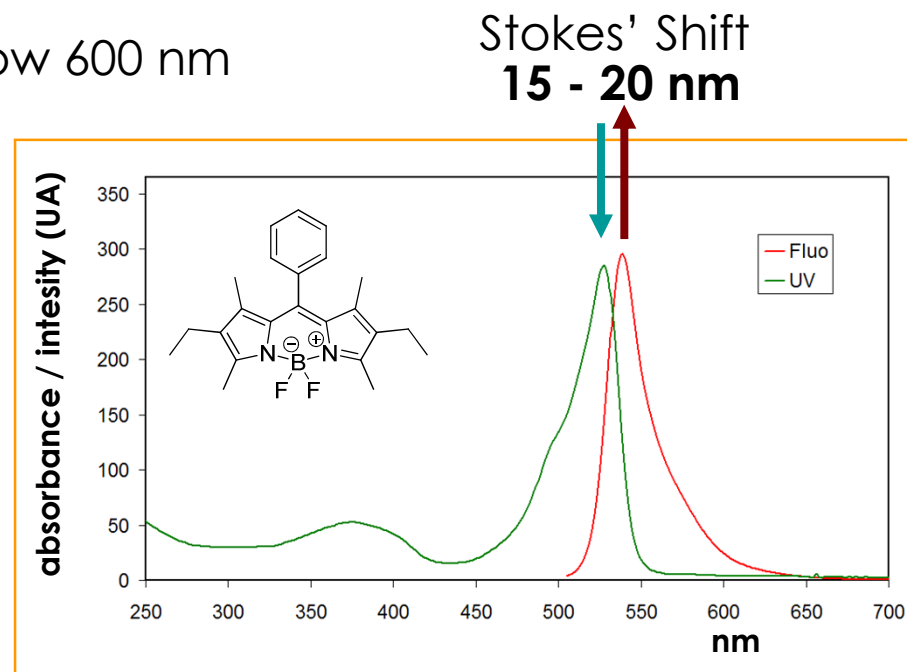


Centro Andaluz de
Nanomedicina & Biotecnología

Difluoro-boradiazaindacene **BODIPY**

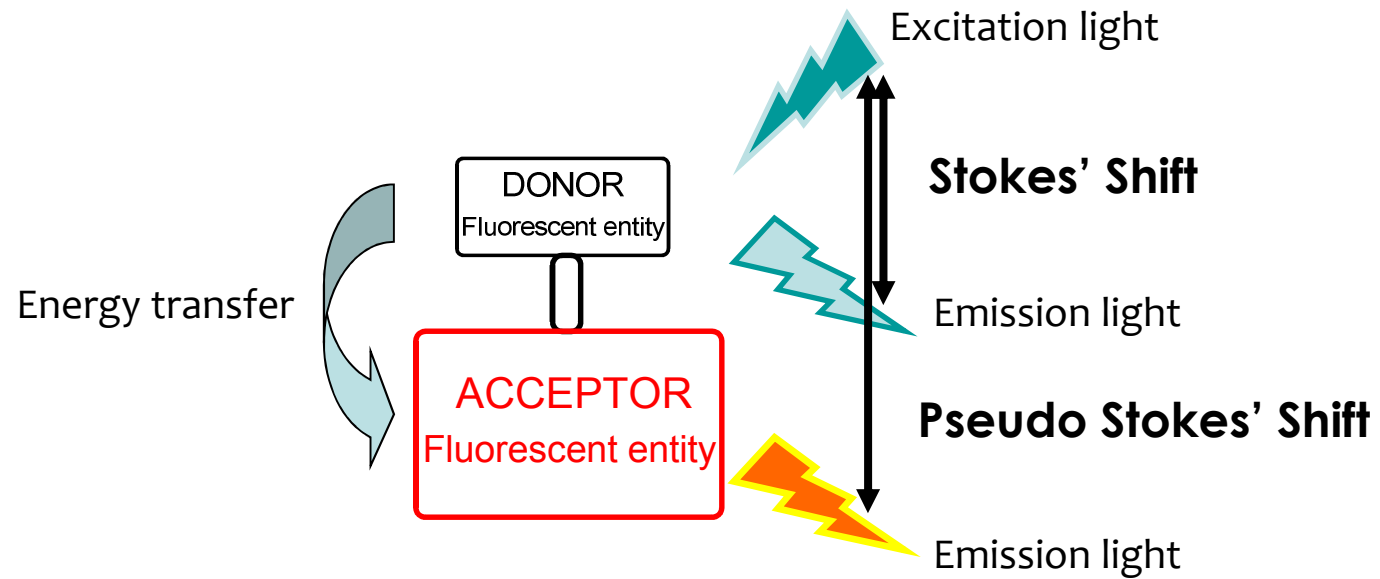


- Small molecules
- Large molar absorption coefficients
- High fluorescence quantum yields
- relatively insensitive to the polarity and pH of their environment
- Small Stokes' shift
- Fluorescence Emission below 600 nm
- Low solubility in water



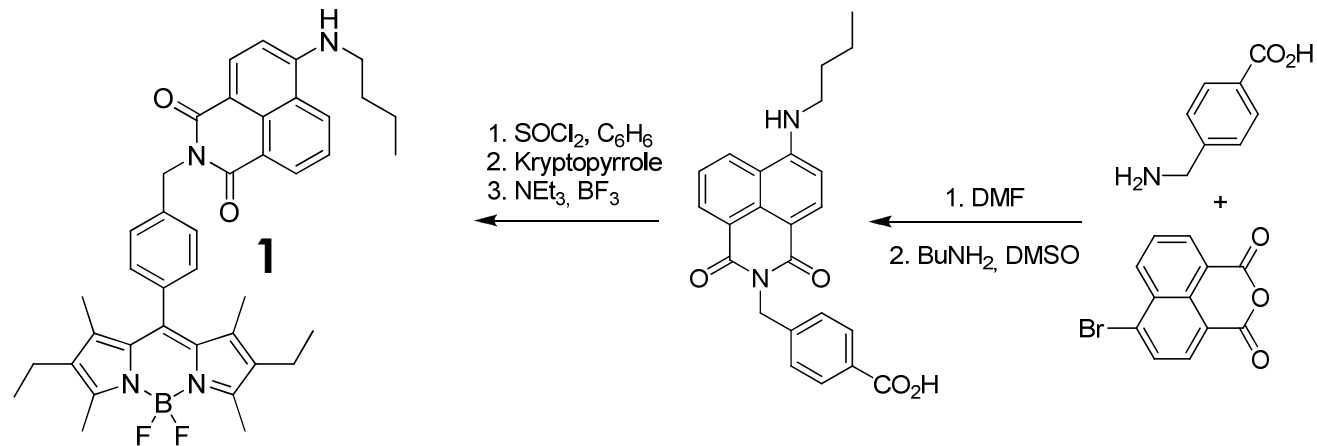
BODIPY – the problem of the small Stokes' shift

Energy Transfer Cassettes



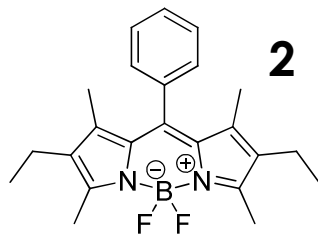
BODIPY – Our approach

Energy Transfer Cassettes

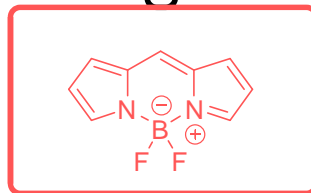


BODIPY – naphthalimide cassette

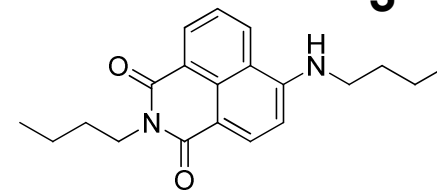
BODIPY unit



Fluorescent entity



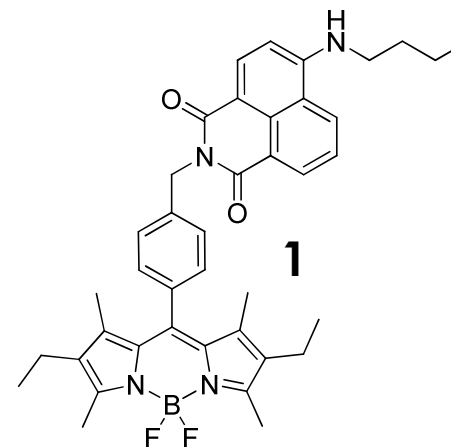
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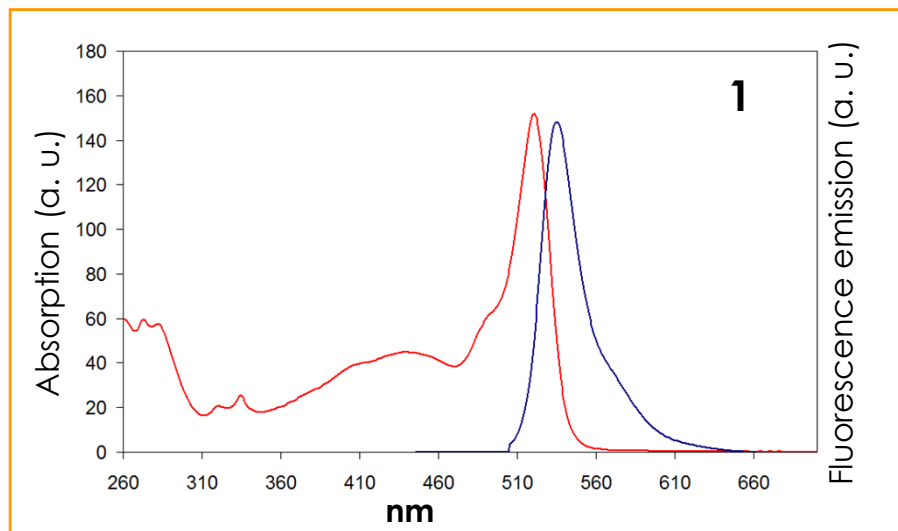
Naphthalimide unit

BODIPY – Naphthalimide Energy Transfer Cassettes

UV: $\lambda_{\text{max}} = 522 \text{ nm}$
($\epsilon = 50100 \text{ M}^{-1}\text{cm}^{-1}$)
FLUO: $\lambda_{\text{max}} = 534 \text{ nm}$ ($\Phi = 0.7, \tau = 5.43$)
 440 nm ($\Phi = 0.4, \tau = 5.43$)
 CH_3CN

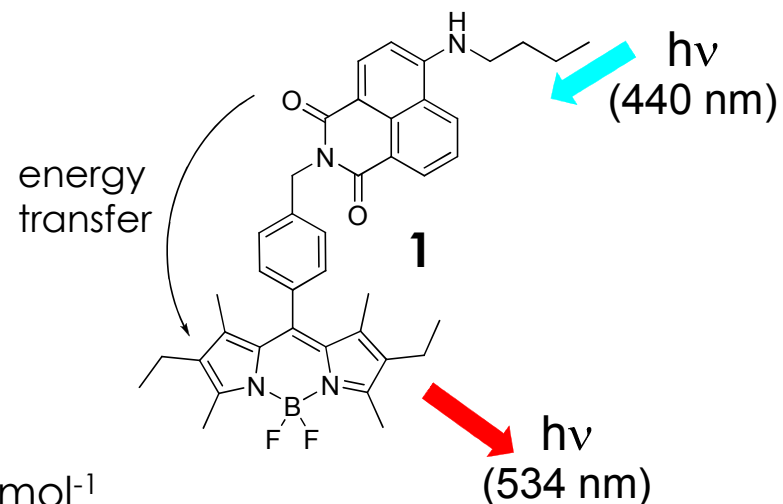


UV - Fluo spectra in CH_3CN

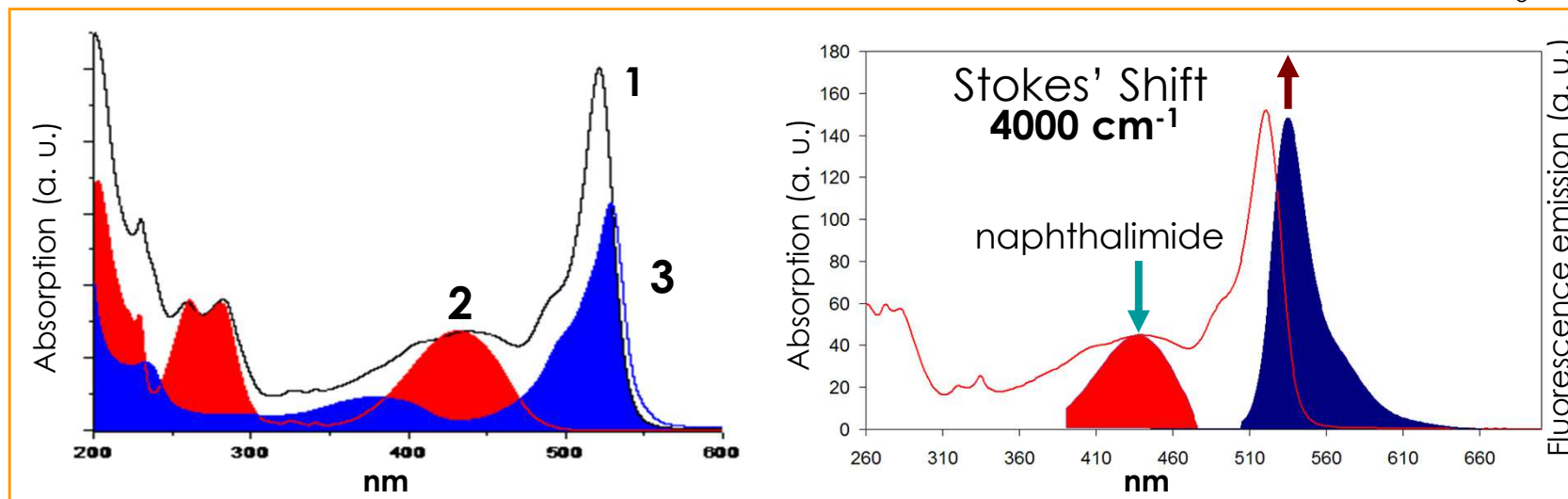


BODIPY – Naphthalimide Energy Transfer Cassettes

$\Phi_{\text{fluo}} = 0.7$
 $R_0 = 28.7 \text{ \AA}$
 $R = 10.0 \text{ \AA}$
 $k_{\text{EET}} = 1.0 \times 10^{11} \text{ s}^{-1}$
 $J = 1.6 \times 10^{-10} \text{ cm}^6 \text{ mol}^{-1}$
 $\Phi_{\text{EET}} = 1.0$

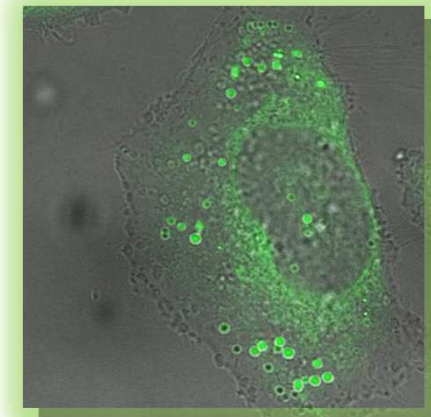
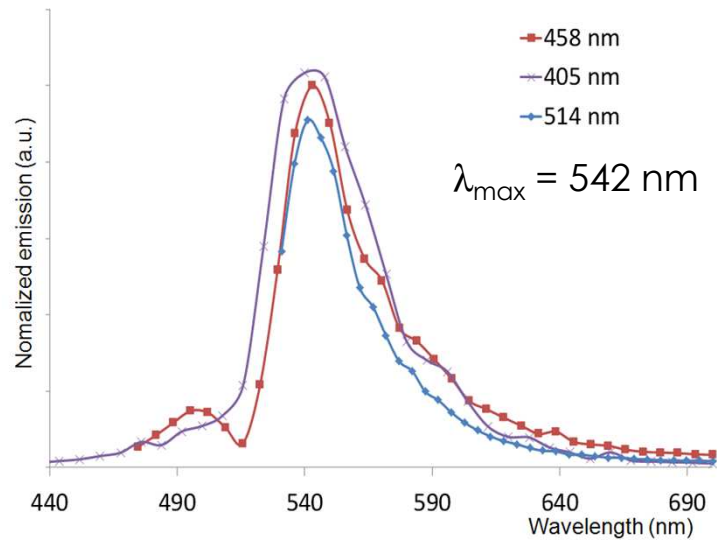
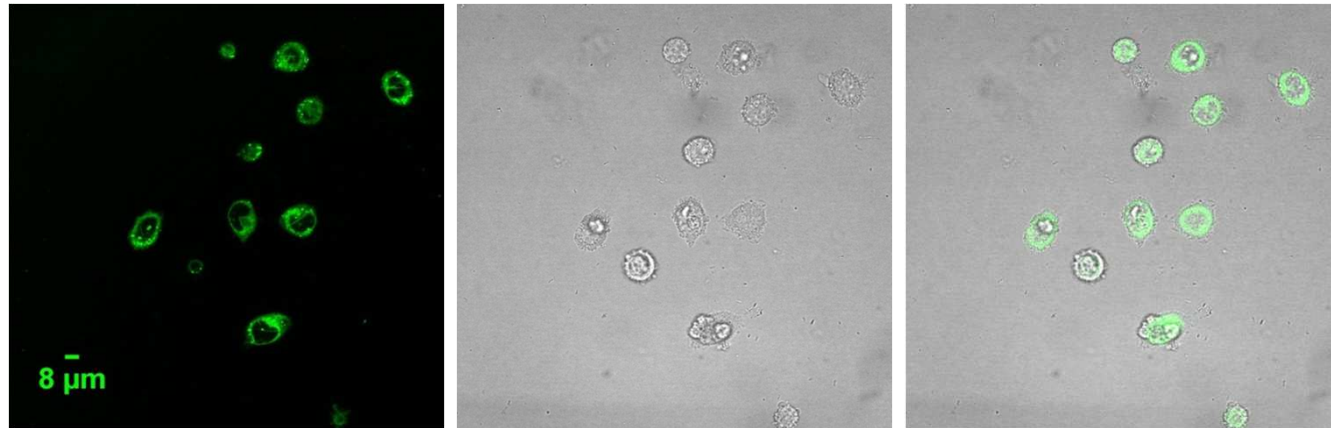


UV - Fluo spectra in CH_3CN



BODIPY – Naphthalimide Energy Transfer Cassettes

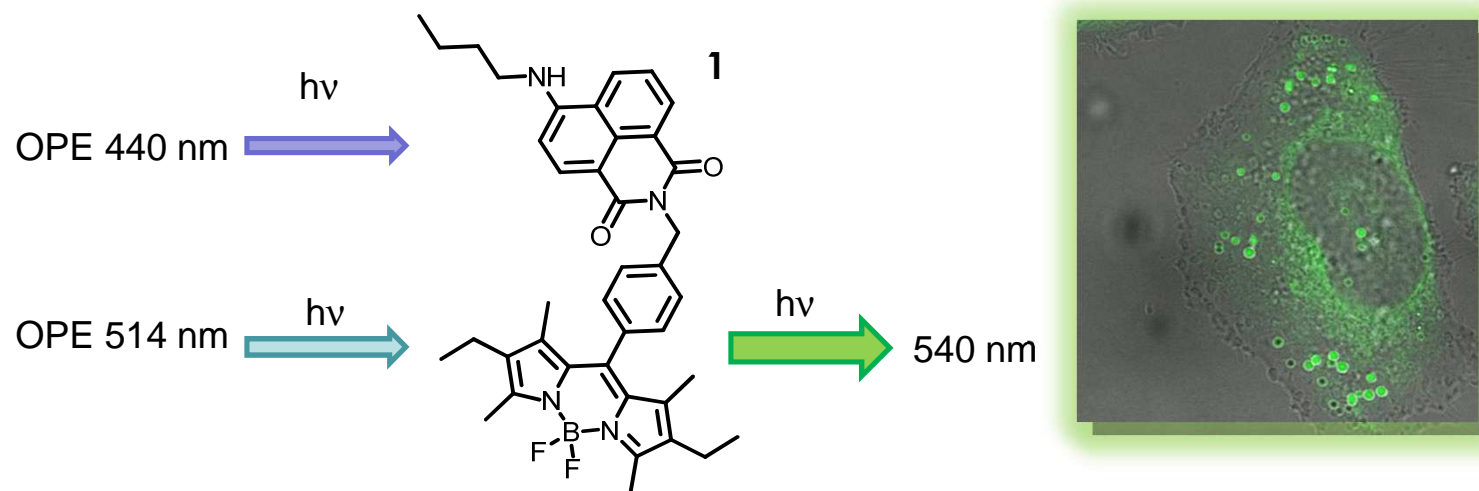
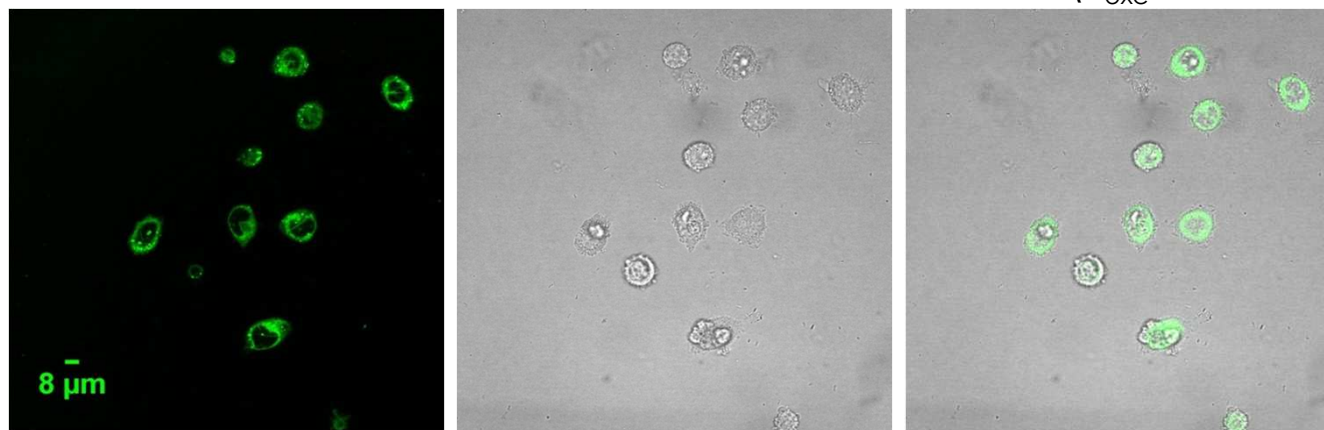
Confocal microscopy images of HeLa cells
incubated with **1** ($\lambda_{exc} = 514 \text{ nm}$)



Localized spectra of the confocal microscopic images

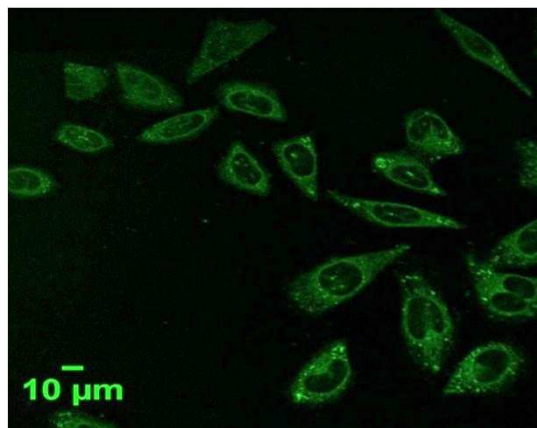
BODIPY – Naphthalimide Energy Transfer Cassettes

Confocal microscopy images of HeLa cells
incubated with **1** ($\lambda_{\text{exc}} = 514 \text{ nm}$)

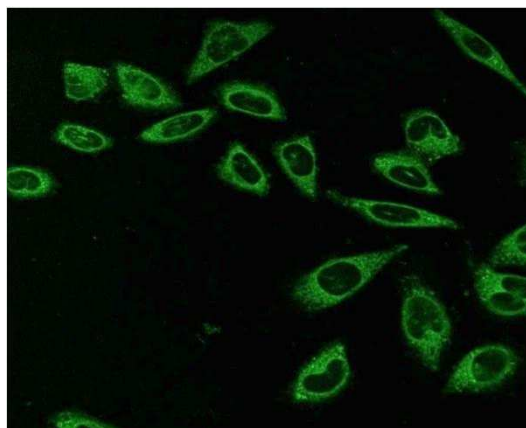


BODIPY – Naphthalimide Energy Transfer Cassettes

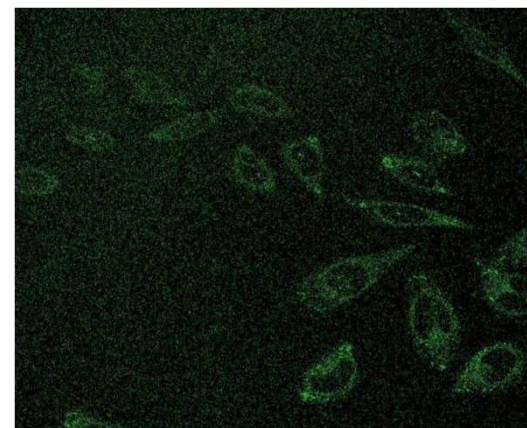
Two-photon microscopy images of HeLa cells
incubated with **1**



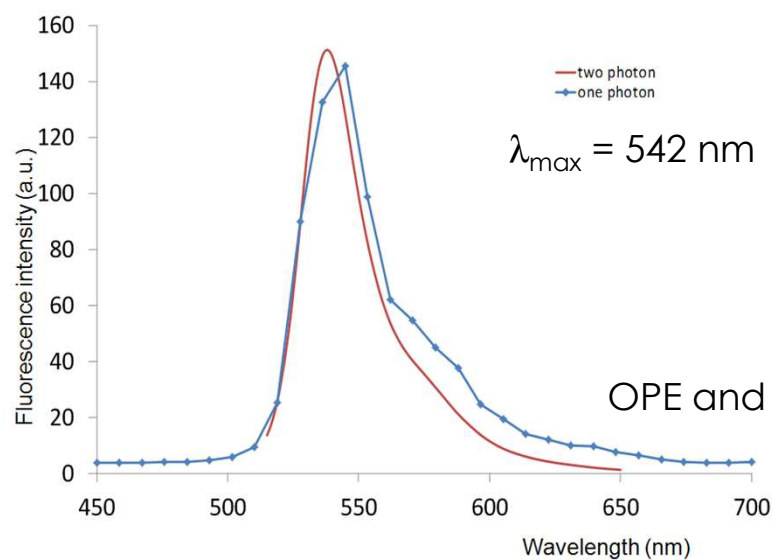
Laser excitation: 720 nm



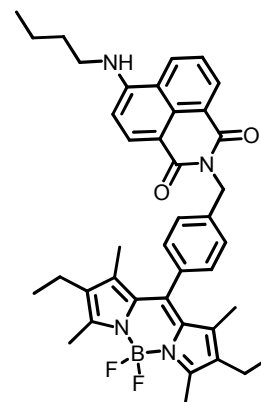
880 nm



1040 nm

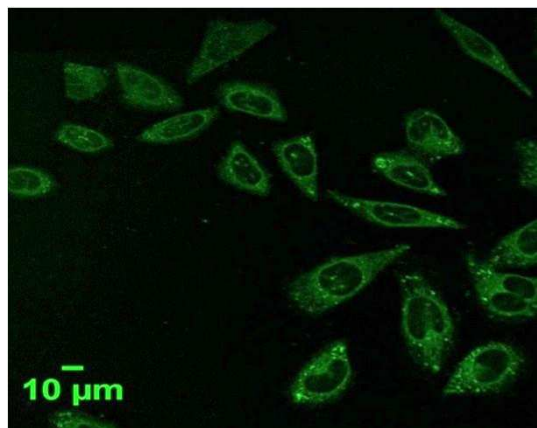


OPE and TPE emission spectra of **1**

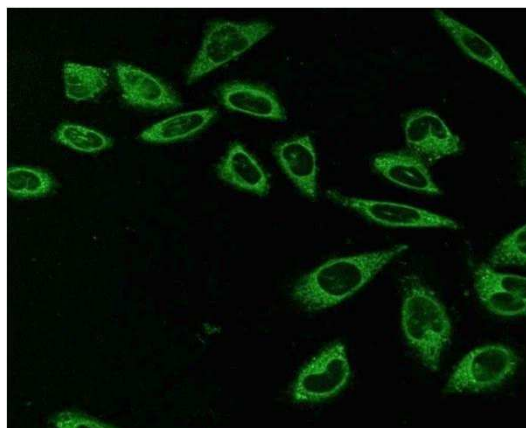


BODIPY – Naphthalimide Energy Transfer Cassettes

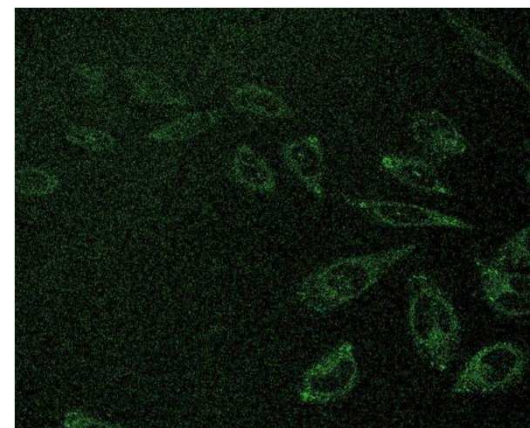
Two-photon microscopy images of HeLa cells
incubated with **1**



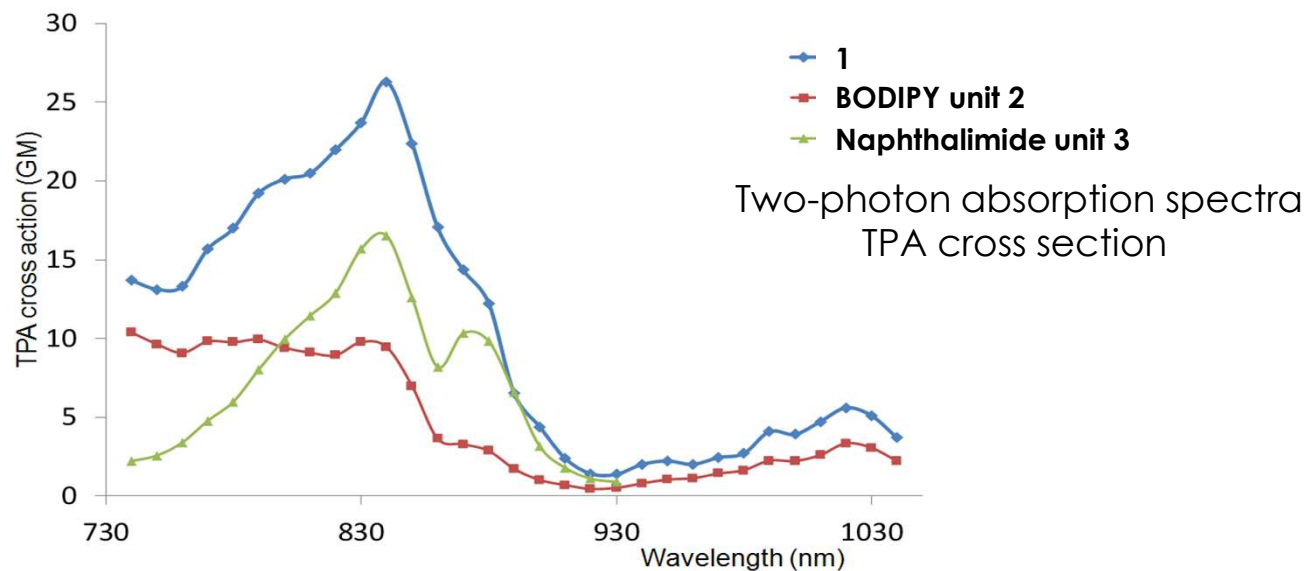
Laser excitation: 720 nm



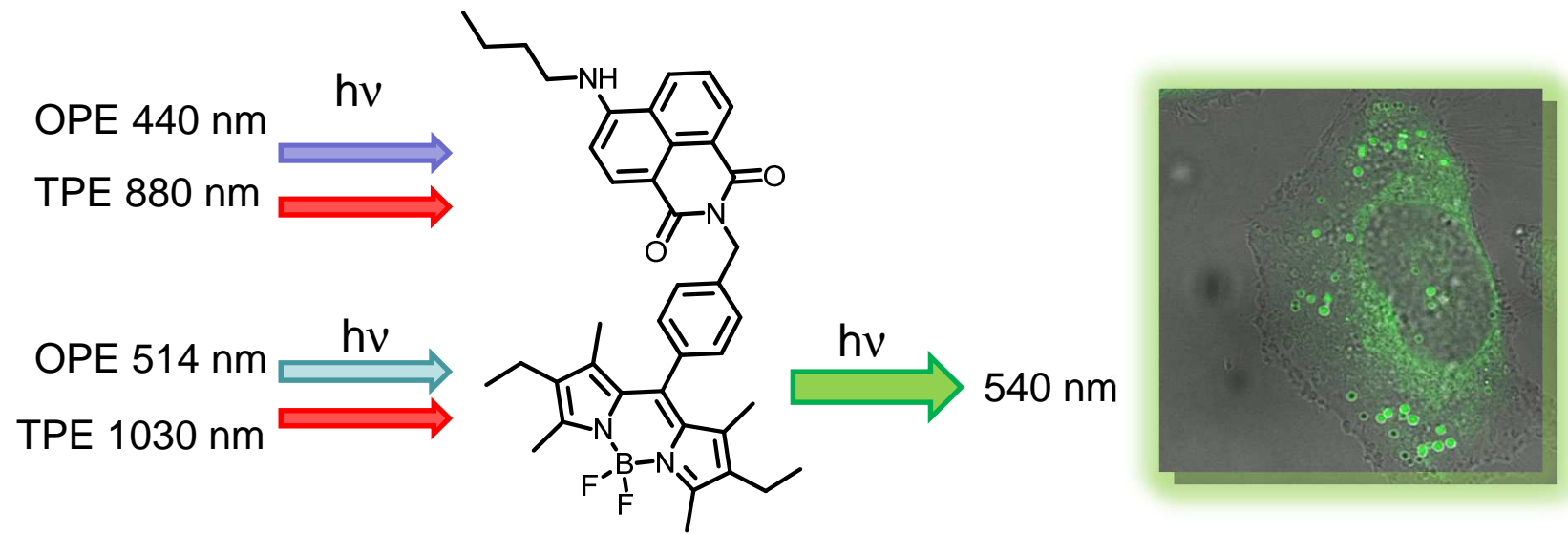
880 nm



1040 nm



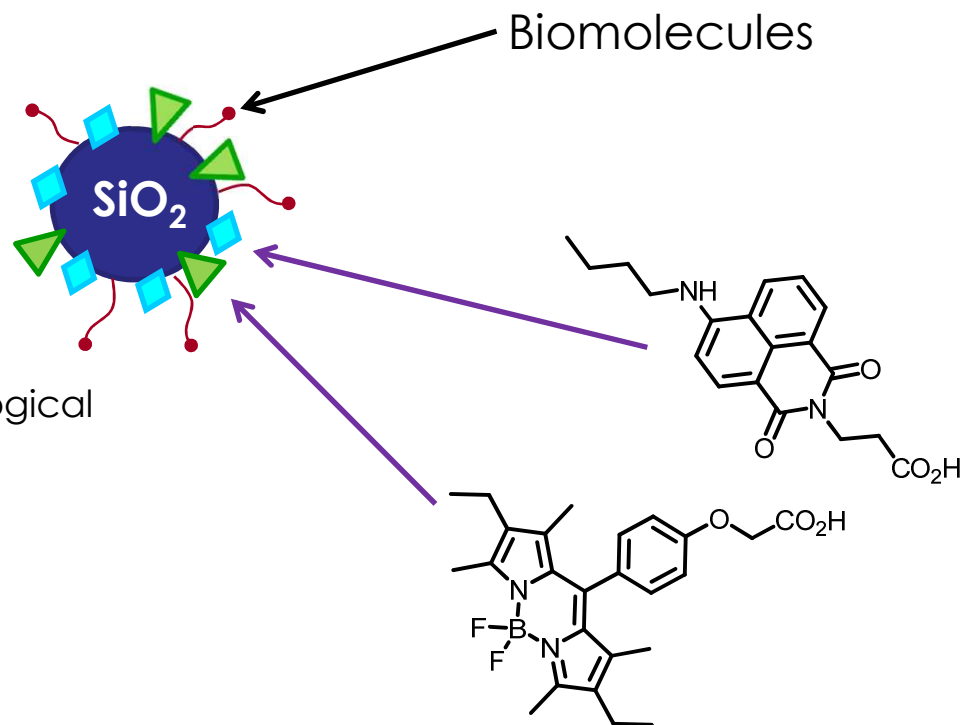
BODIPY – Naphthalimide Energy Transfer Cassettes



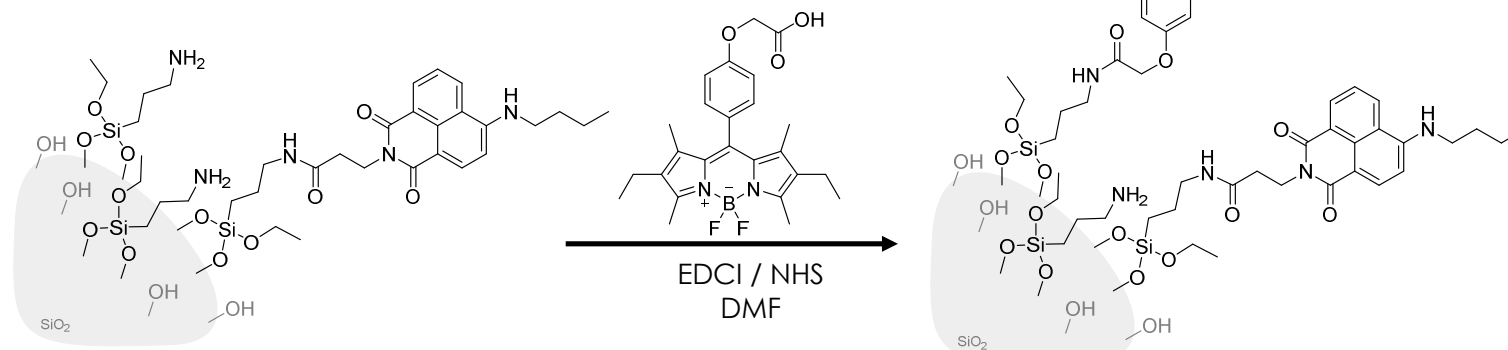
BODIPY – Naphthalimide

Fluorescent silica nanoparticles

hydrophilicity,
biocompatibility
stability under physiological
conditions

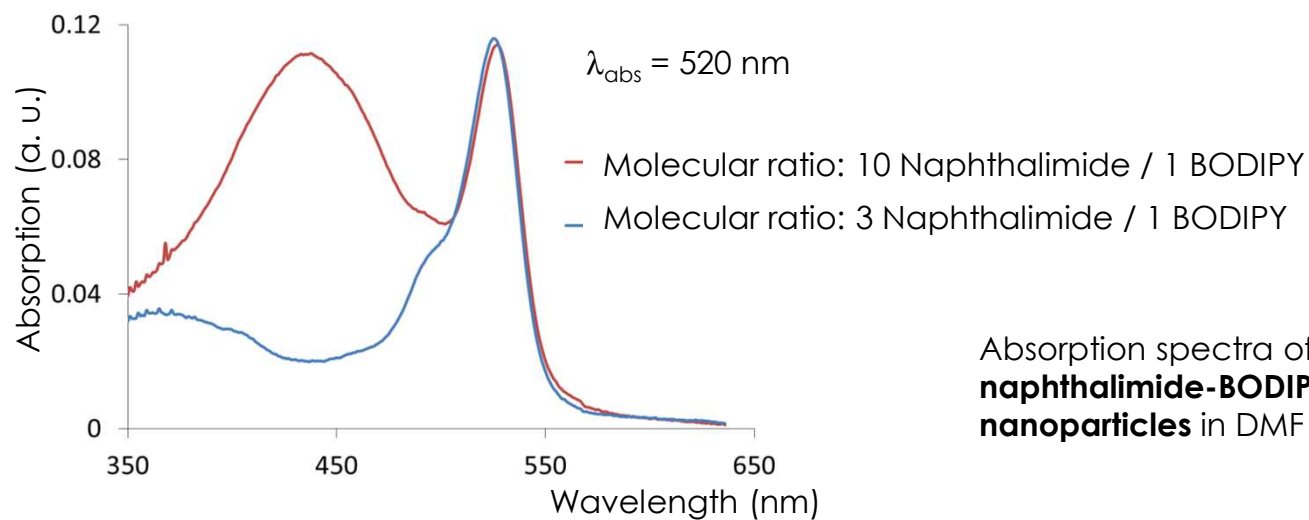


BODIPY – Naphthalimide Incorporation on SiO₂ particles surfaces...



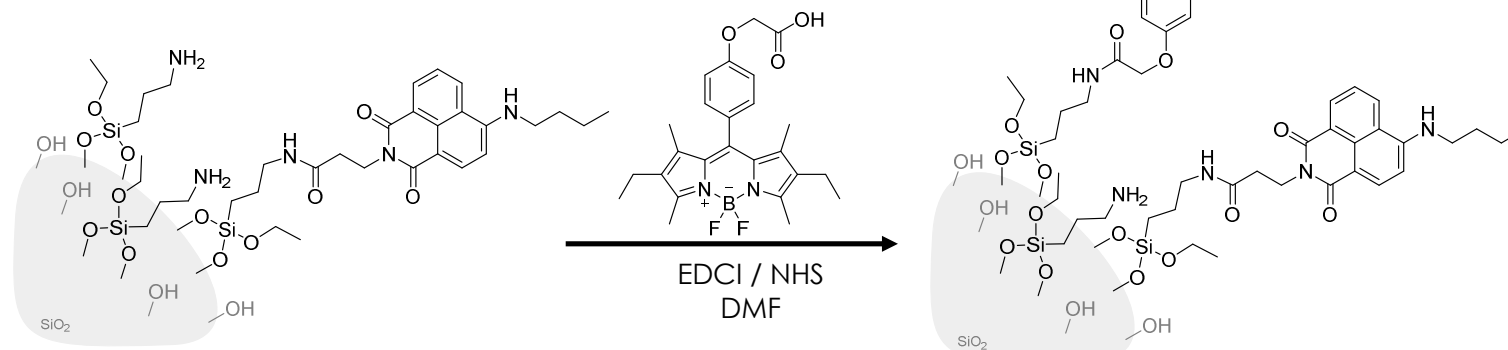
2 μmol –Naphthalimide/ g SiO₂ particles
0.6 μmol –Naphthalimide/ g SiO₂ particles

2 μmol –Naphthalimide/ g SiO₂ particles
0.2 μmol –BODIPY/ g SiO₂ particles
0.6 μmol –Naphthalimide/ g SiO₂ particles
0.2 μmol –BODIPY/ g SiO₂ particles



Absorption spectra of **surface modified naphthalimide-BODIPY silica nanoparticles** in DMF

BODIPY – Naphthalimide Incorporation on SiO₂ particles surfaces...

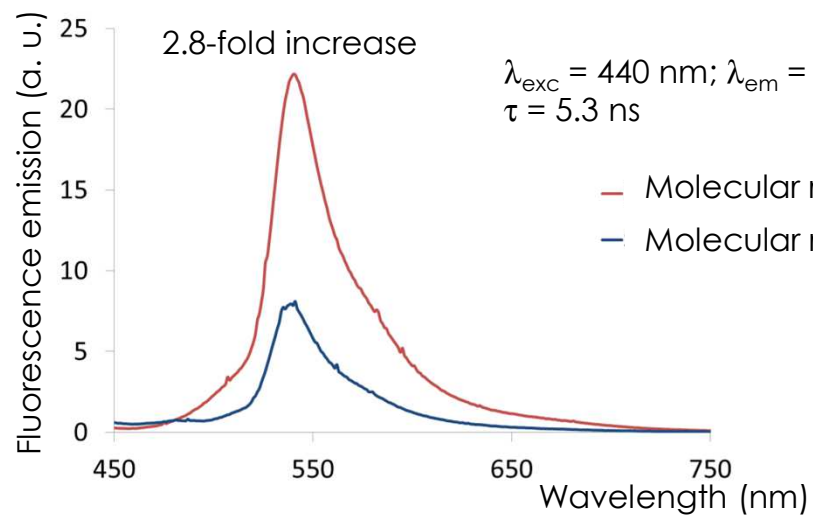


2 μmol –Naphthalimide/ g SiO₂ particles

0.6 μmol –Naphthalimide/ g SiO₂ particles

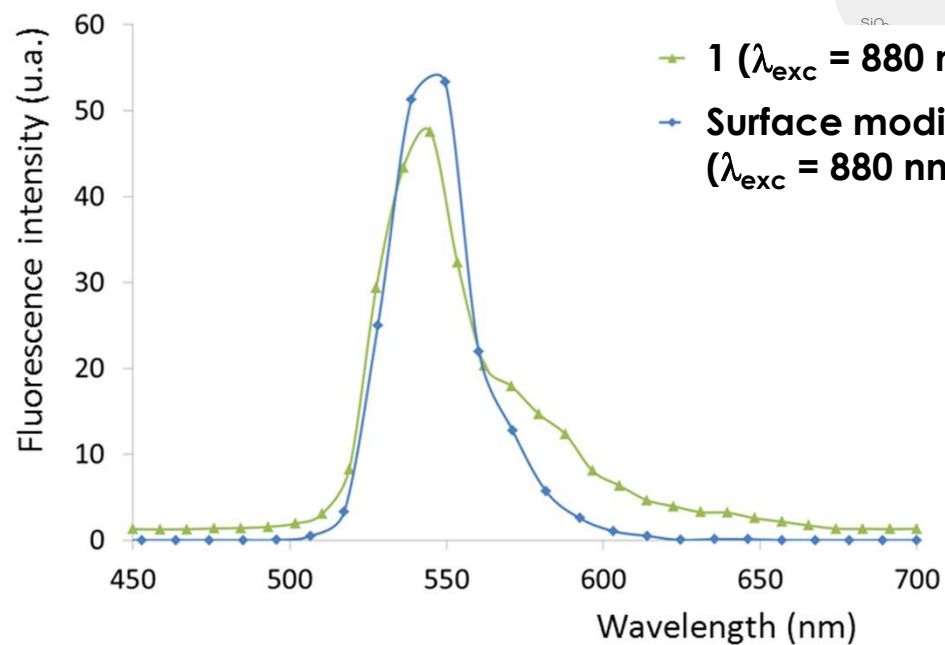
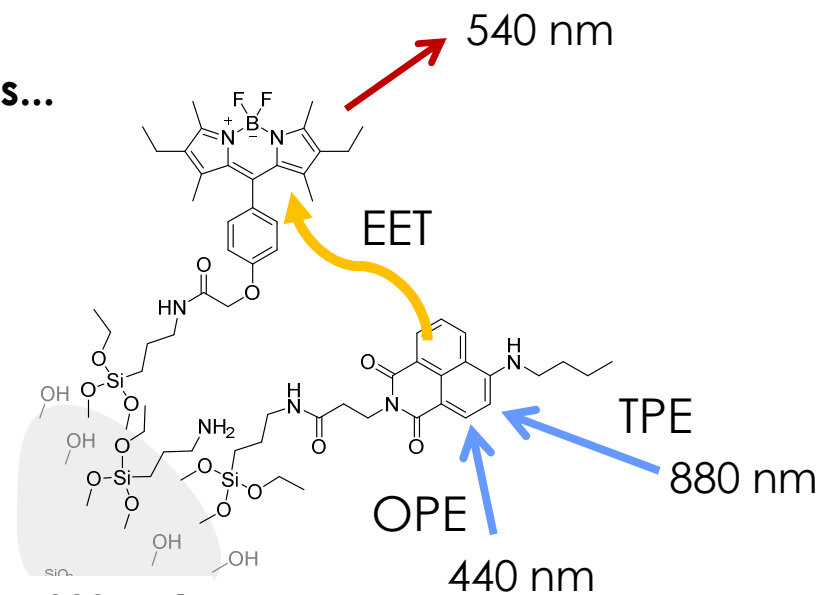
2 μmol –Naphthalimide/ g SiO₂ particles
0.2 μmol –BODIPY/ g SiO₂ particles

0.6 μmol –Naphthalimide/ g SiO₂ particles
0.2 μmol –BODIPY/ g SiO₂ particles



OPE emission spectra of **surface modified naphthalimide-BODIPY silica nanoparticles** in DMF

BODIPY – Naphthalimide Incorporation on SiO₂ particles surfaces...



- ▲— **1** ($\lambda_{exc} = 880 \text{ nm}$)
- ◆— **Surface modified silica nanoparticles** ($\lambda_{exc} = 880 \text{ nm}$)

TPE emission spectra of **1** and **naphthalimide-BODIPY silica nanoparticles** in DMF



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Thanks you for your attention

Funds



European Community: COST Action TD0802
FEDER Funds



Ministerio de Sanidad, Servicios Sociales e Igualdad



Ministerio de Economía y Competitividad (Spain)



Consejería de Salud, Junta de Andalucía (Spain)

