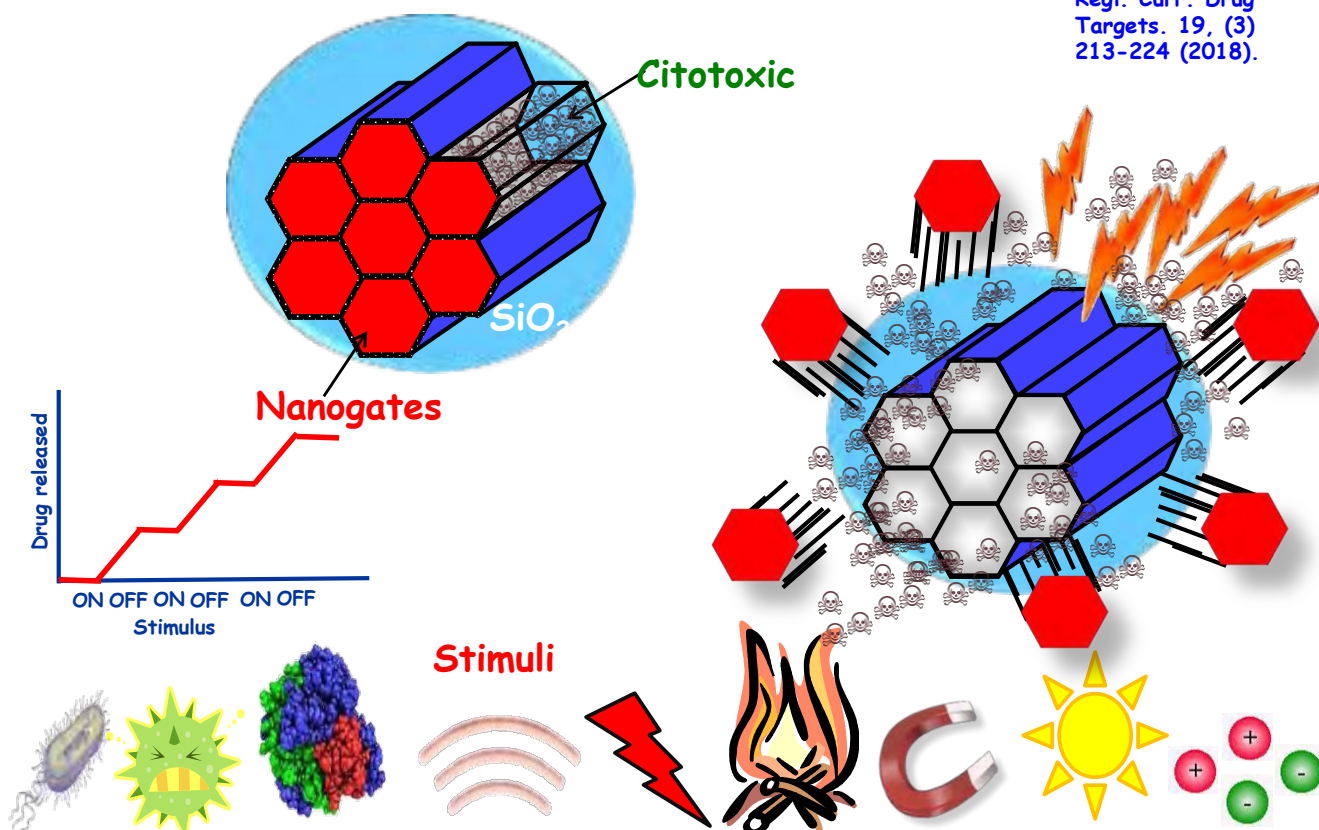


Nanosistemas inteligentes para liberación de fármacos

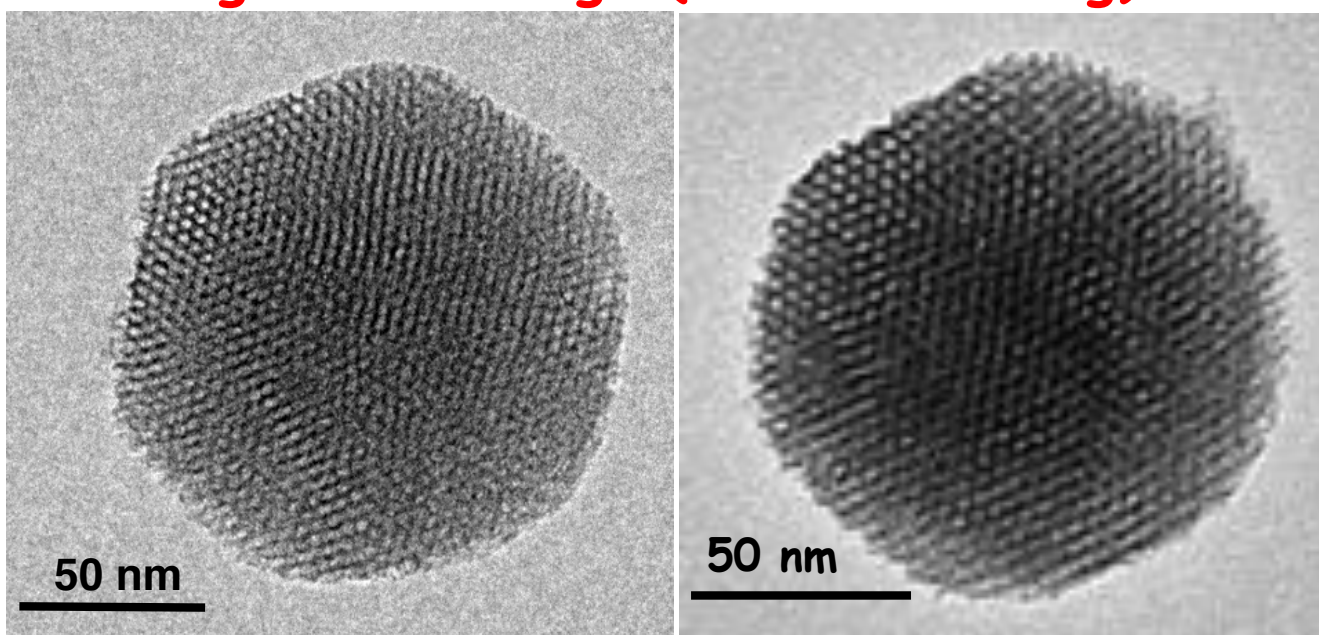


María Vallet-Regí

A. Baeza, M. Vallet-Regí. *Curr. Drug Targets*. 19, (3) 213-224 (2018).



Mesoporous silica nanoparticles MCM-41 TYPE High load charge ($S \approx 1000 \text{ m}^2/\text{g}$)



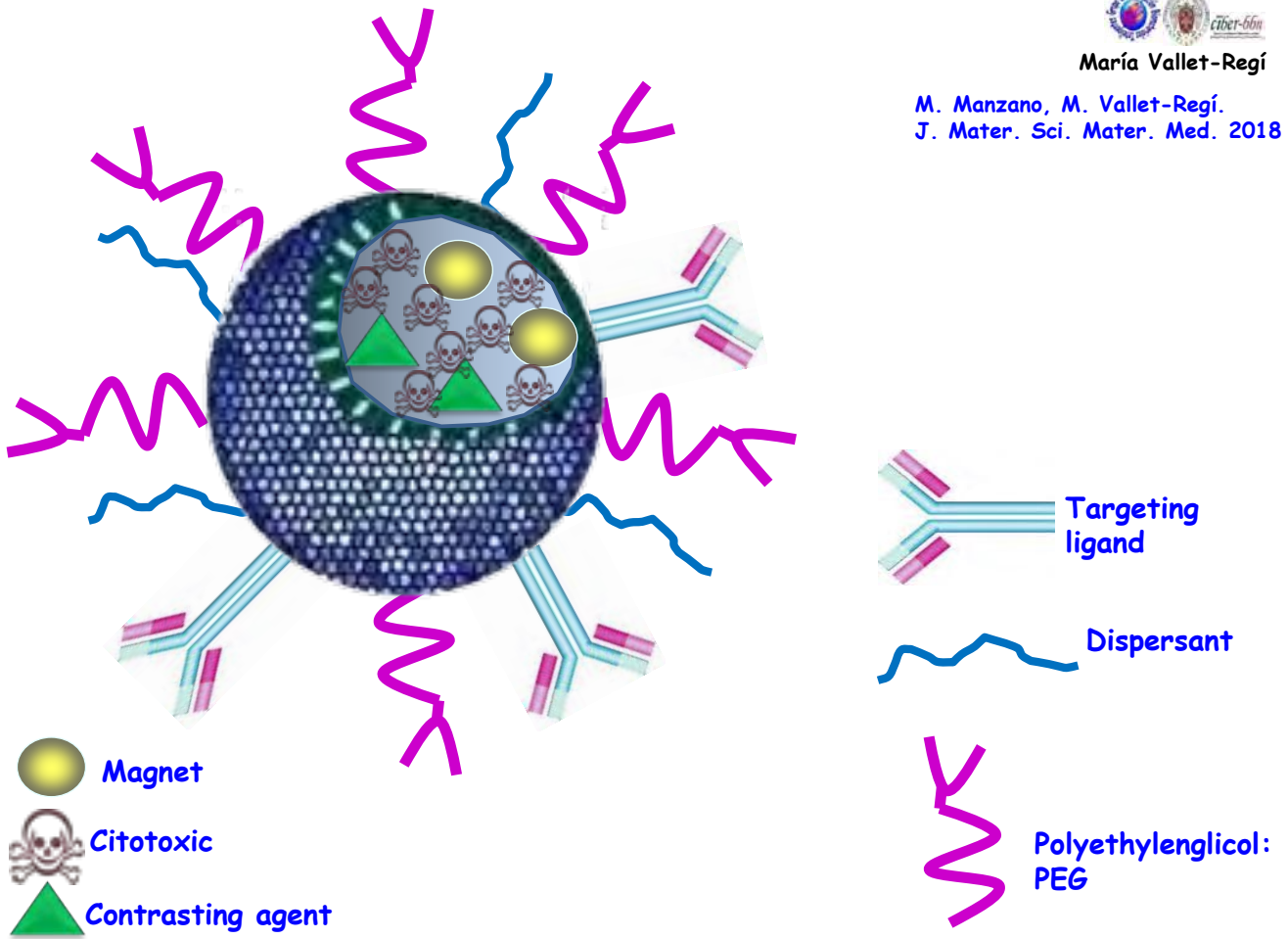
Mechanically, thermally and chemically stable

Outstanding properties for the adsorption of drugs

- High surface areas (ca. $1000 \text{ m}^2/\text{g}$)
- High pore volume (ca. $1 \text{ cm}^3/\text{g}$)
- Narrow distribution of tunable pore diameters (2-50 nm)

Easy chemical modification of surface silanol groups

M. Vallet-Regí, M. Colilla, I. Izquierdo, M. Manzano. *Molecules*. 23, 47 (2018).



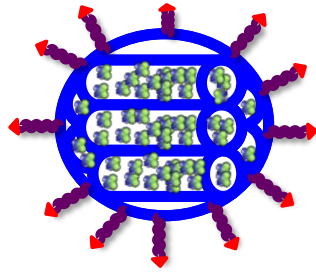
ACTIVE TARGETING



Main concerns in a drug delivery system:

Nanocarrier

- Non toxic
- Drug stability
- Drug protection
- Physical, chemical and microbiological stability
- Good compatibility

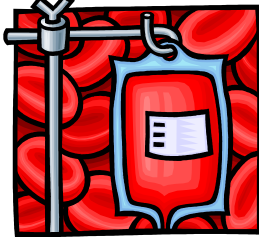


Clinical workforce



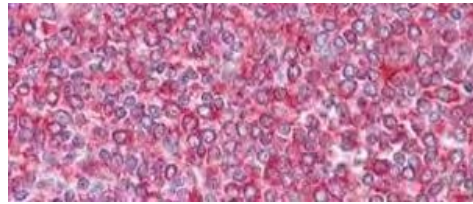
- Easy and safe application
- Easy storage
- Easy sterilisation

Blood



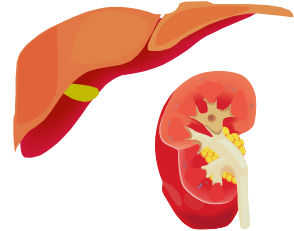
- Hemocompatibility
- Long blood flow times
- Controlled drug release
- No clotting/aggregation
- No phagocyte activation
- No disposal through pulmonary route
- No risk of embolia

Target tissue



- Targeting to a specific cell
- Penetration of biological barriers
- Internalisation in cells/organs
- Designed behaviour for release
- Biodegradable
- Biocompatible
- Non cytotoxic

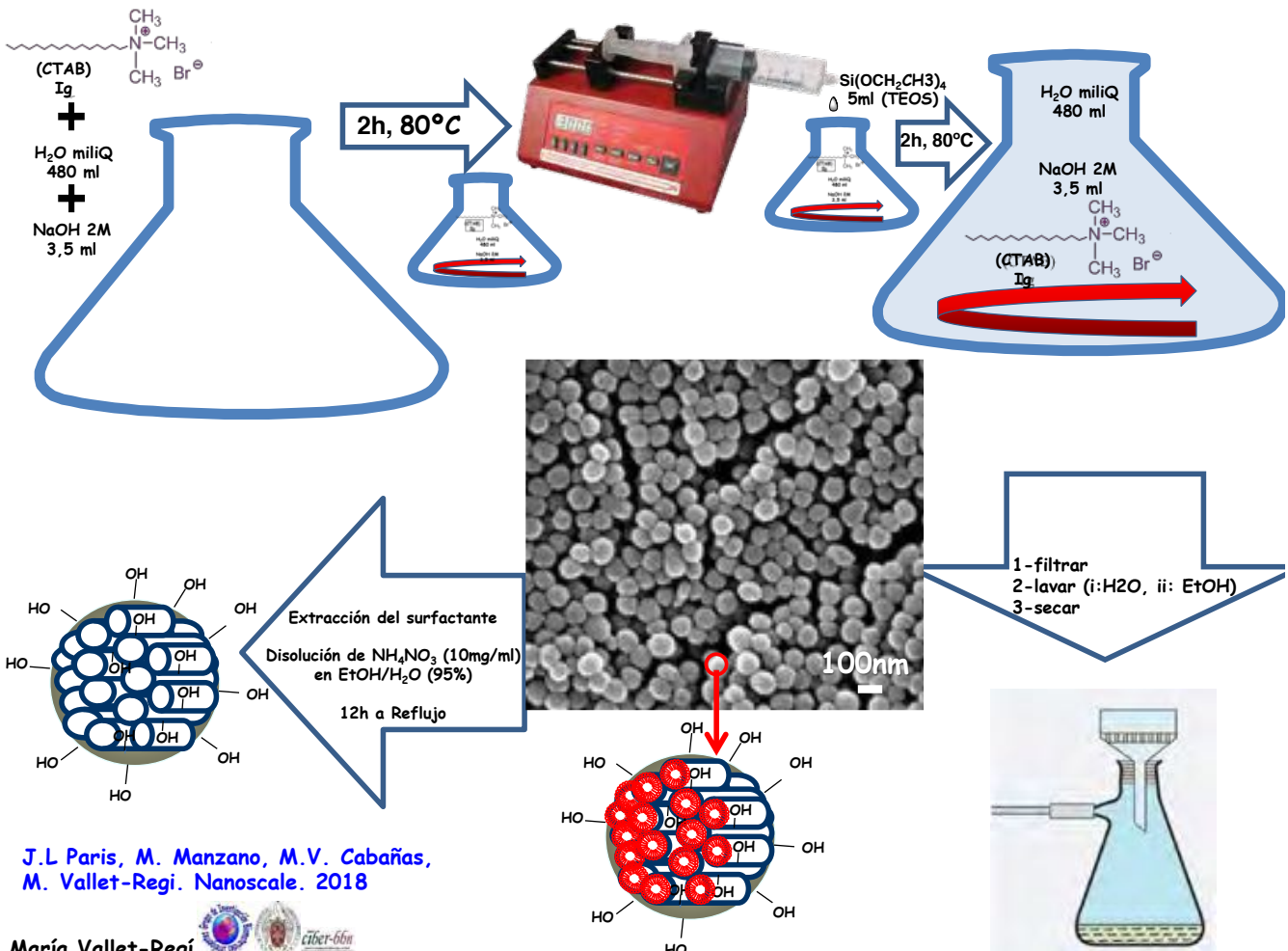
Disposal



- Low molecular weight
- Non toxic degradation products
- No accumulation in organs
- Excreted by liver and kidneys

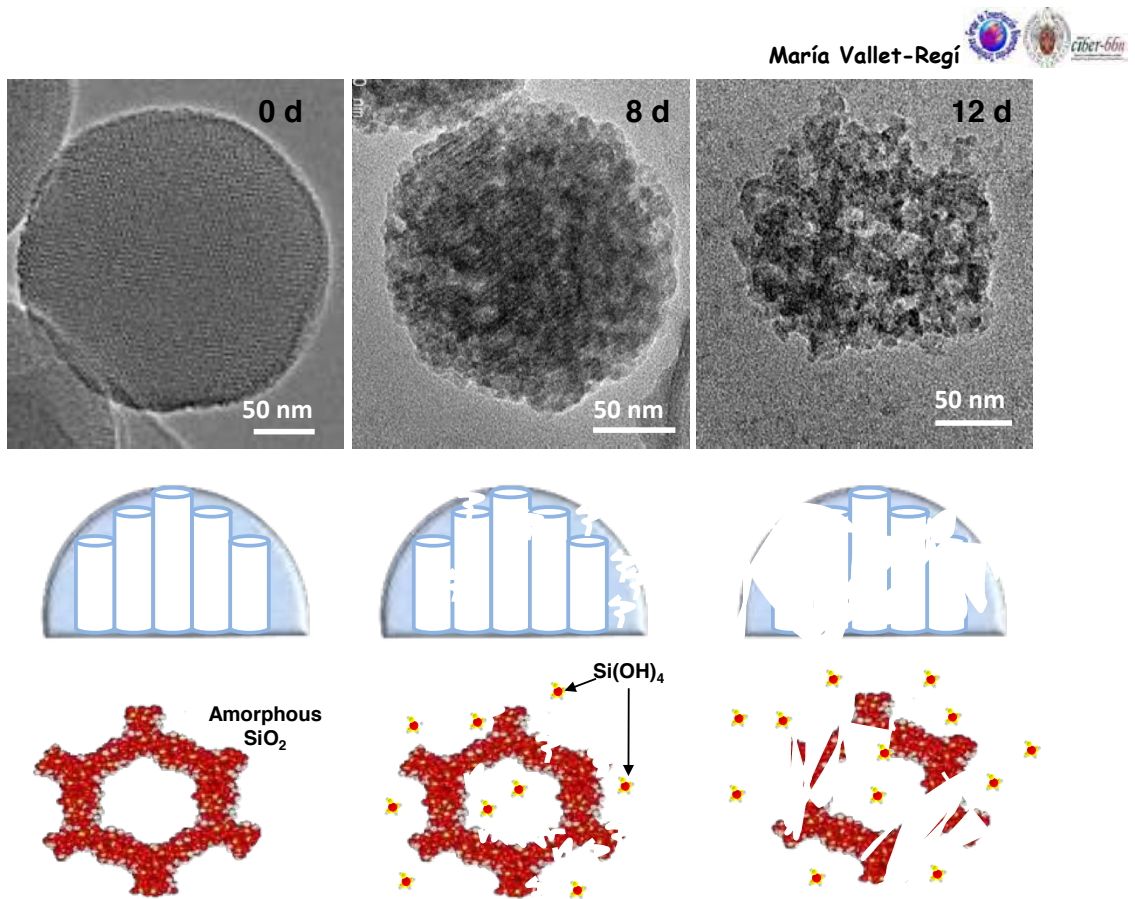
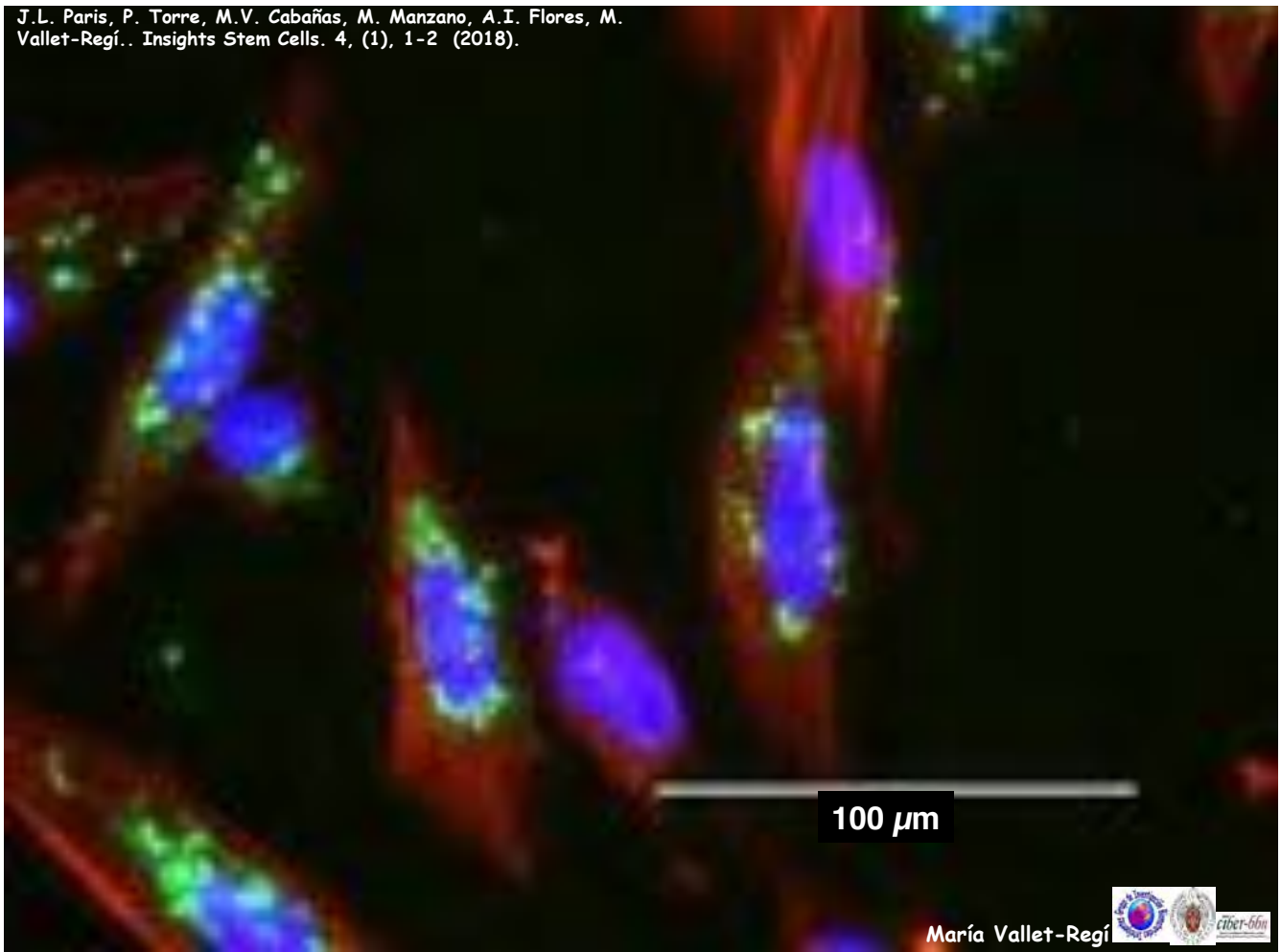
María Vallet-Regí

M. Manzano, M. Vallet-Regí, J. Mater. Sci. Mater. Med. 2018

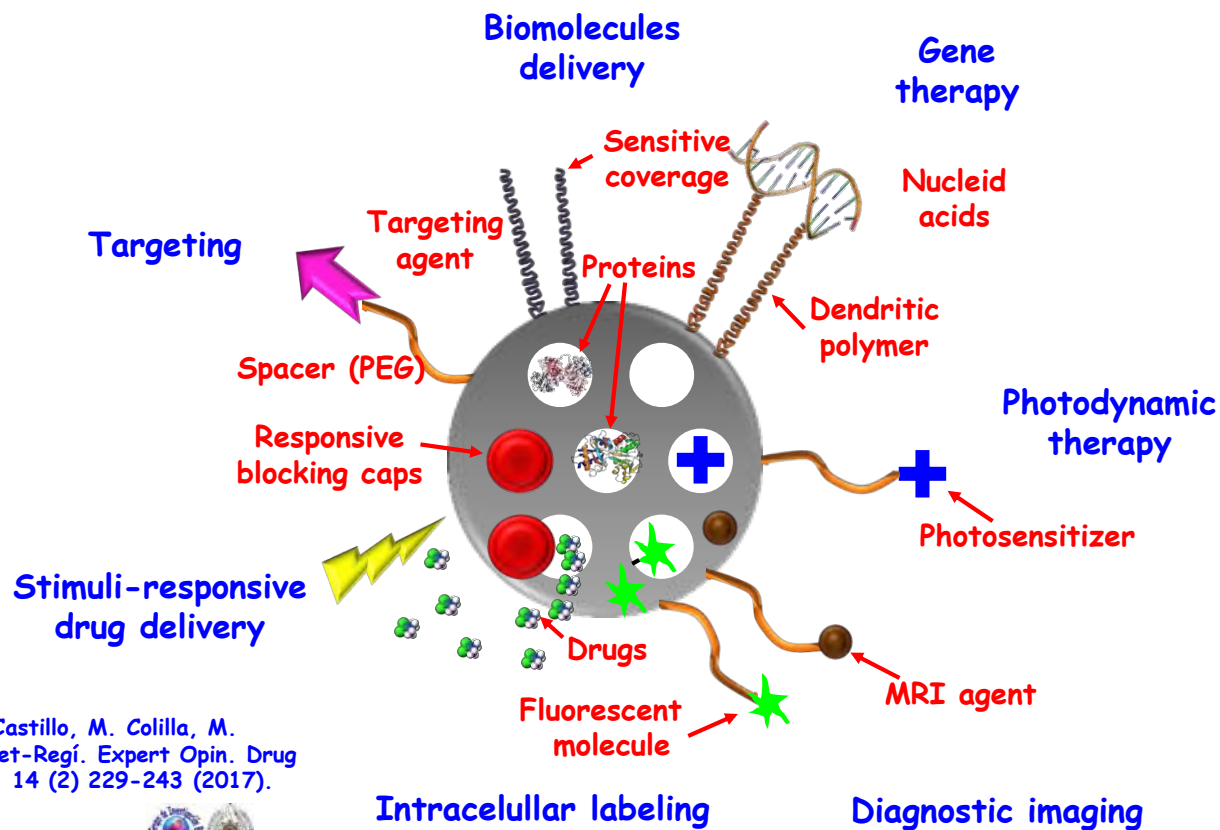


J.L Paris, M. Manzano, M.V. Cabañas, M. Vallet-Regí. Nanoscale. 2018

María Vallet-Regí



Ordered Mesoporous Silica Nanoparticles, MSNs

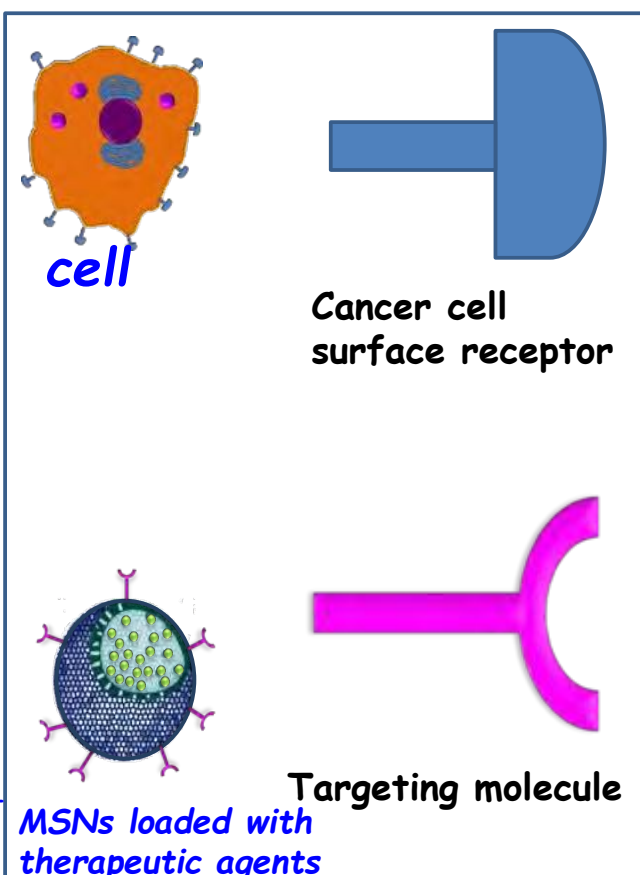
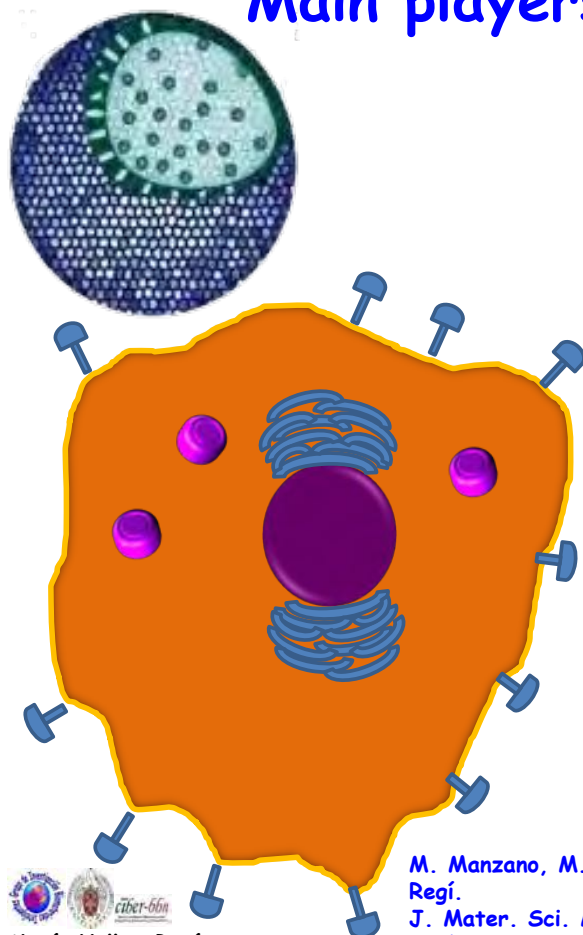


R. Castillo, M. Colilla, M. Vallet-Regí. *Expert Opin. Drug Del.* 14 (2) 229-243 (2017).

María Vallet-Regí

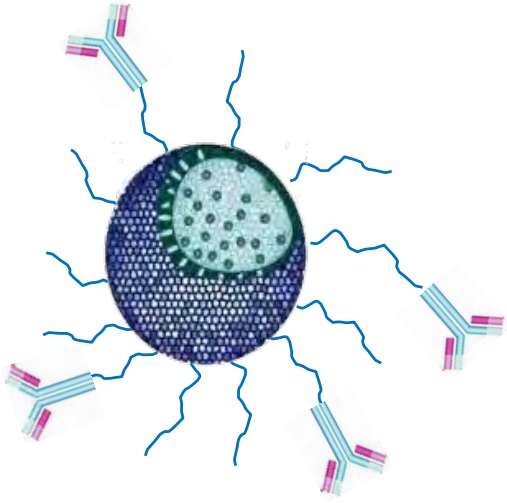
Main players

Design elements



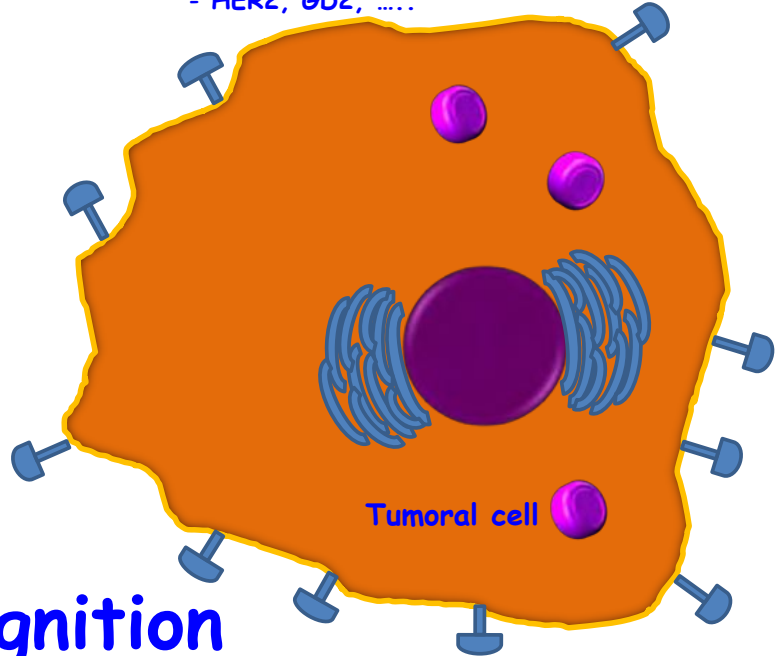
M. Manzano, M. Vallet-Regí. *J. Mater. Sci. Mater. Med.* 2018

María Vallet-Regí



Tumoral cells typical overexpressions:

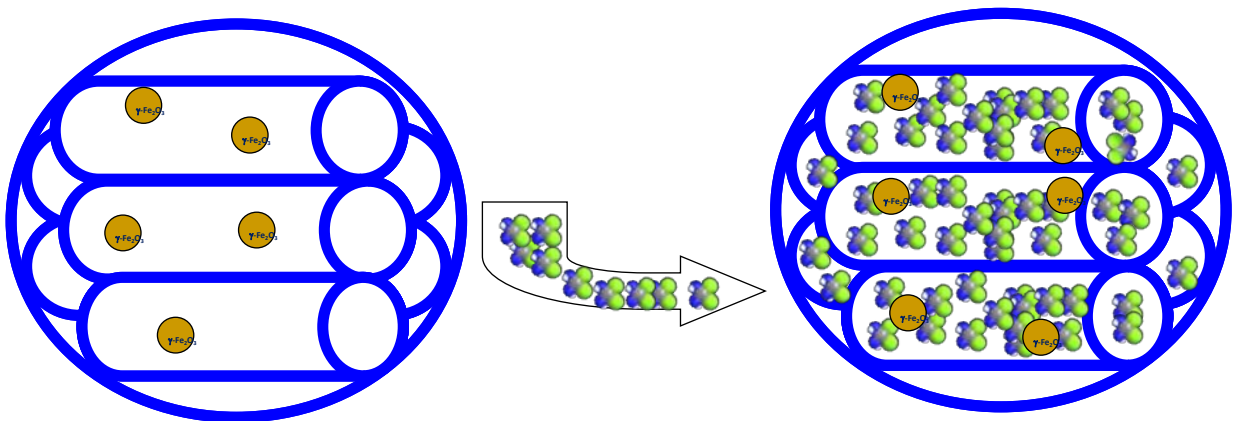
- Folate receptors
- Biotin receptors
- Transferrin receptors
- Specific receptors (Norepinefrine, ...)
- HER2, GD2,

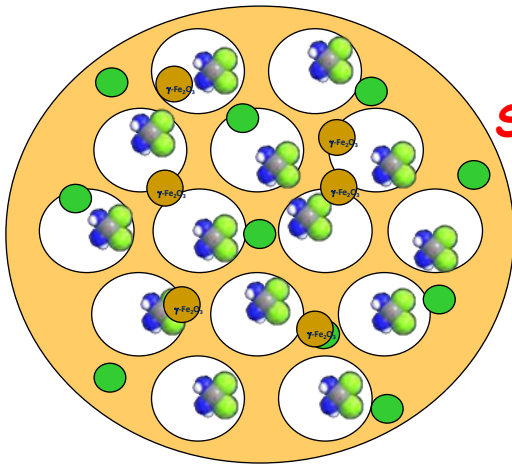


M. Manzano, M. Vallet-Regí.
 J. Mater. Sci. Mater. Med. 2018



María Vallet-Regí 

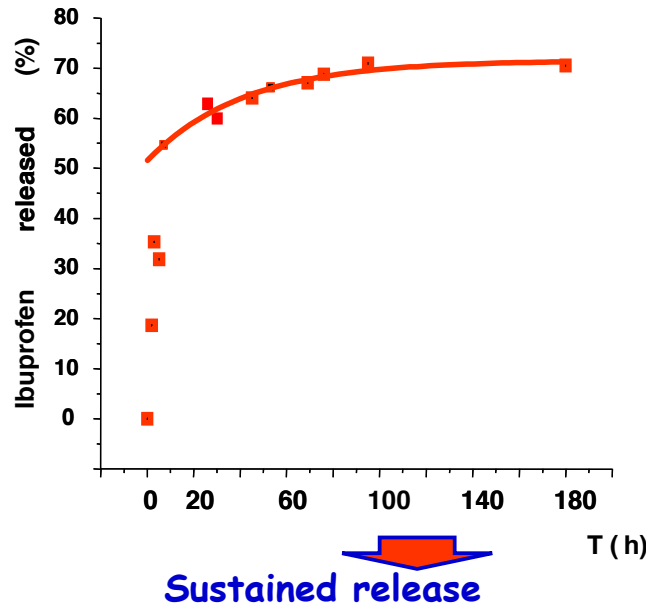
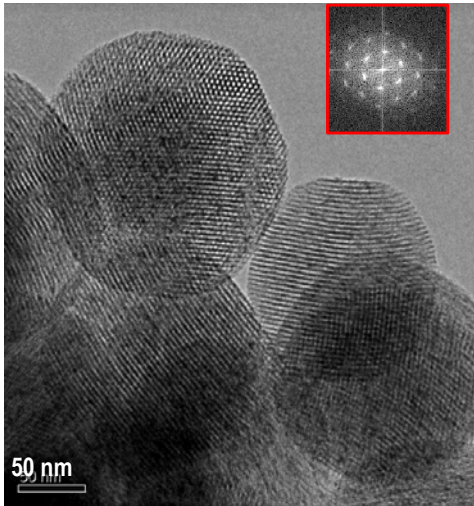
Selective recognition



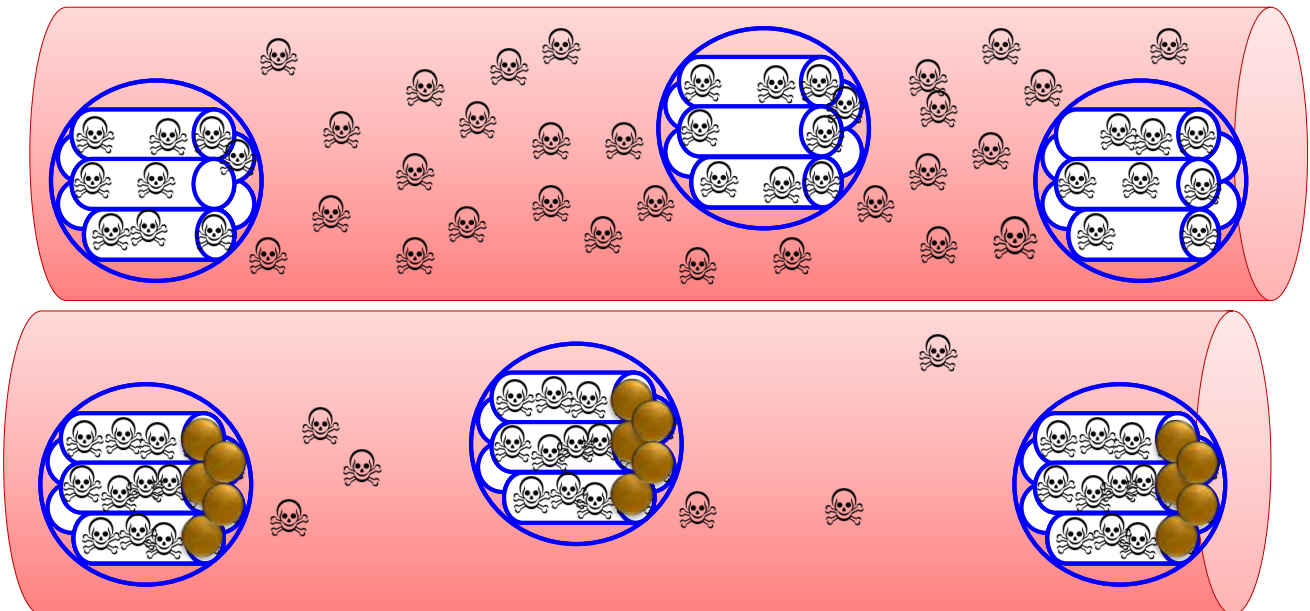


SiO_2

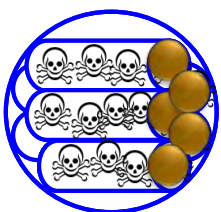
 Cis-platinum
 $\gamma\text{-Fe}_2\text{O}_3$



A. Baeza, D. Ruiz, M. Vallet-Regí. Expert Opin. Drug Del. 14, 783-796 (2017).



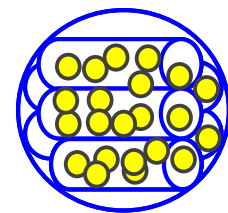
Solutions



Stimuli-responsive



cleavable shell

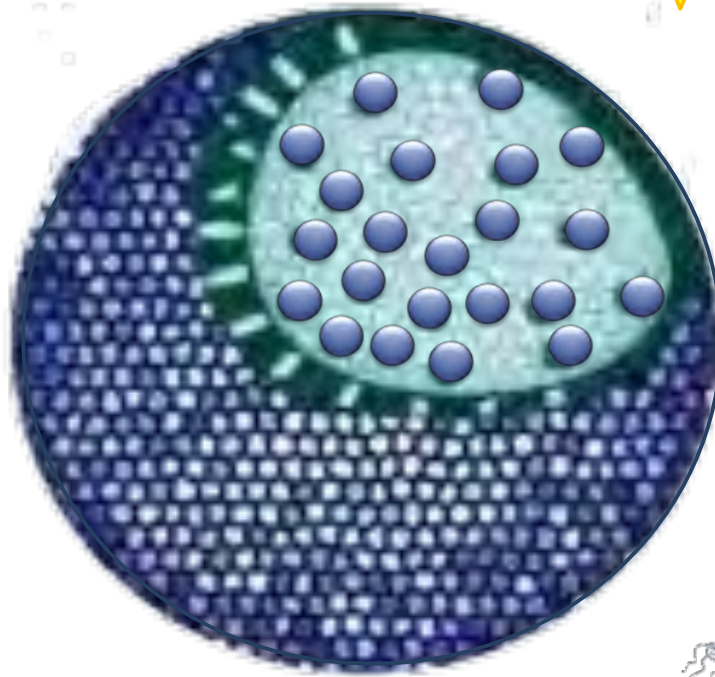


Non-toxic pro-drugs

Electric field

pH

Magnetic field

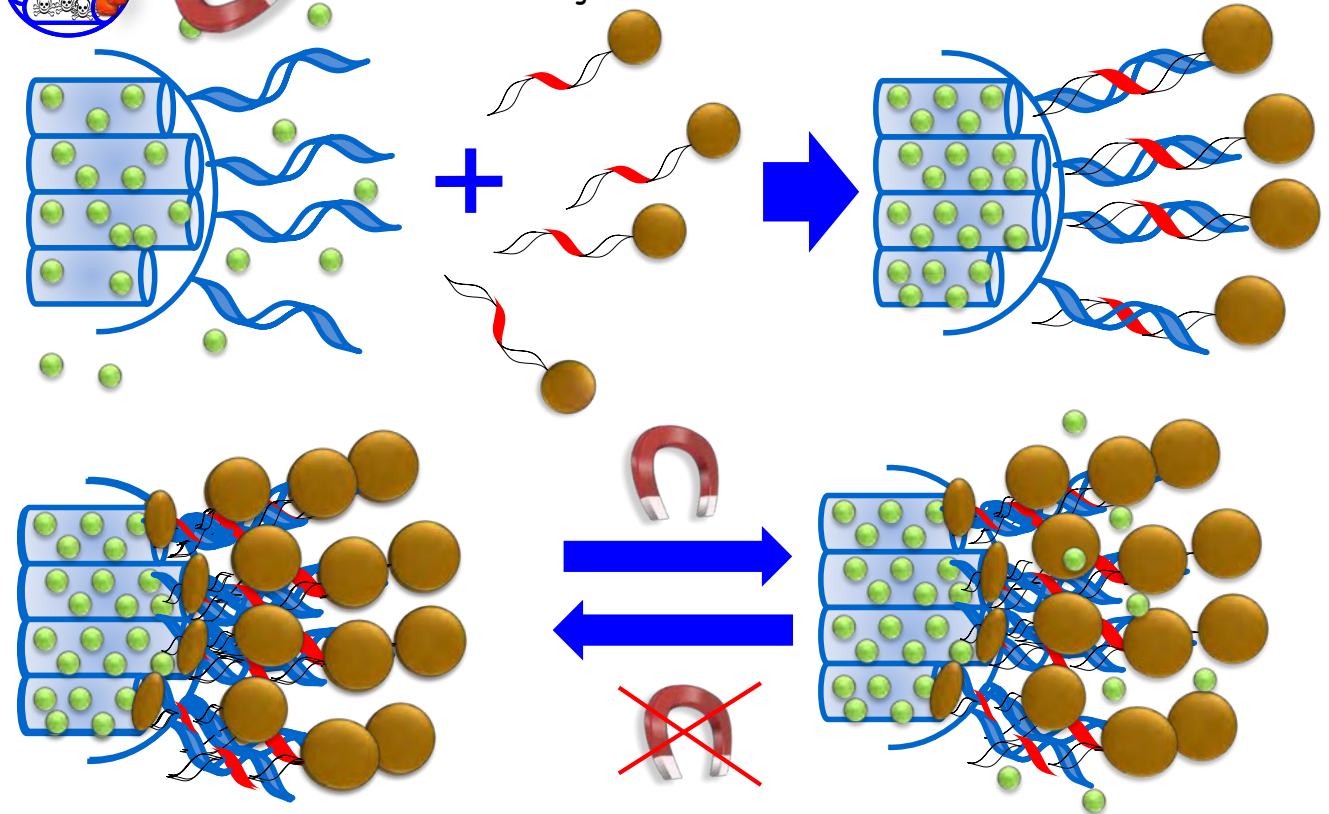


heat

microorganisms

ultrasounds

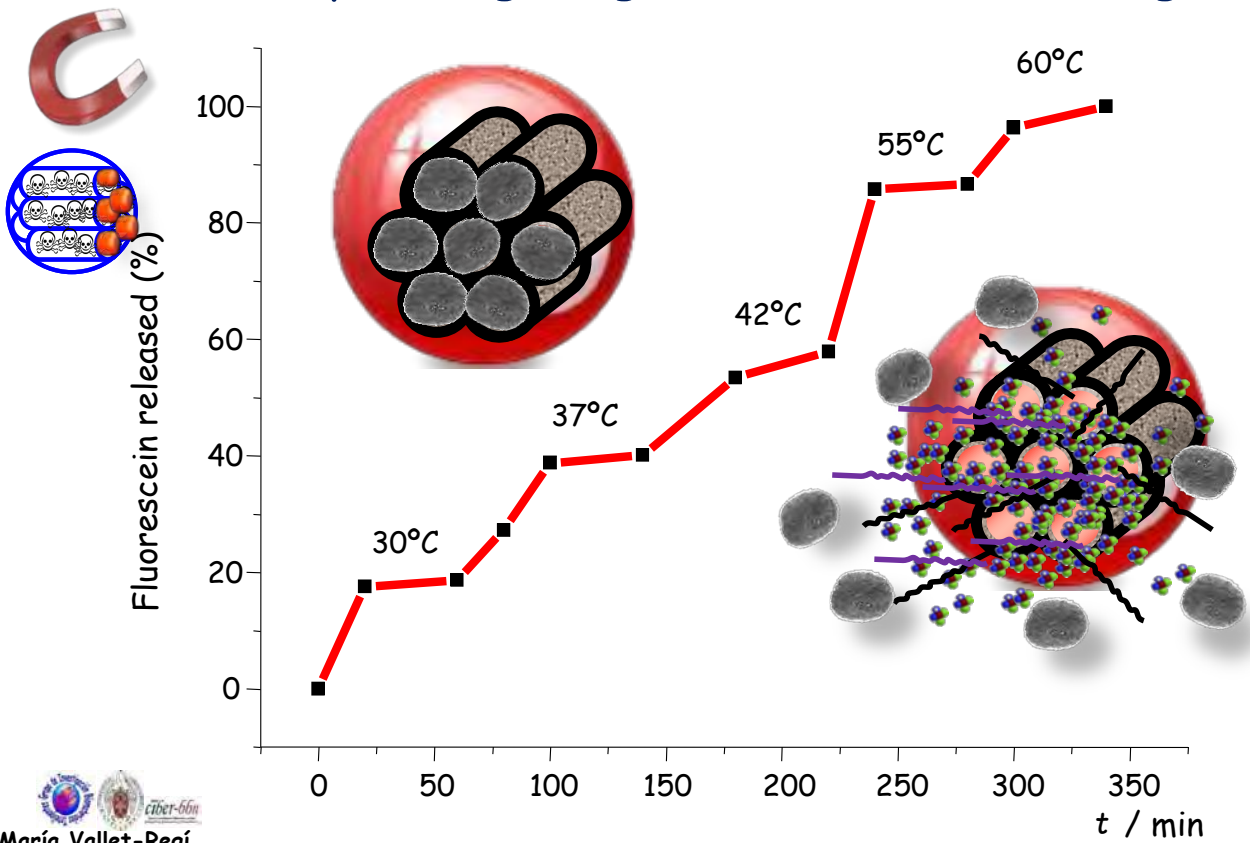
J.L Paris, M. Manzano,
M.V. Cabañas, M. Vallet-Regí. *Nanoscale*. 2018



● Iron oxide nanocaps
● Drug

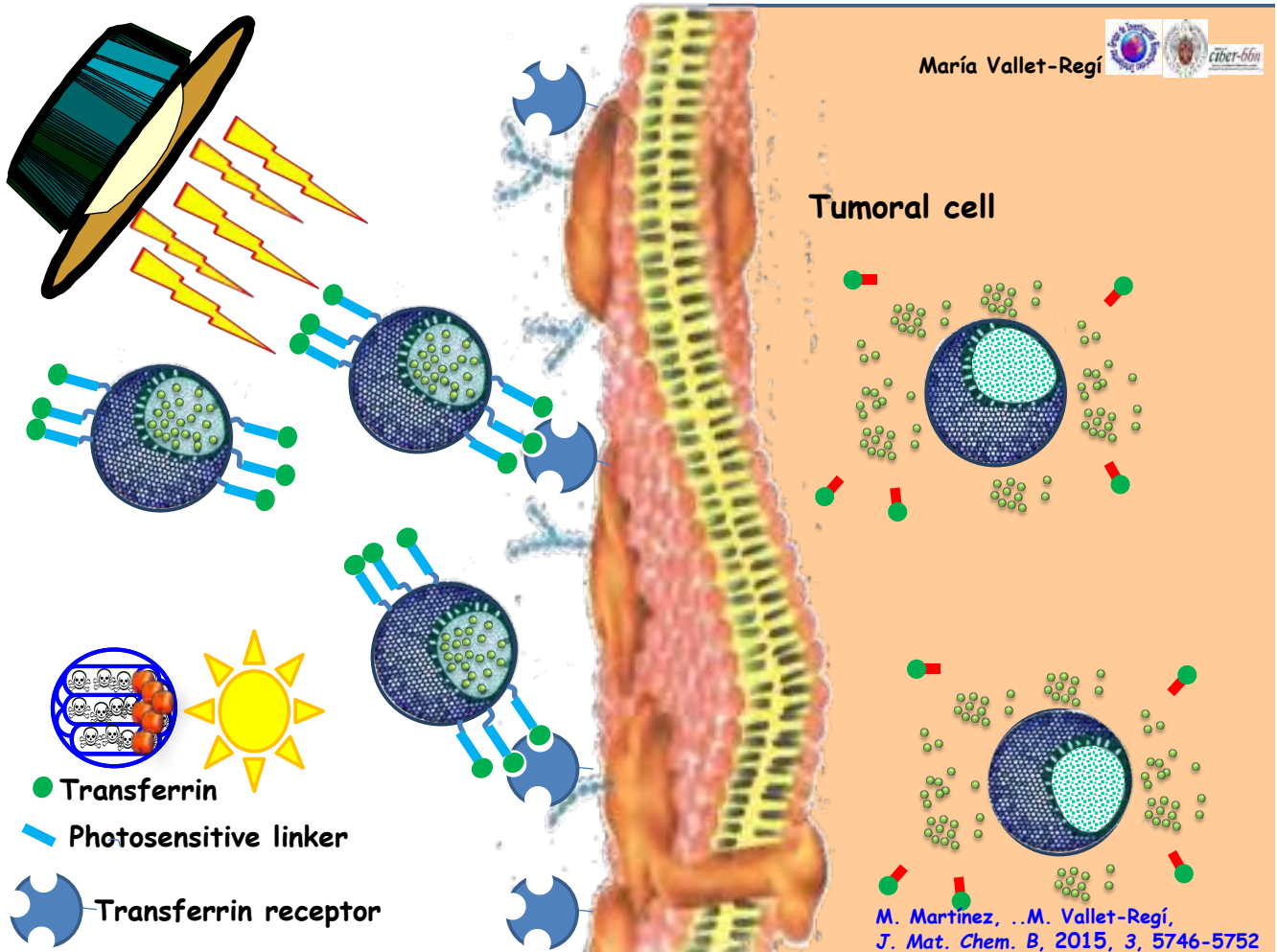
Complementary DNA strands

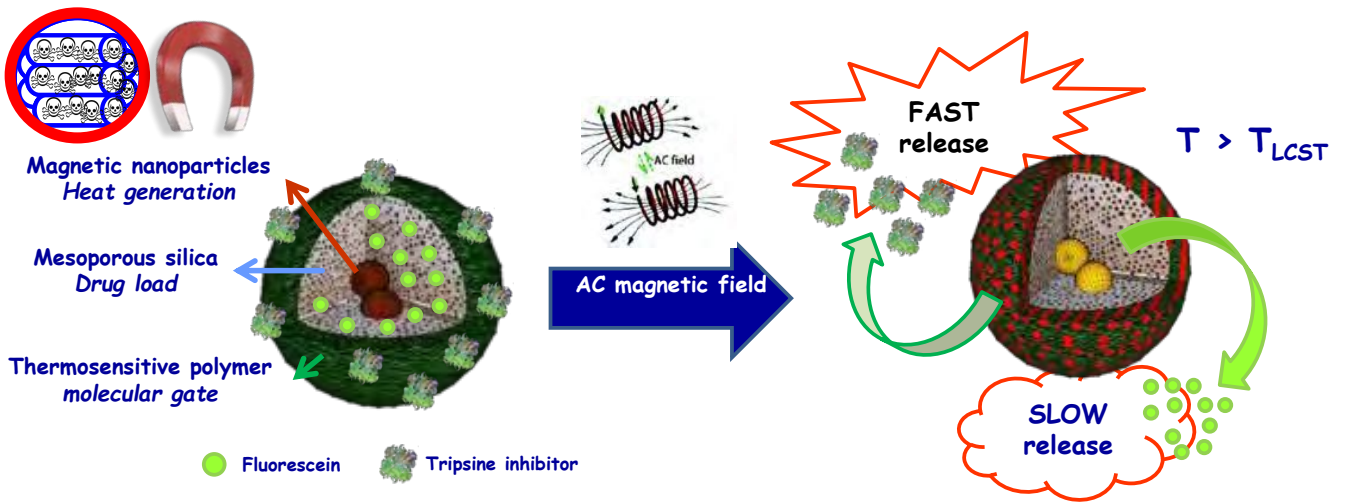
Thermal response: gating mechanism and dosing



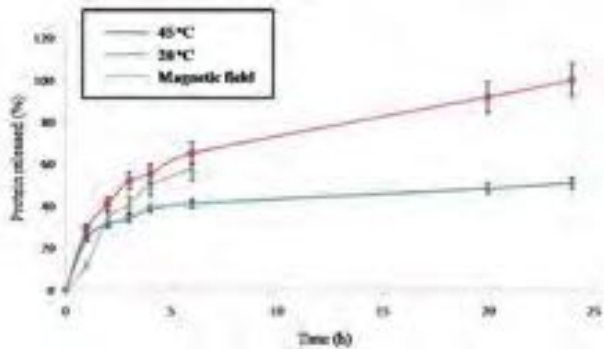
María Vallet-Regí

E. Ruiz. A. Baeza. M. Vallet-Regí. *ACS Nano* 2011, 5(2) 1259-1266

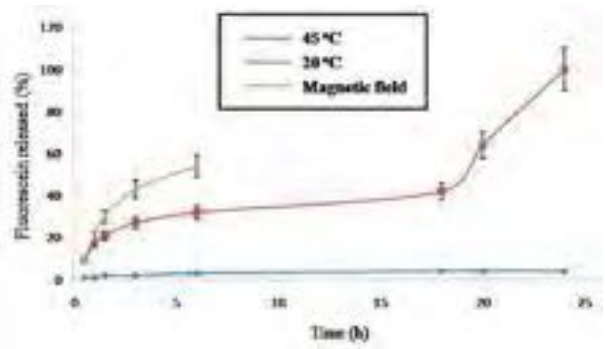




Trypsin inhibitor release: fast release



Fluorescein release: slow release

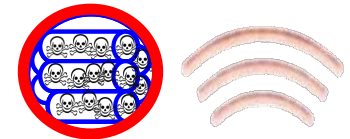


María Vallet-Regí

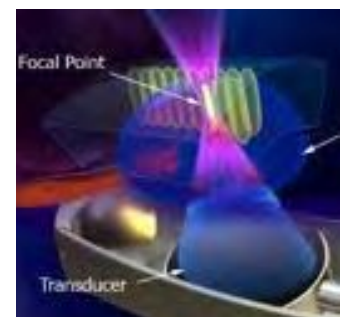
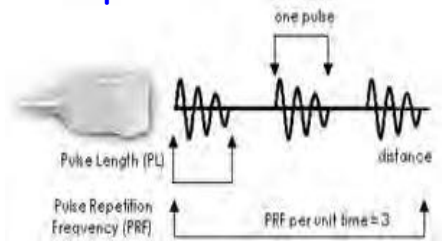
Baeza, A.; Guisasaola, E.; Ruiz-Hernández, E.; Vallet-Regí, M. *Chem. Mater.* 2012, 24 (3), 517-524

Ultrasound

Mechanical waves of frequency >20 kHz.

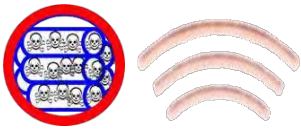


Diagnostic US: 3.5-30 MHz
Therapeutic US: 0.1-5 MHz

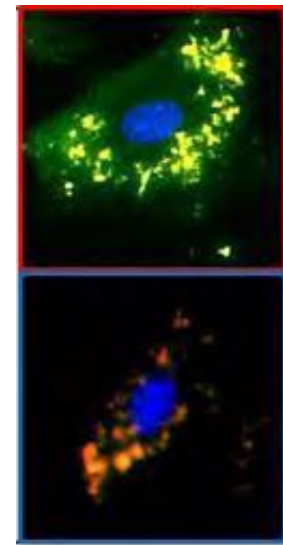
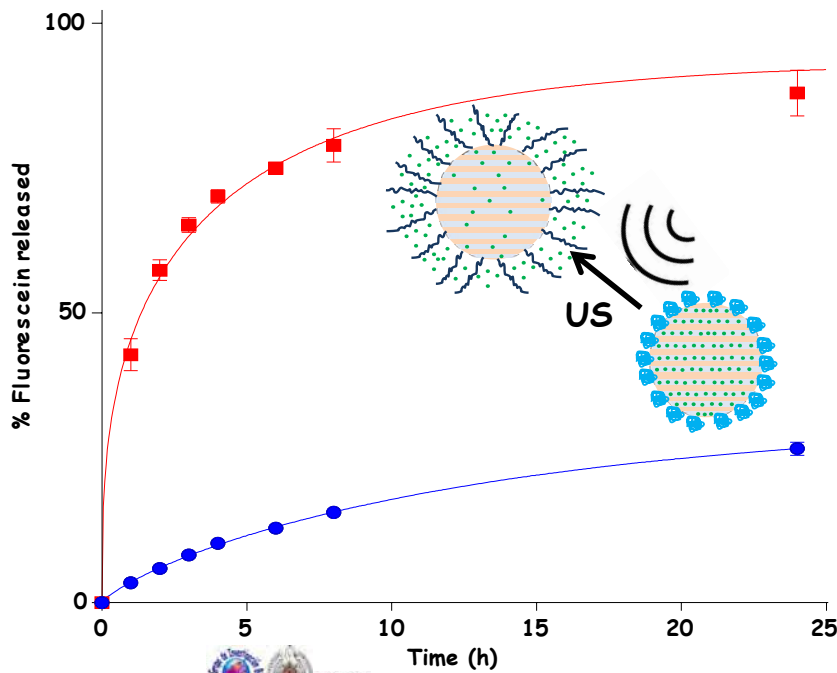
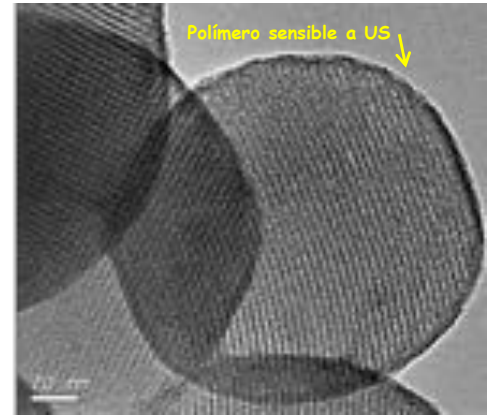


María Vallet-Regí

J.L. Paris, M. Manzano, M.V. Cabañas, M. Vallet-Regí *Nanoscale*. 2018



Ultrasounds

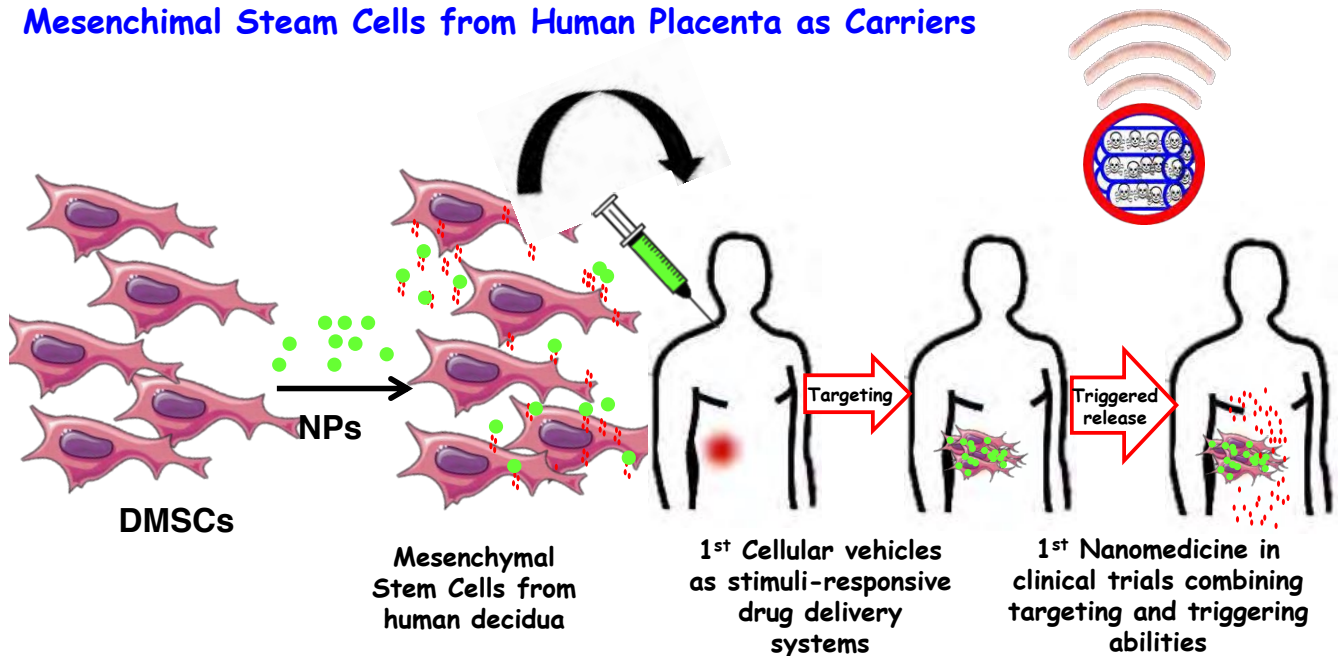


María Vallet-Regí



J.L. Paris, M. V. Cabañas, M. Manzano, and M. Vallet-Regí, *ACS Nano* 2015.

Mesenchymal Stem Cells from Human Placenta as Carriers



J.L. Paris, P. de la Torre, M. Manzano, M.V. Cabañas, A.I. Flores and M. Vallet-Regí, *Acta Biomater.* 2016, 33, 275-282.

María Vallet-Regí

