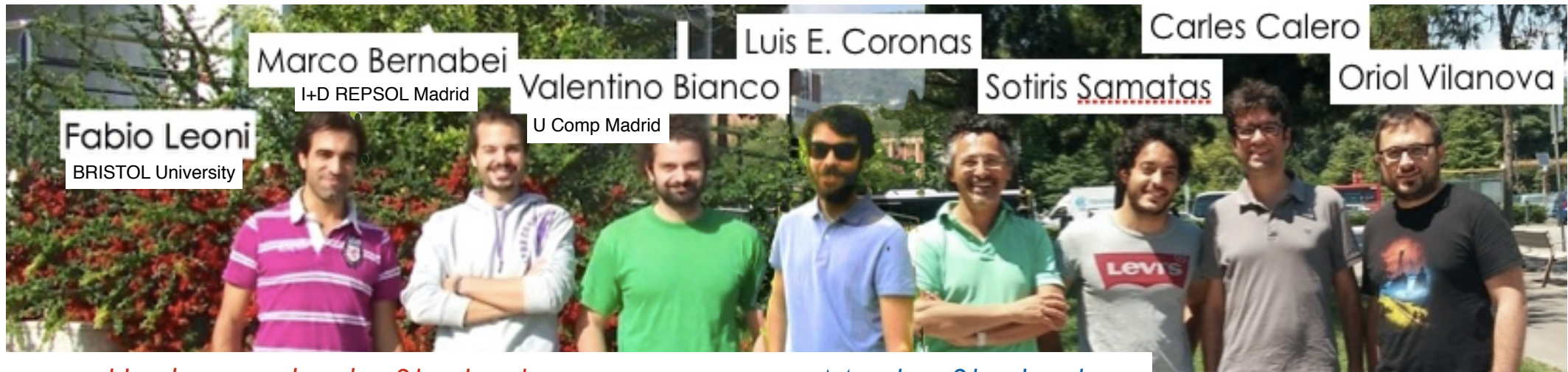


From Nanomaterials to Perspectives for Brain Cancer Treatments

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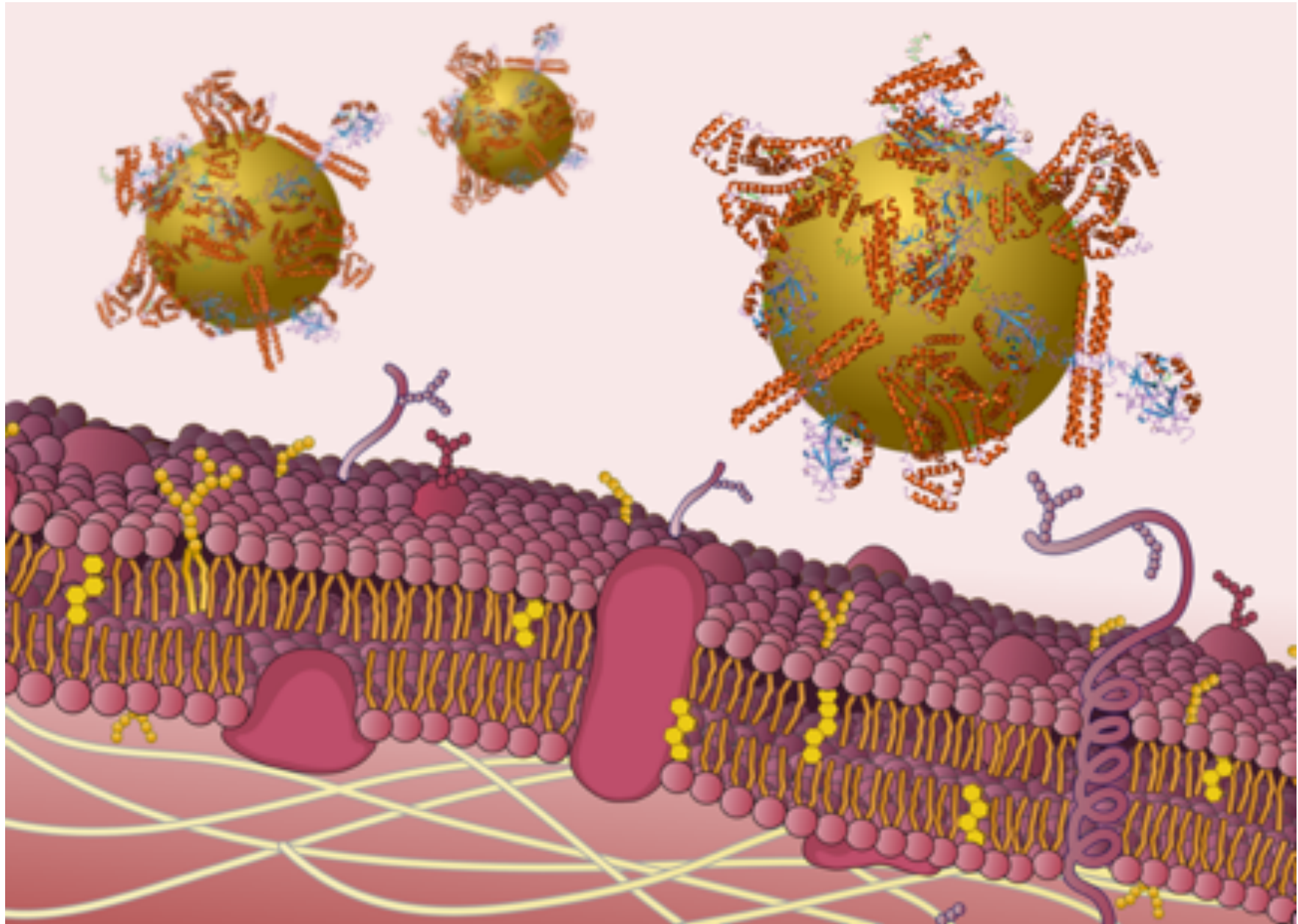
Institut de Nanociència
i Nanotecnologia



Generalitat
de Catalunya

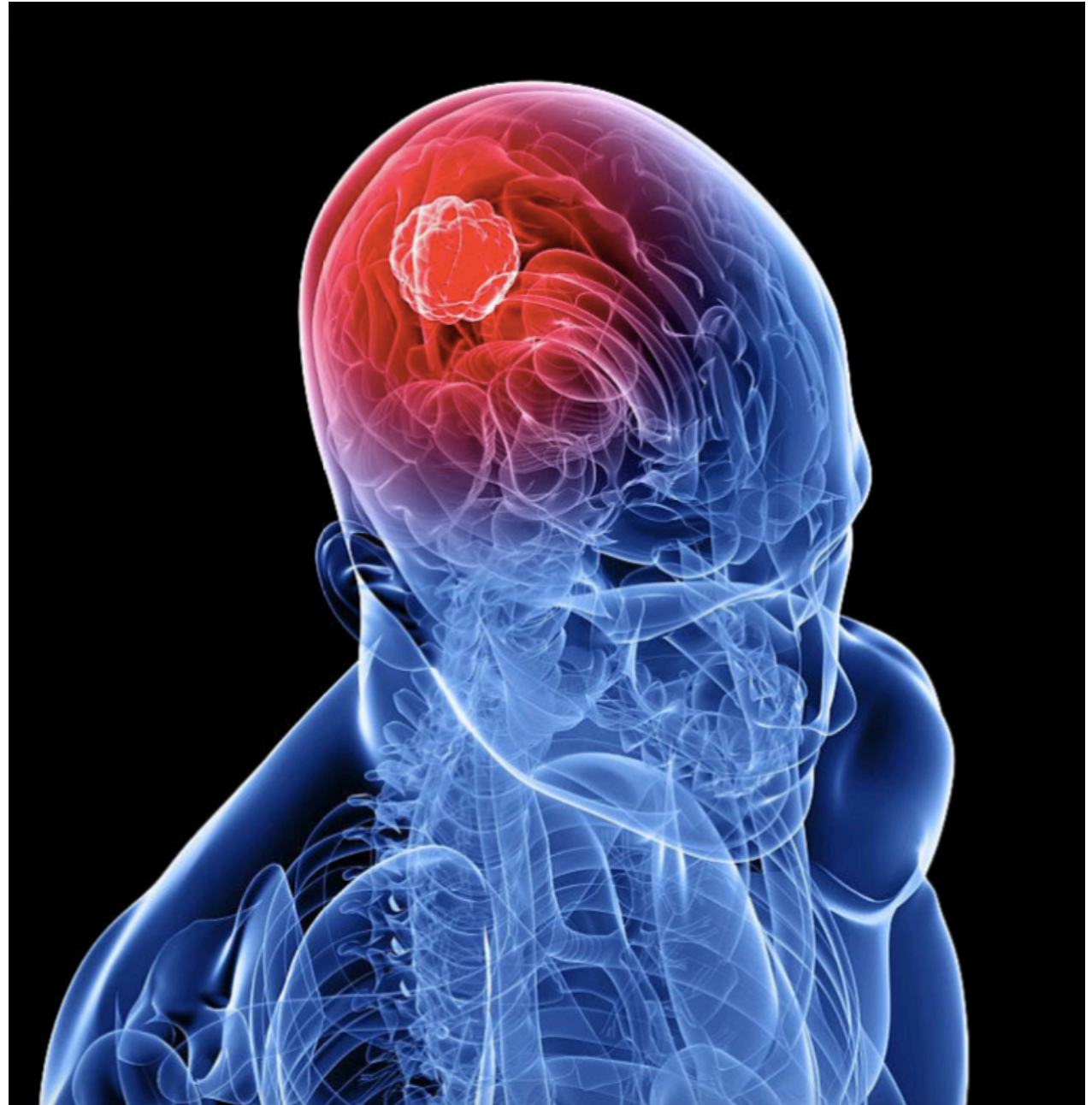
Agència
de Gestió
d'Ajuts
Universitaris
i de Recerca
AGAUR

SUMMARY

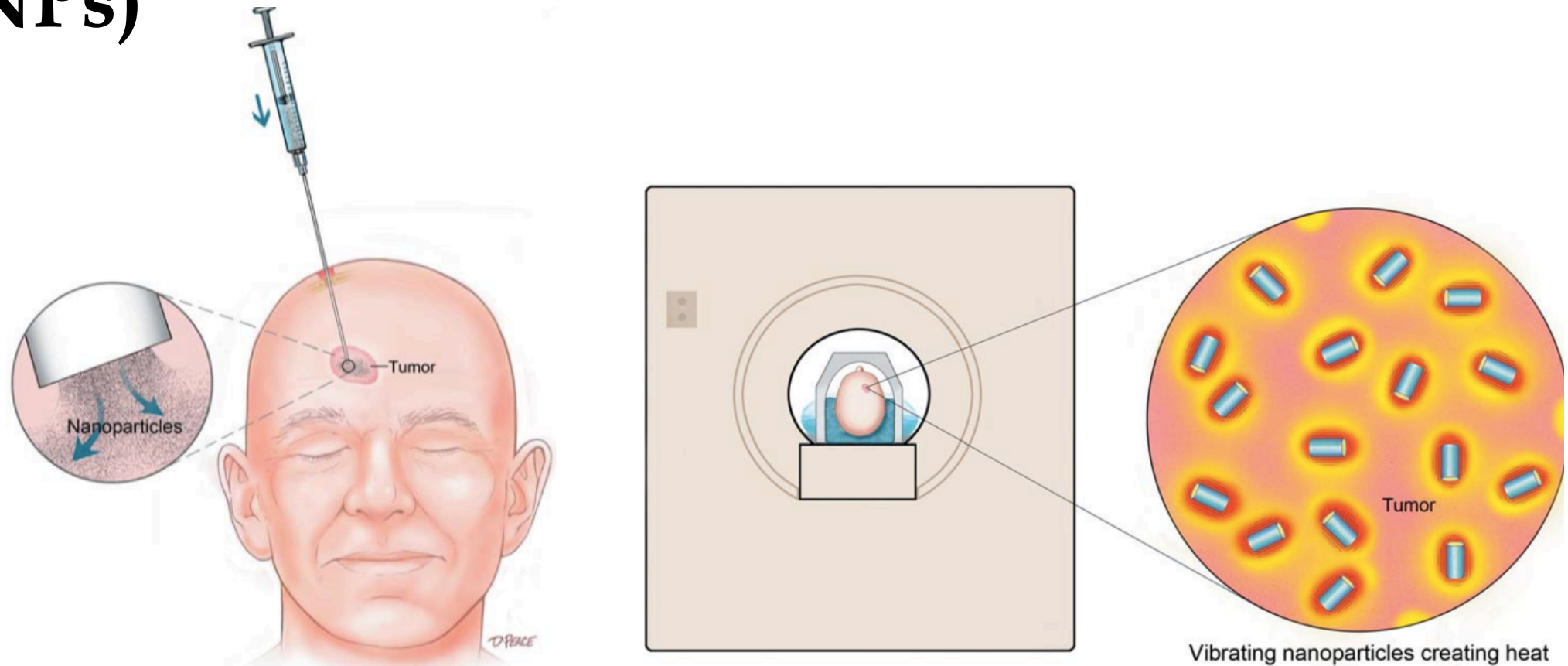


Glioblastoma Multiforme: Lethal in 6 months

Treated with
Chemiotherapy
+
Radiotherapy
+
Thermal ablation with
Nanoparticles:
increases the Overall
Survival to
15 months

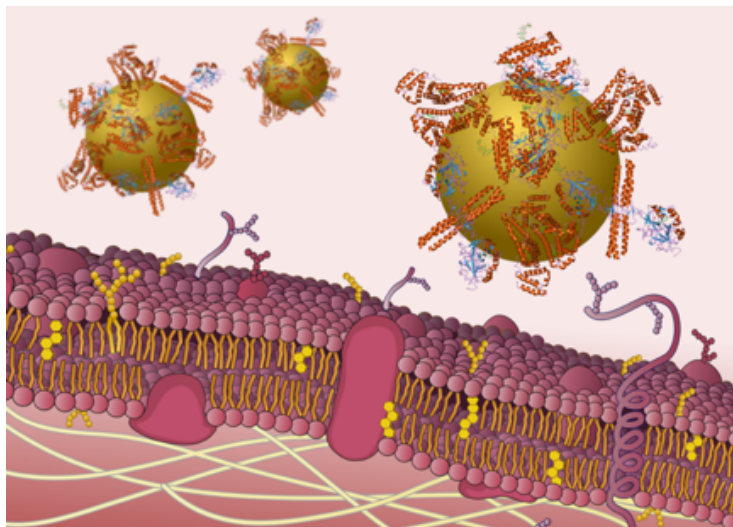
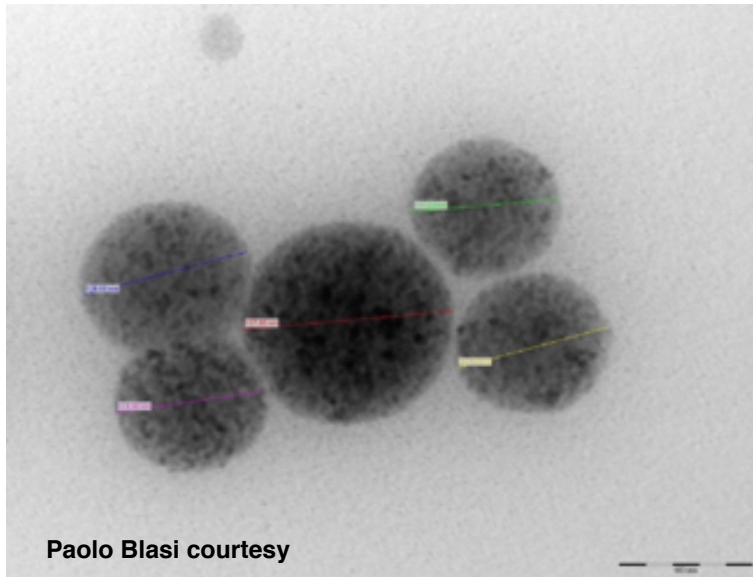


Thermotherapy is invasive and possible only for accessible tumors (Iron Oxide NPs)

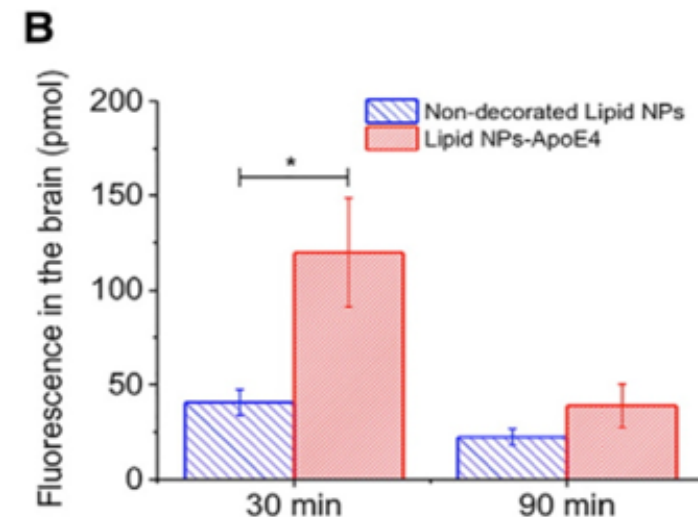
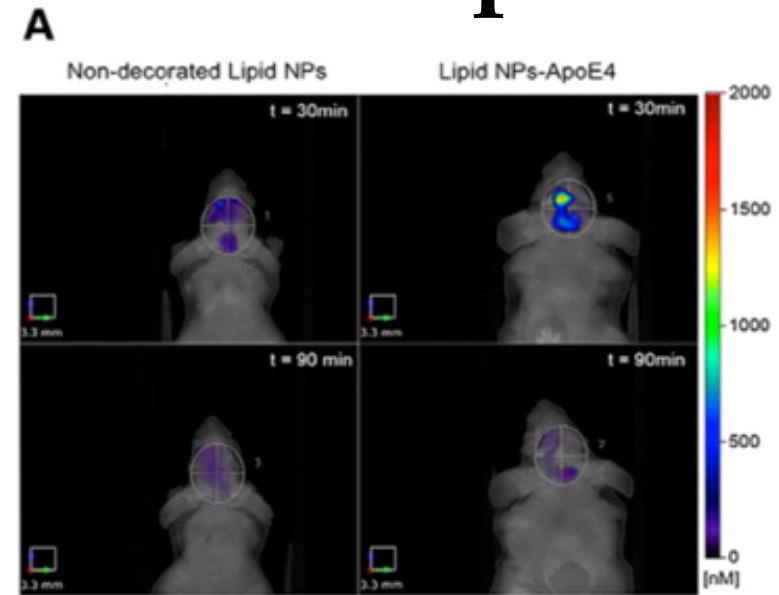


Titworth *et al*: ANTICANCER RESEARCH 34: 565-574 (2014)

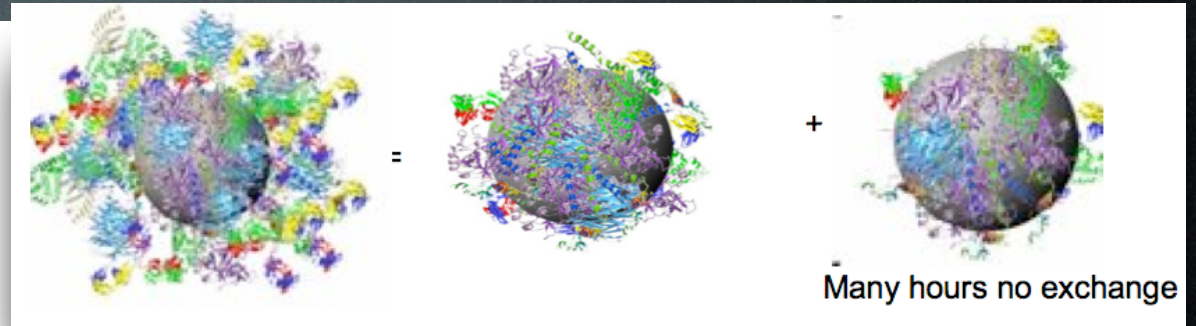
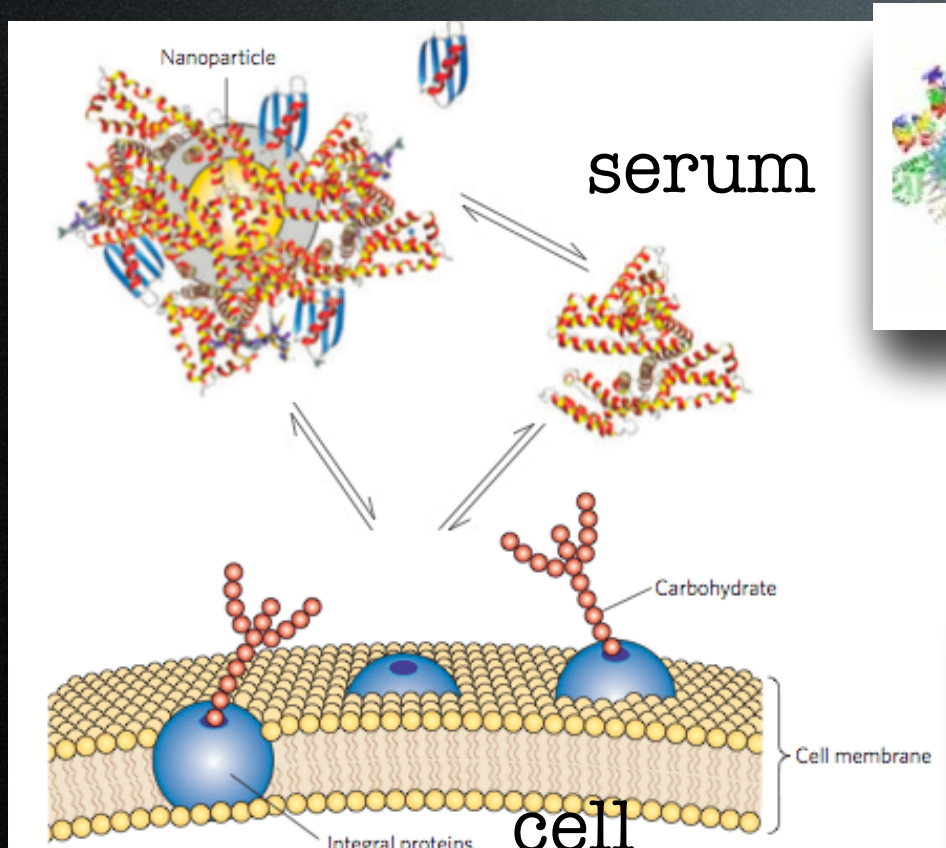
Intravenous or intratracheal administration Iron Oxide NPs encapsulated in lipid NPs?



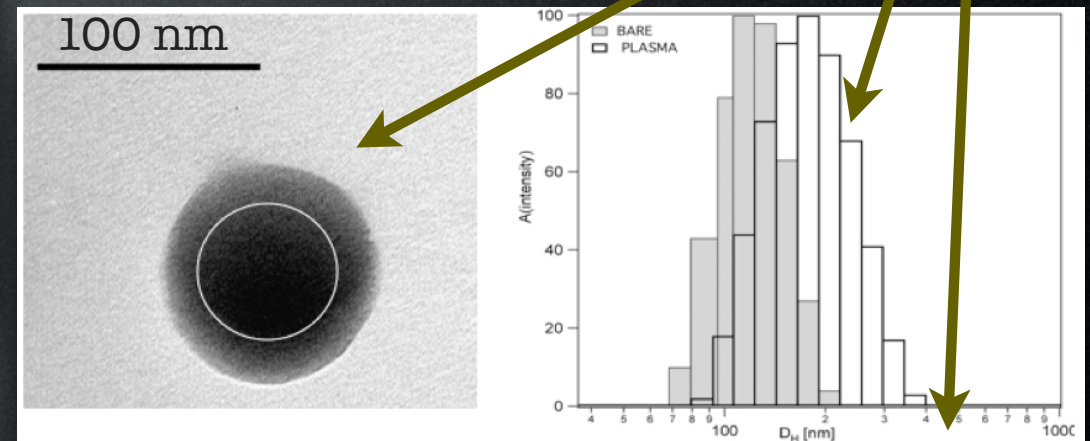
ApoE
precoating
increases
BBB
crossing



Protein Corona



Complete corona = Dynamic corona + Hard corona



Stable: characterizes the uptake

I. Lynch, & K. A. Dawson, Nano Today 3, 40 (2008)

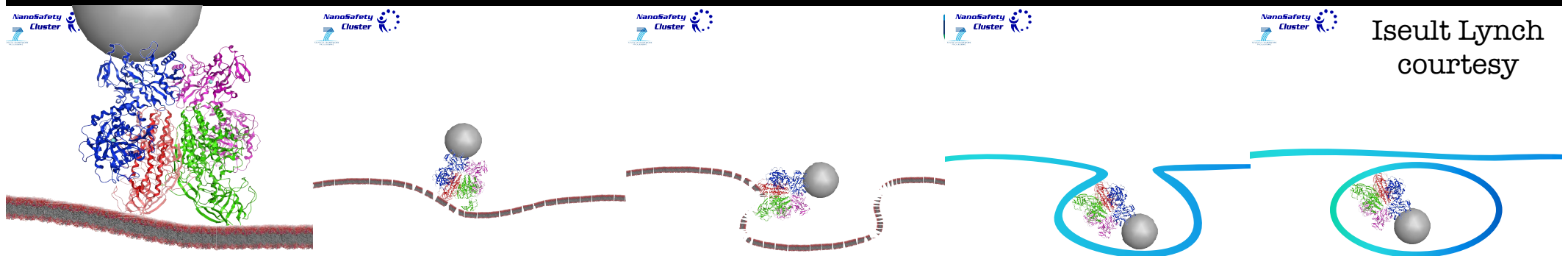
I. Lynch, A. Salvati & K. A. Dawson, Nature Nanotechnology (2009)

D. Walczyk, F.B. Bombelli, M.P. Monopoli, I. Lynch & K. A. Dawson JACS 132, 5761 (2010)

How the Protein Corona affects the cell barrier crossing?



?

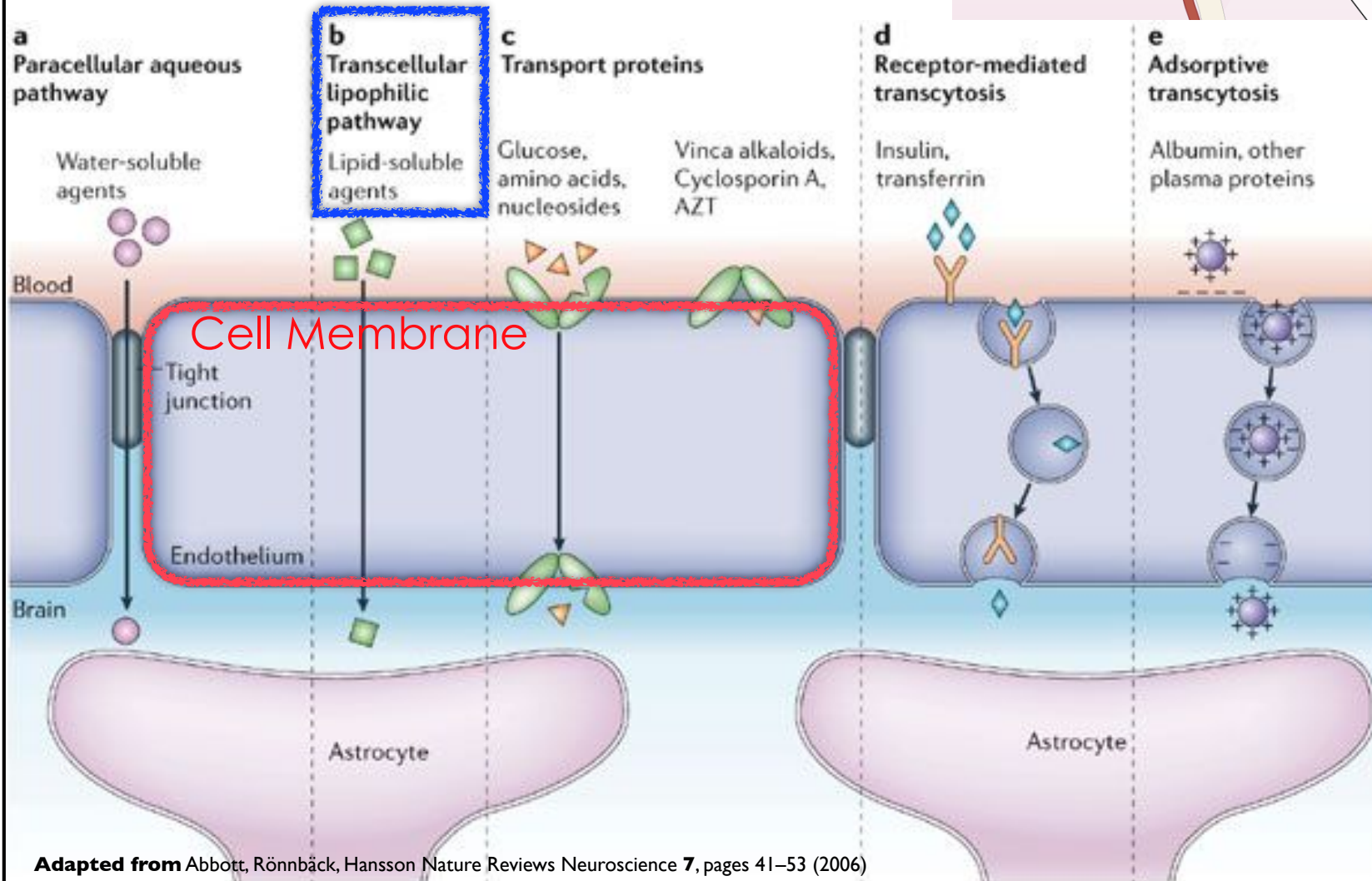
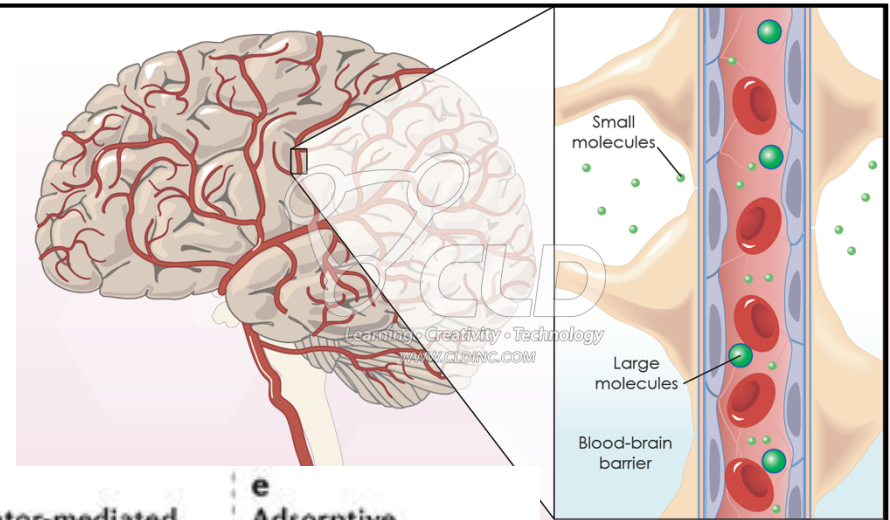


Iseult Lynch
courtesy

First step: understanding
the Protein adsorption
(kinetics, composition, ...)

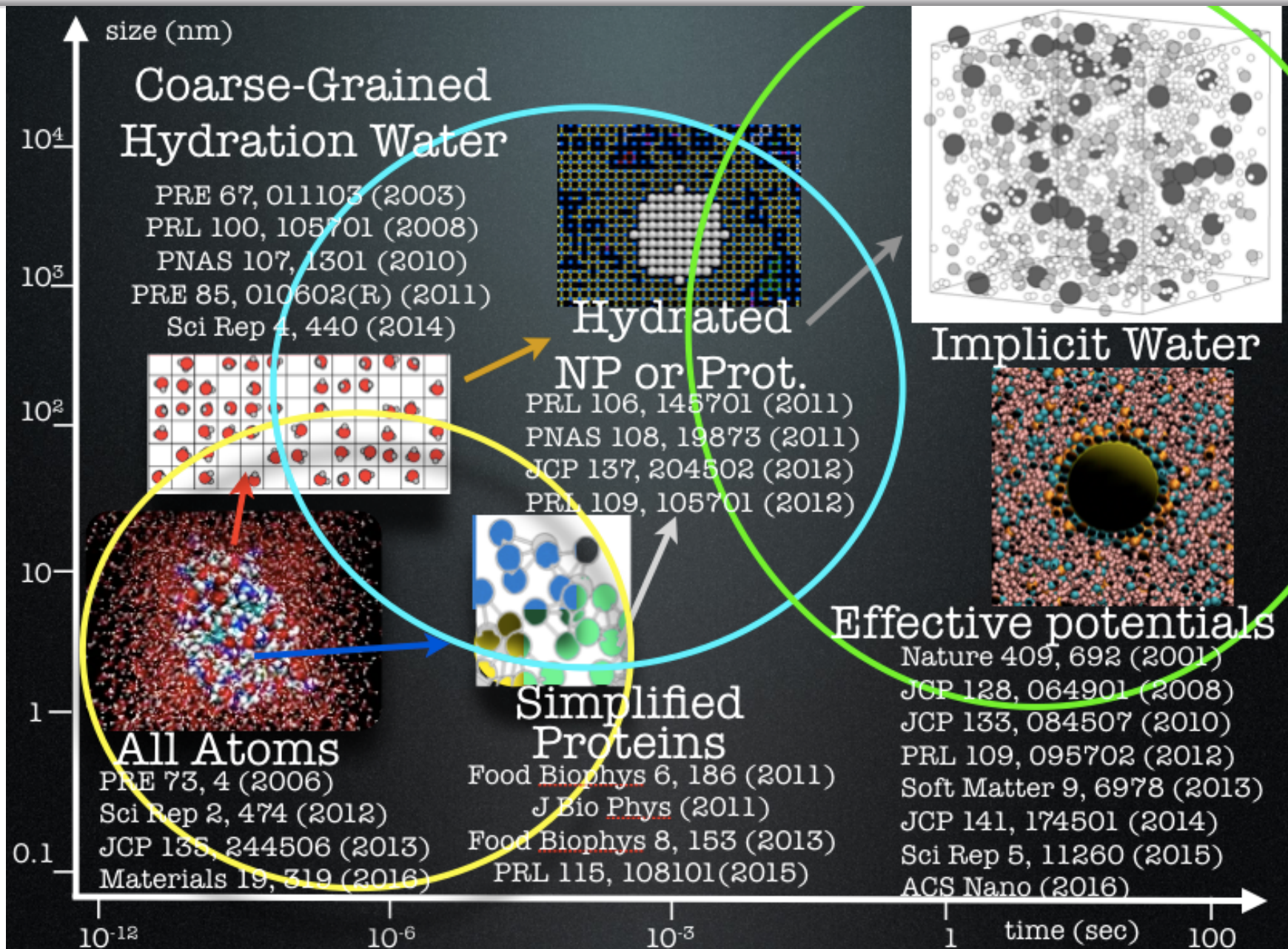
How to model the NP-corona—BBB interaction?

most CNS drugs enter via route **b**

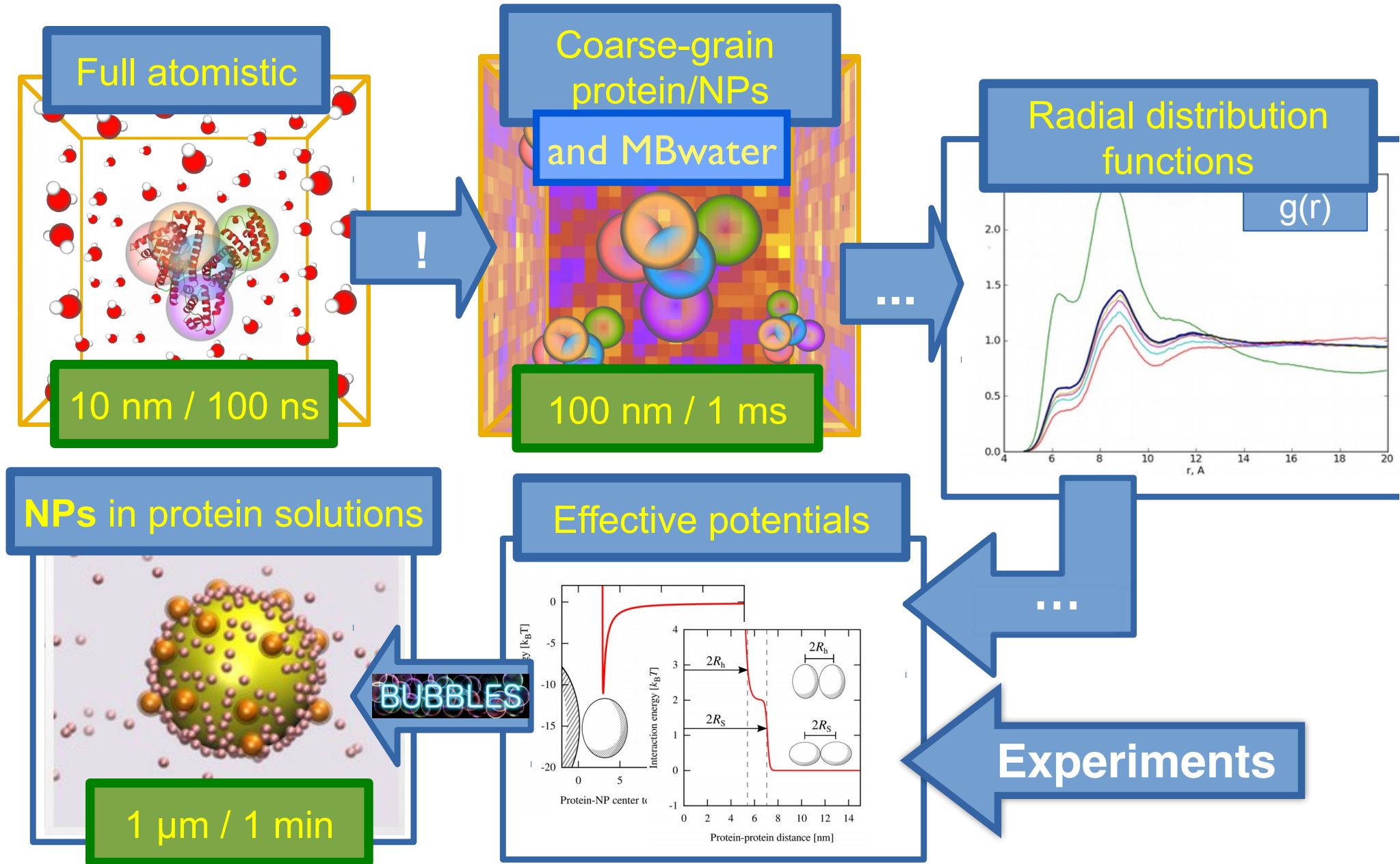


Blood
Brain
Barrier

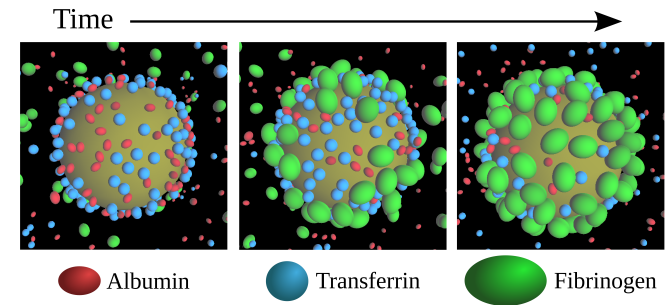
Our approach: Multi-scale modeling



Multi-scale approach for Proteins & Nanoparticles



TAKE HOME MESSAGE



- With our software/theory we can **predict** the **multicomponents NP-protein corona kinetics & composition from ns to hours** using basic data from **experiments of monocomponent** solutions.
- We find:
 - **Memory Effect** (irreversible degeneration of adsorbed proteins)
 - **Size Effect** (Protein corona changes with NP-size)
 - **Near the membrane the milieu is “colder” than ~2nm away**, with possible effects on (i) stability of NP protein-corona and (ii) NP-membrane interaction, relevant for BBB-crossing.

We look for collaborations with oncologists / genetists / immunologists / biotechnologists / ...

REFERENCES AND FURTHER INFORMATION:

<http://www.ffn.ub.es/gfranzese>

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