

THE NANOPARTICLE TOOL BOX FOR MEDICINE

NANOMEDICINE

i.- SERVICES PROVIDED BY NPs:

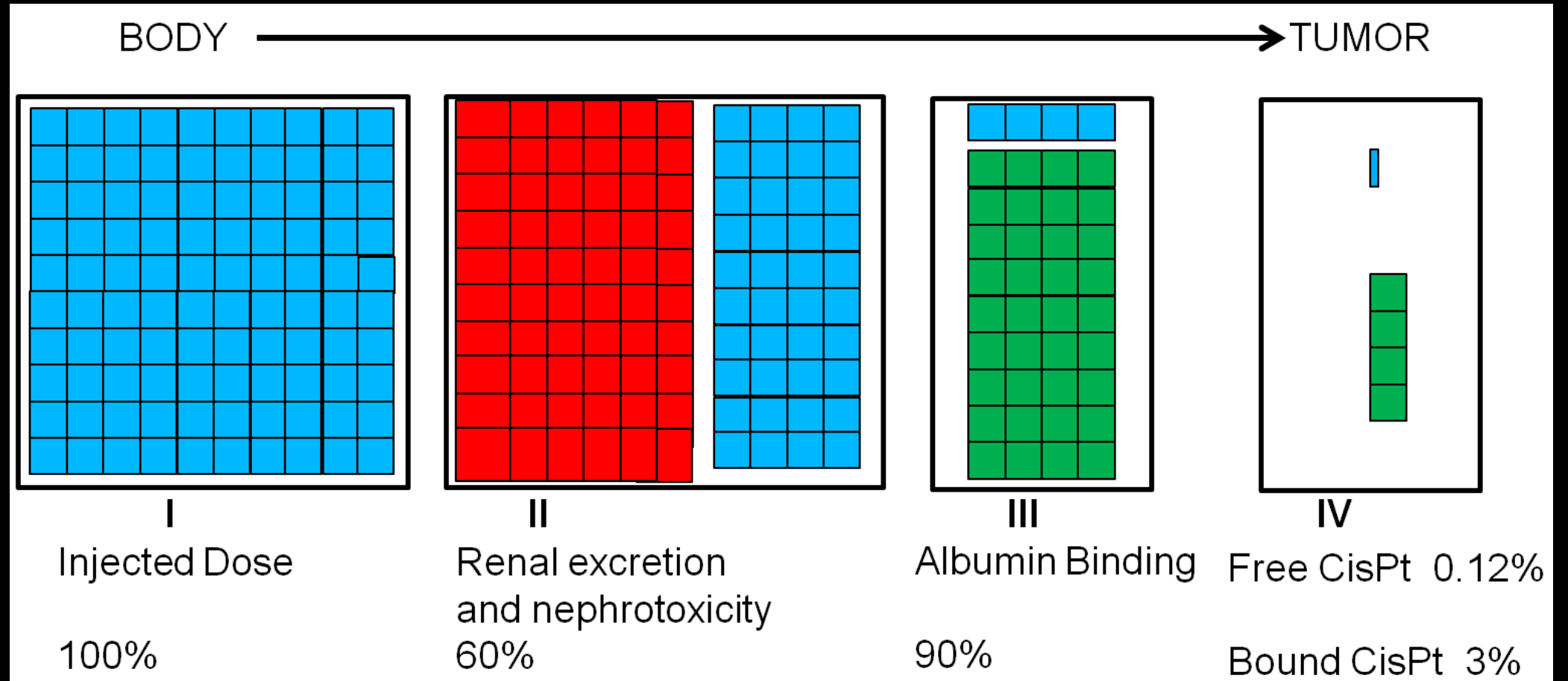
- Drug Delivery**
- Radiomedicine**
- Antigen Presenter**
- Active Principle**

ii.- NP EVOLUTION IN PHYSIOLOGICAL MEDIA. NANOPHARMACOKINETICS (nADME).

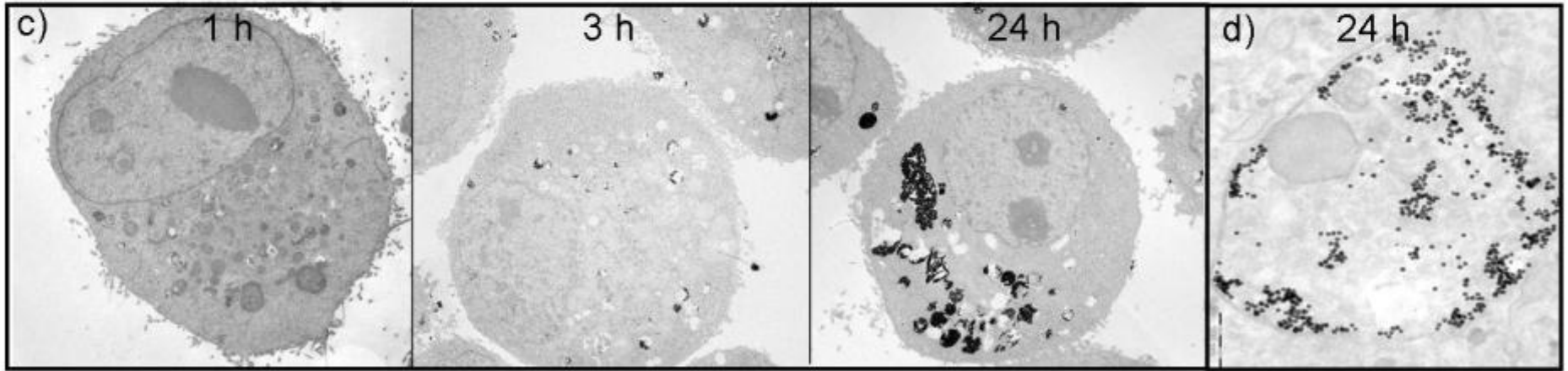
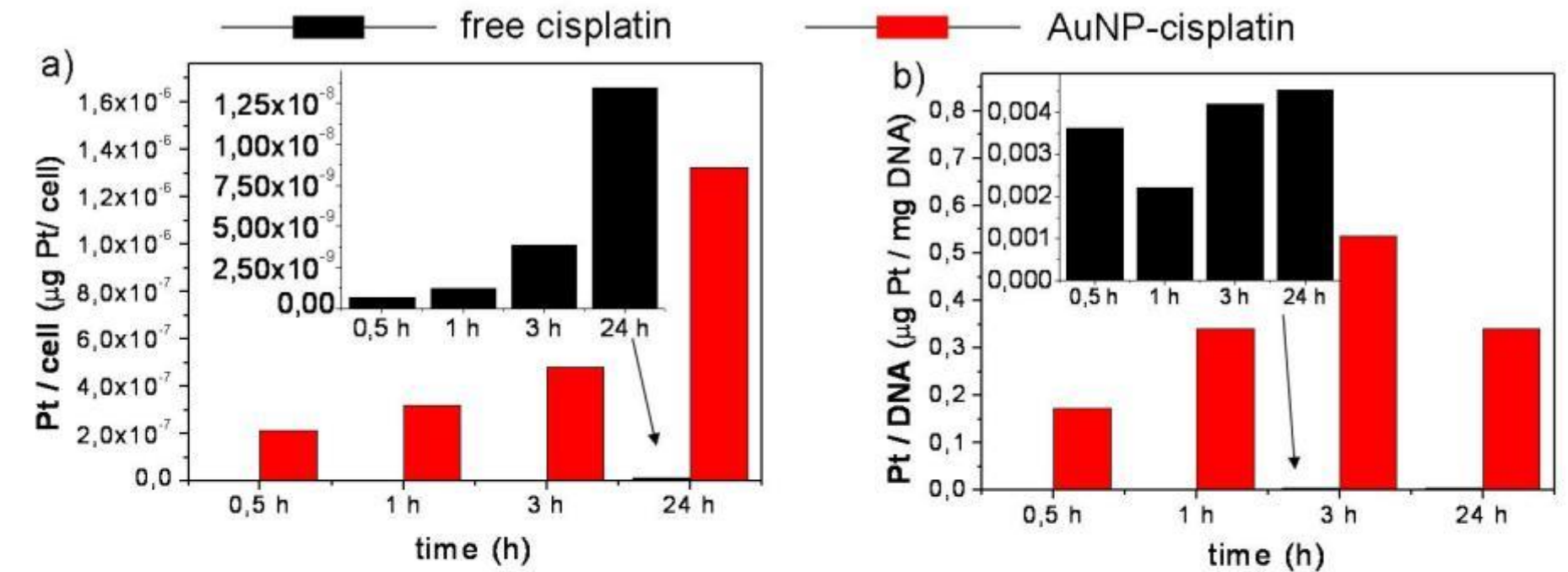
iii.- NANOIMMUNOLOGY

1.- NANOPARTICLES FOR DRUG DELIVERY

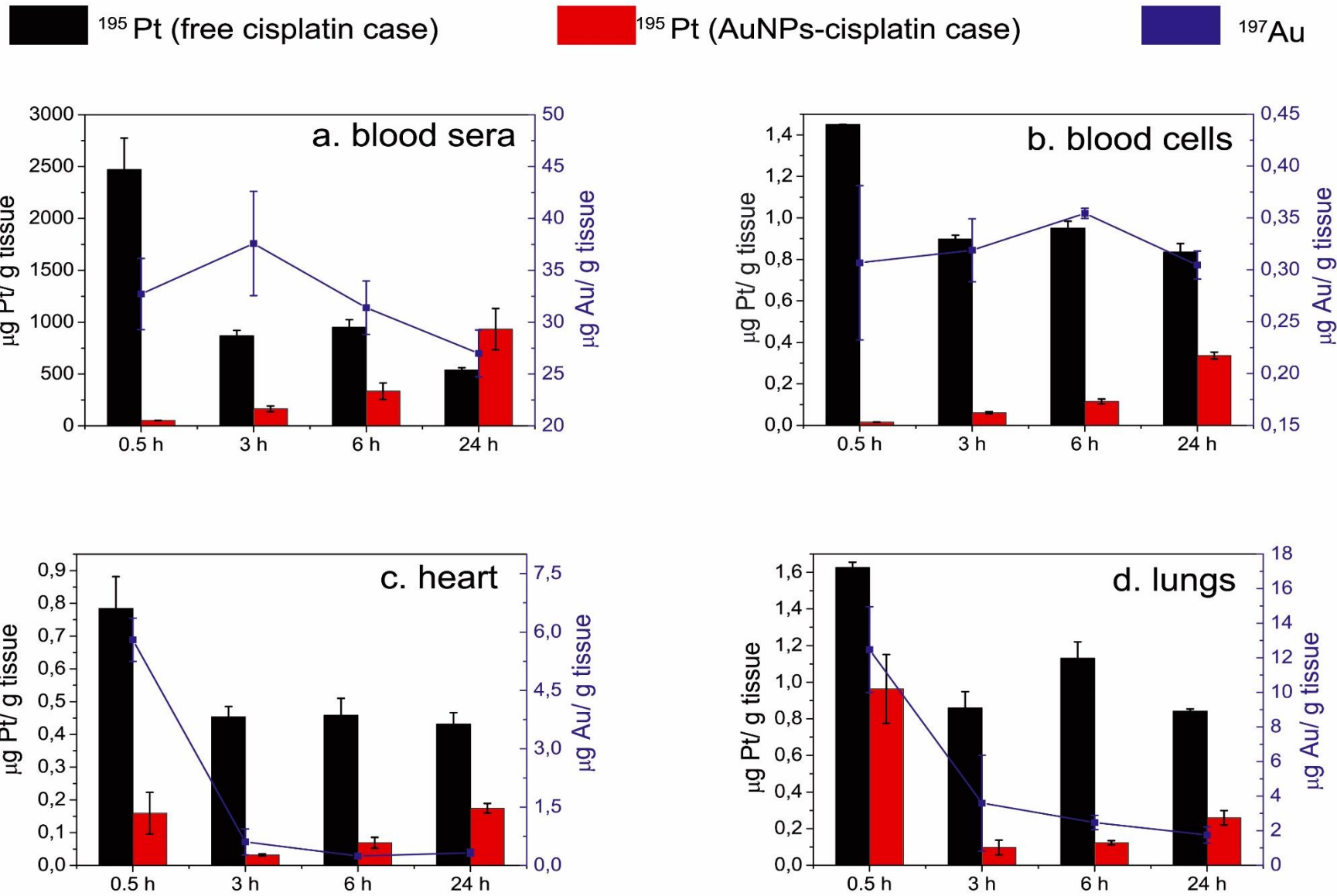
CHAPTER 1 DRUG DELIVERY. THE CASE OF CISPLATIN



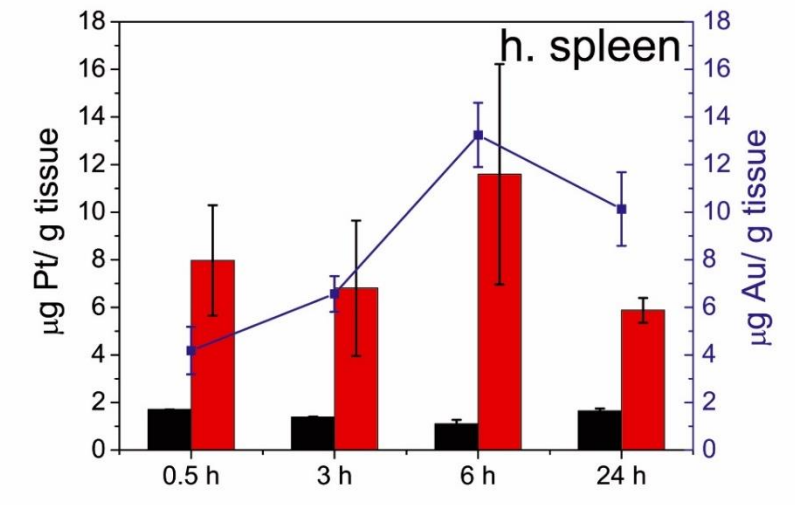
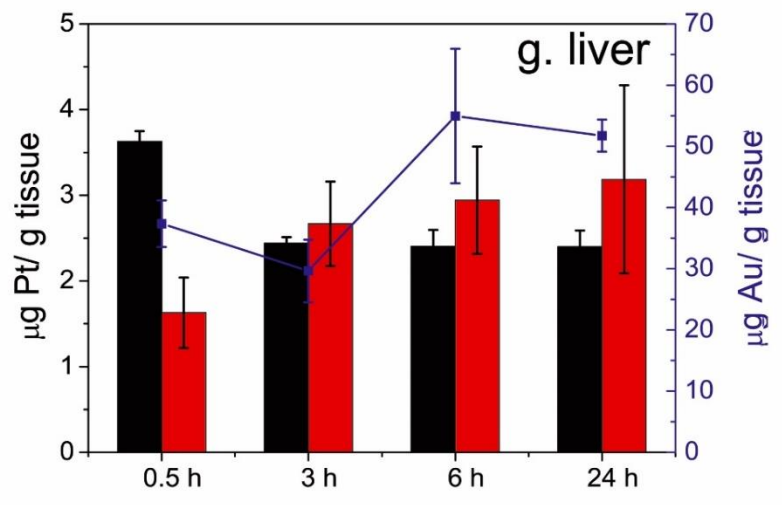
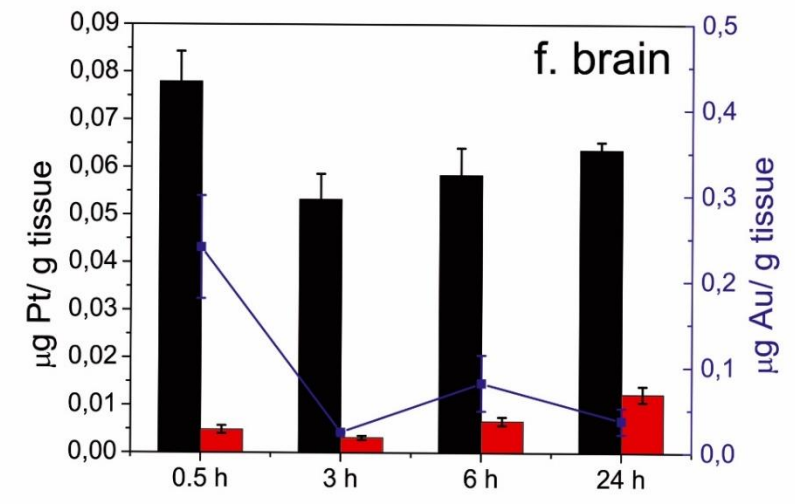
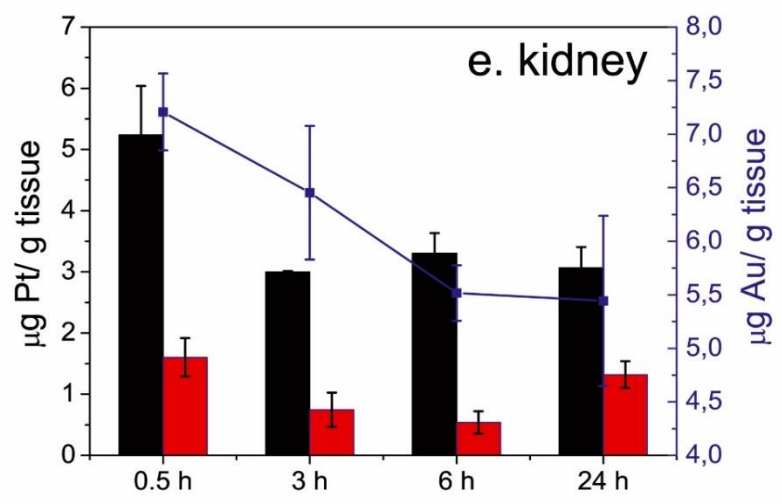
Pt CELL AND DNA ACCUMULATION.



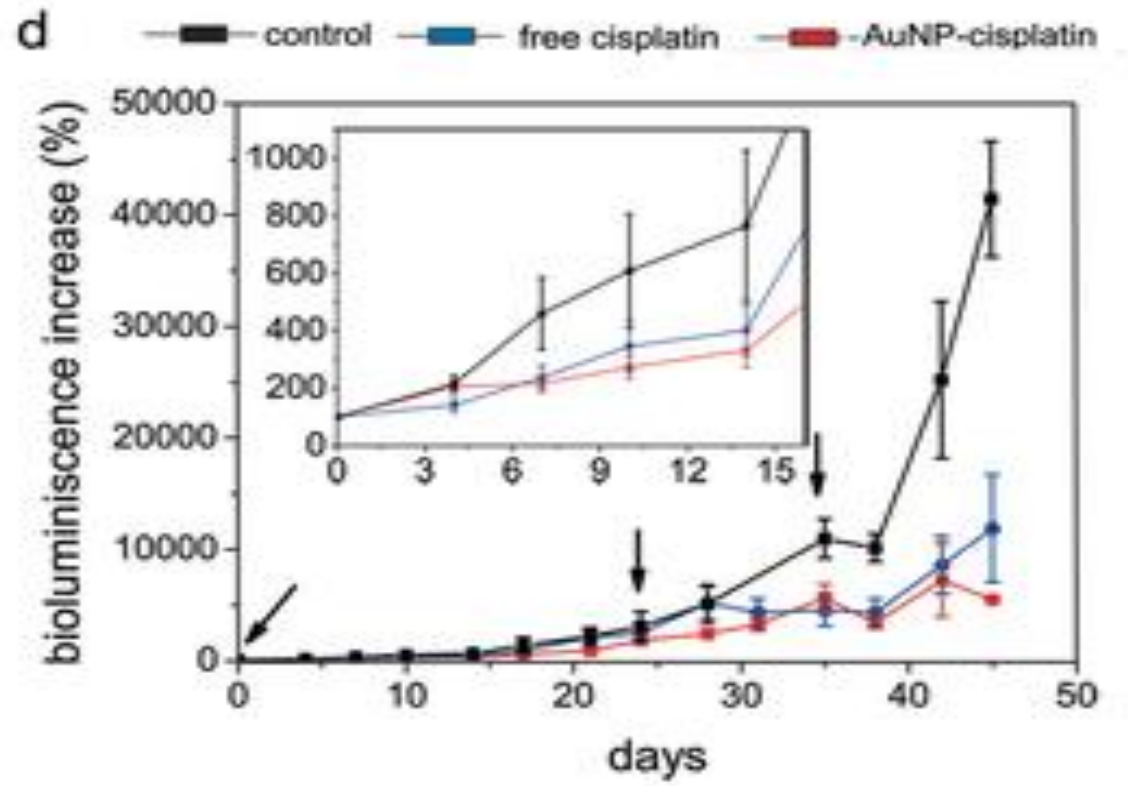
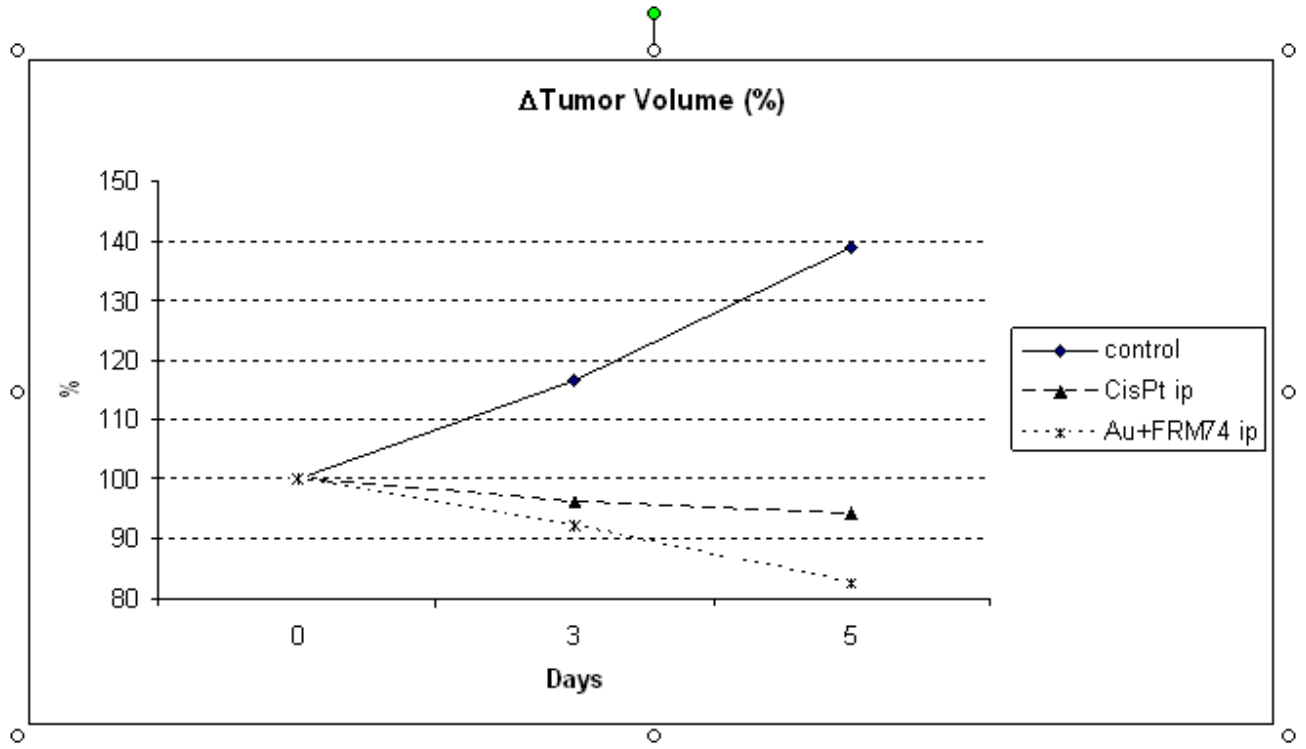
BIODISTRIBUTION IN MICE



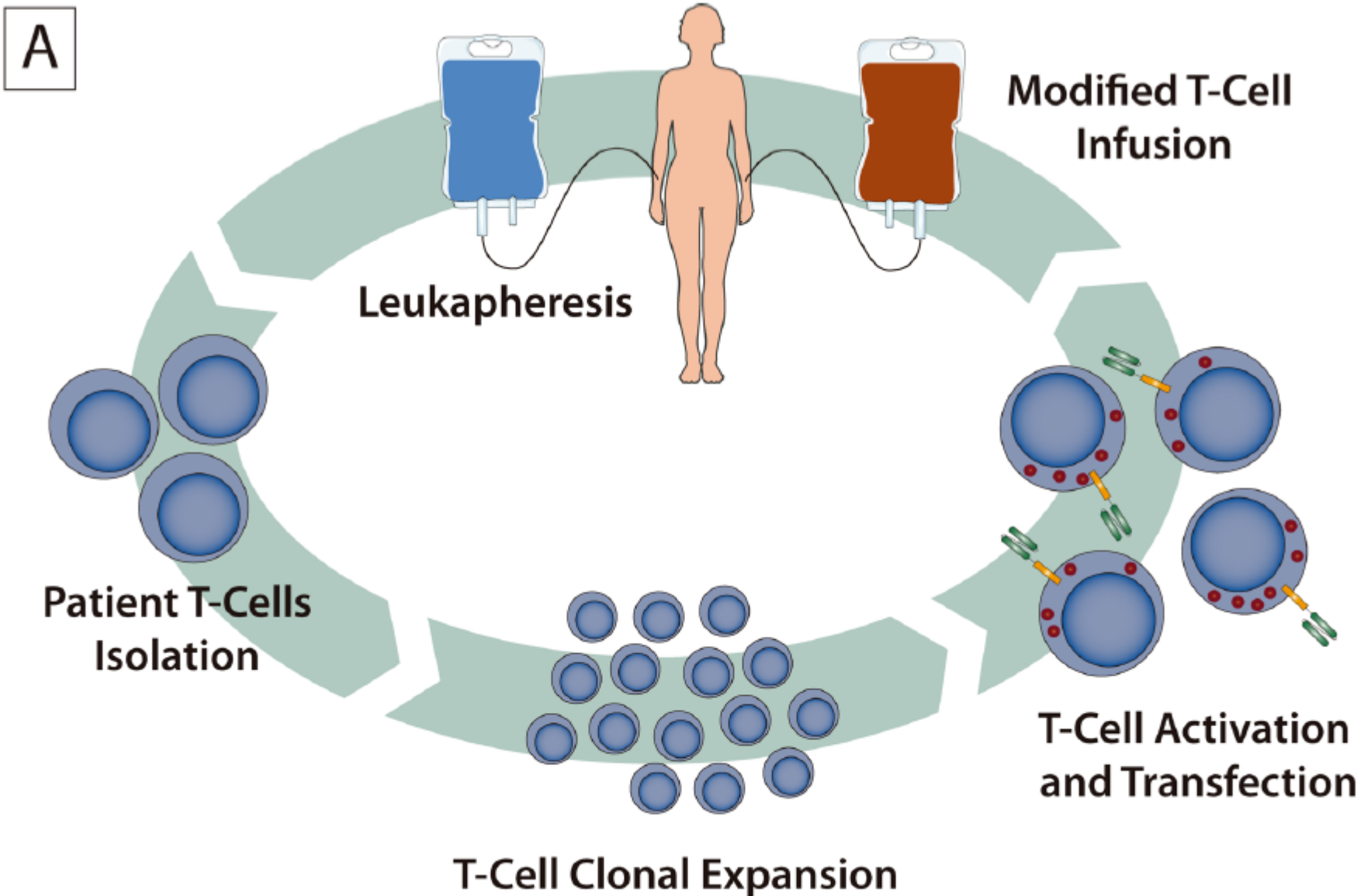
BIODISTRIBUTION IN MICE



AuNP- cisPt TUMORAL EFFECTS



NON-VIRAL VECTOR FOR mRNA CAR T CELL THERAPY



SAFE NON-VIRAL VECTOR FOR OLIGONUCLEOTIDES THERAPY

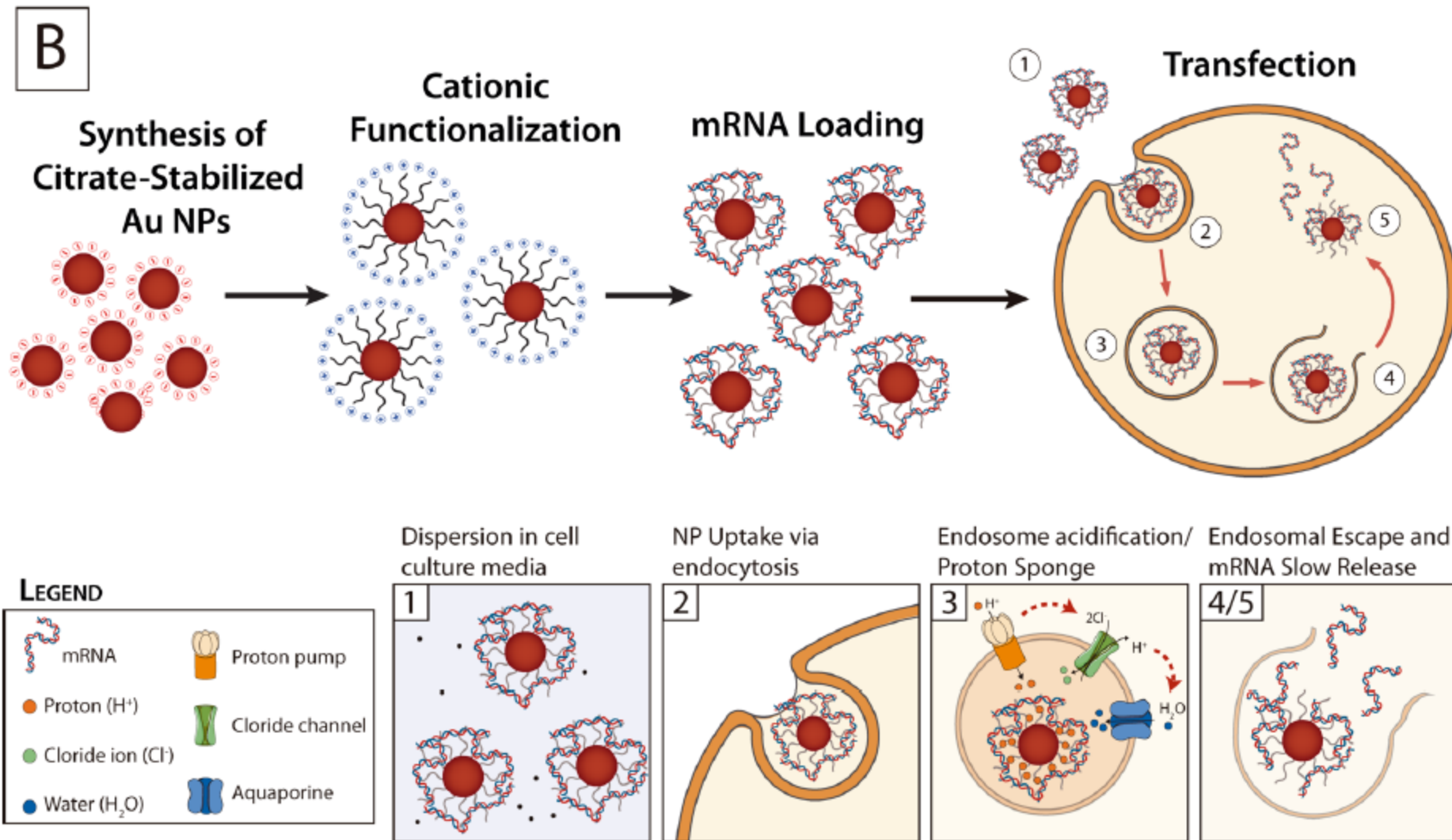
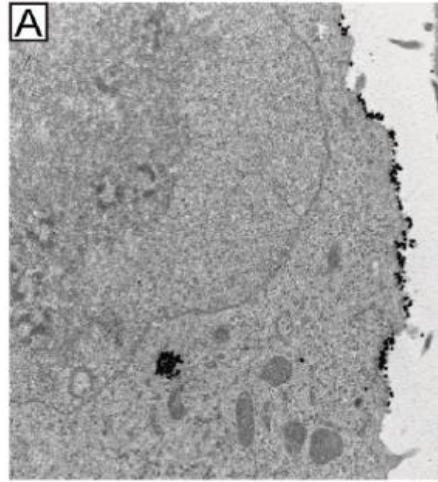


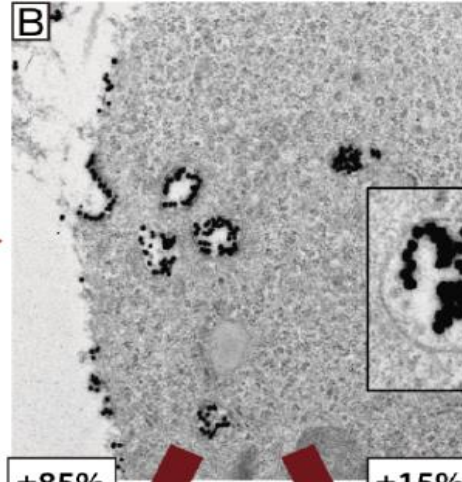
Figure 2.2. (A) CAR T-Cell manufacturing process, based on non-viral nanoparticle mRNA transfection. First,

NON-VIRAL VECTOR FOR TRANSFECTION

Cell Membrane



Endosome Formation

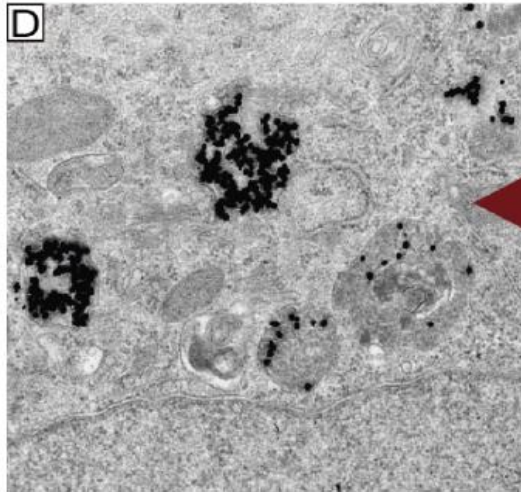


$\pm 85\%$

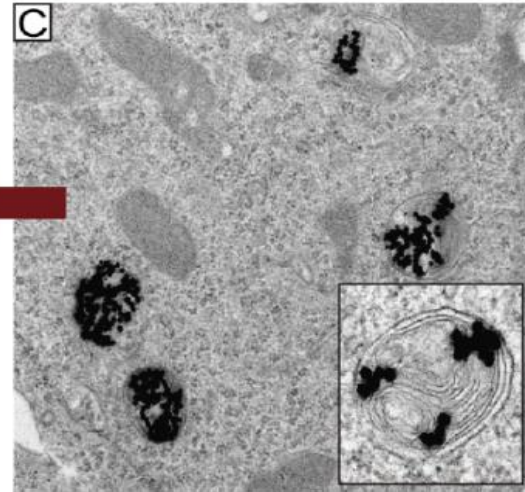
$\pm 15\%$



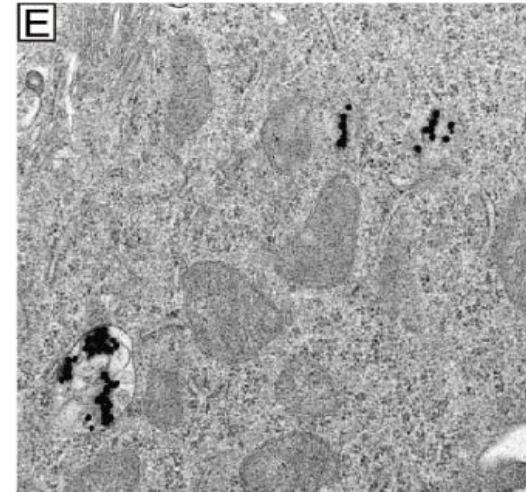
Lysosomes



Amphisomes



Cytoplasm Dispersion



NON-VIRAL VECTOR FOR TRANSFECTION

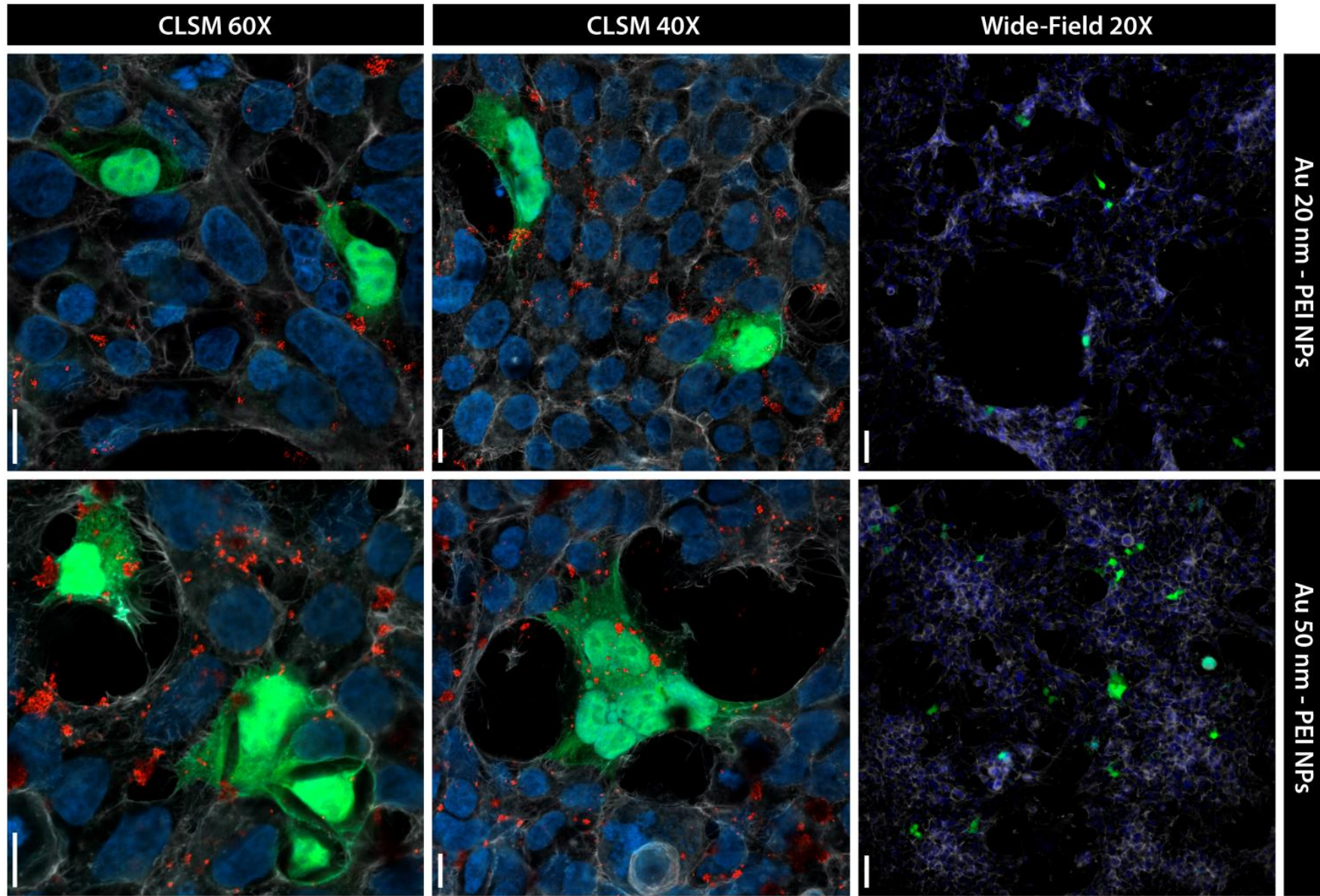


Figure 2.25. Wide-Field Fluorescence and Confocal Imaging of mRNA-GFP Transfected HEK293 cells.

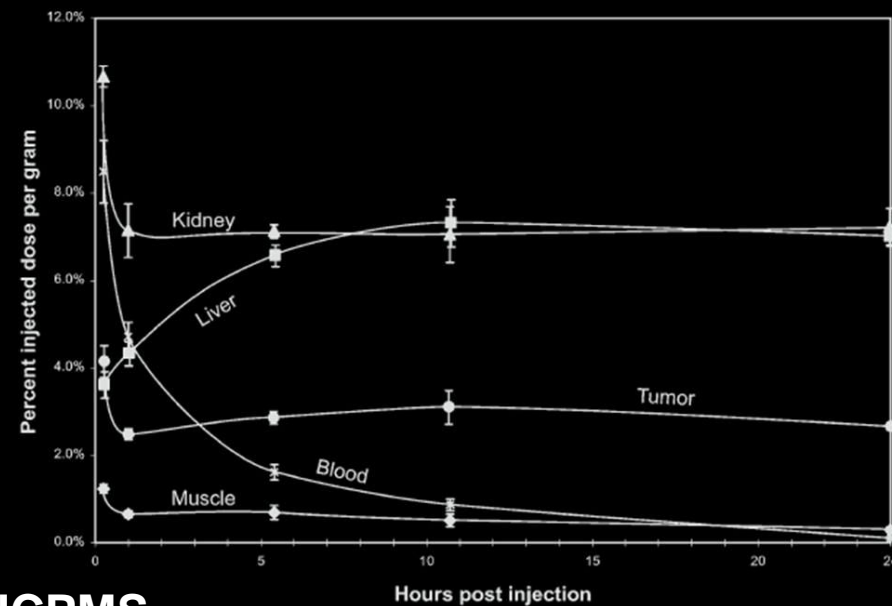
2.- NANOPARTICLES AS CONTRAST AGENTS.

CHAPTER 2 RADIOMEDICINE. IMAGING CONTRAST AGENTS



FLUORESCENCE

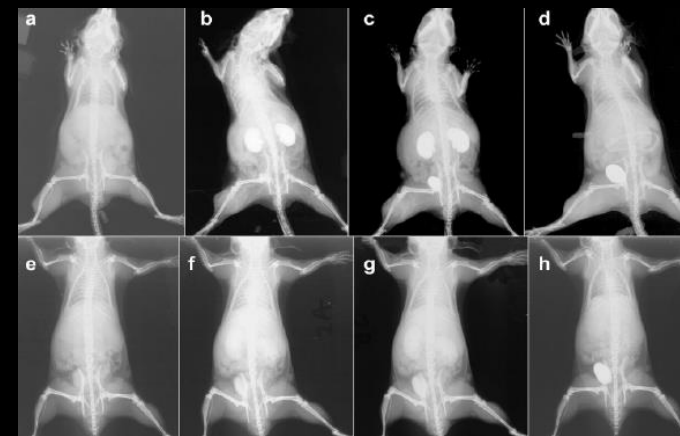
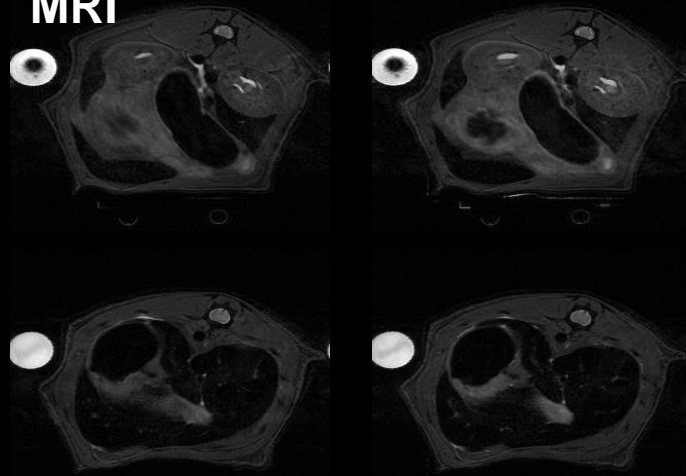
Short communication: Gold nanoparticles



ICPMS



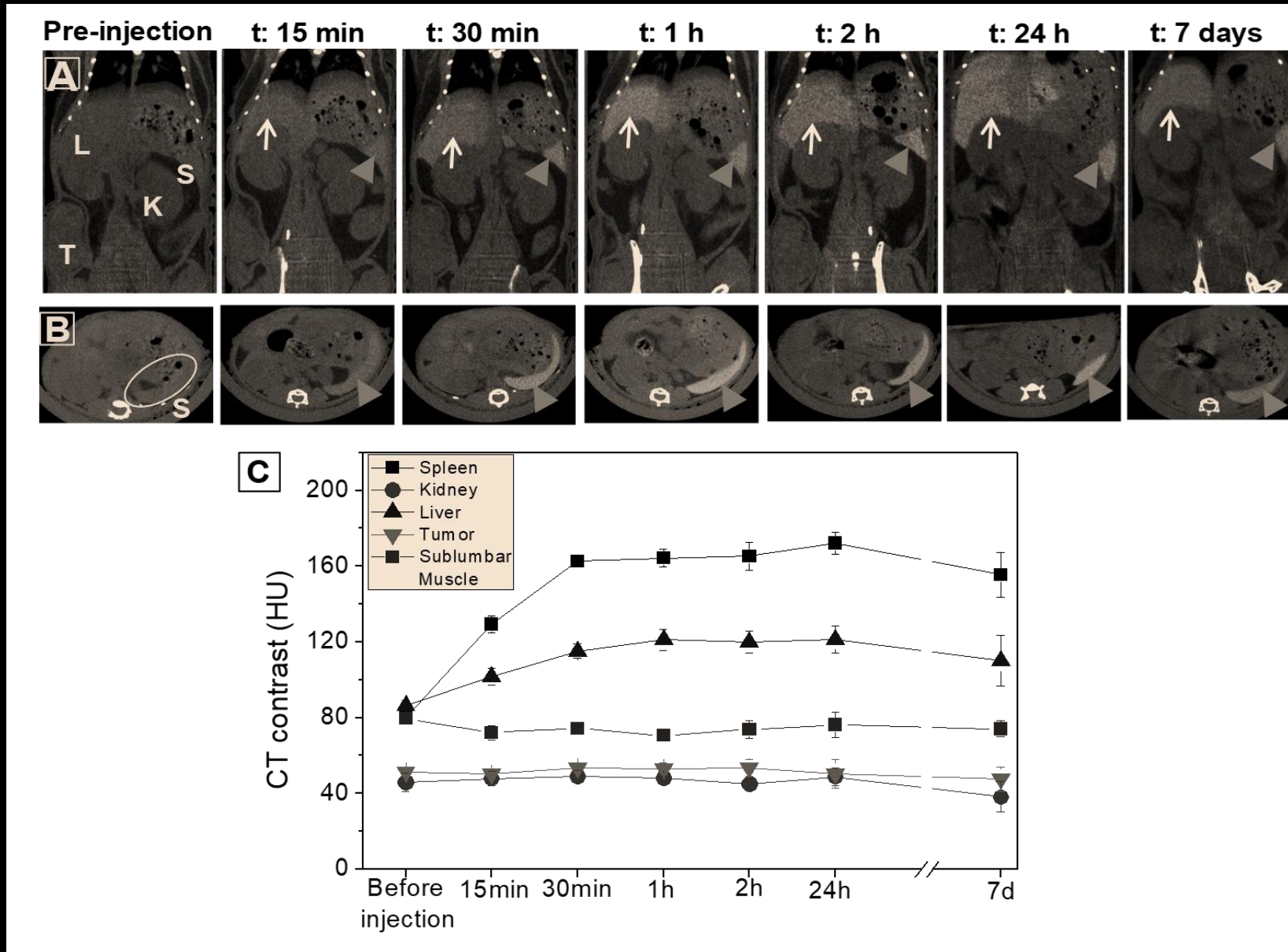
MRI



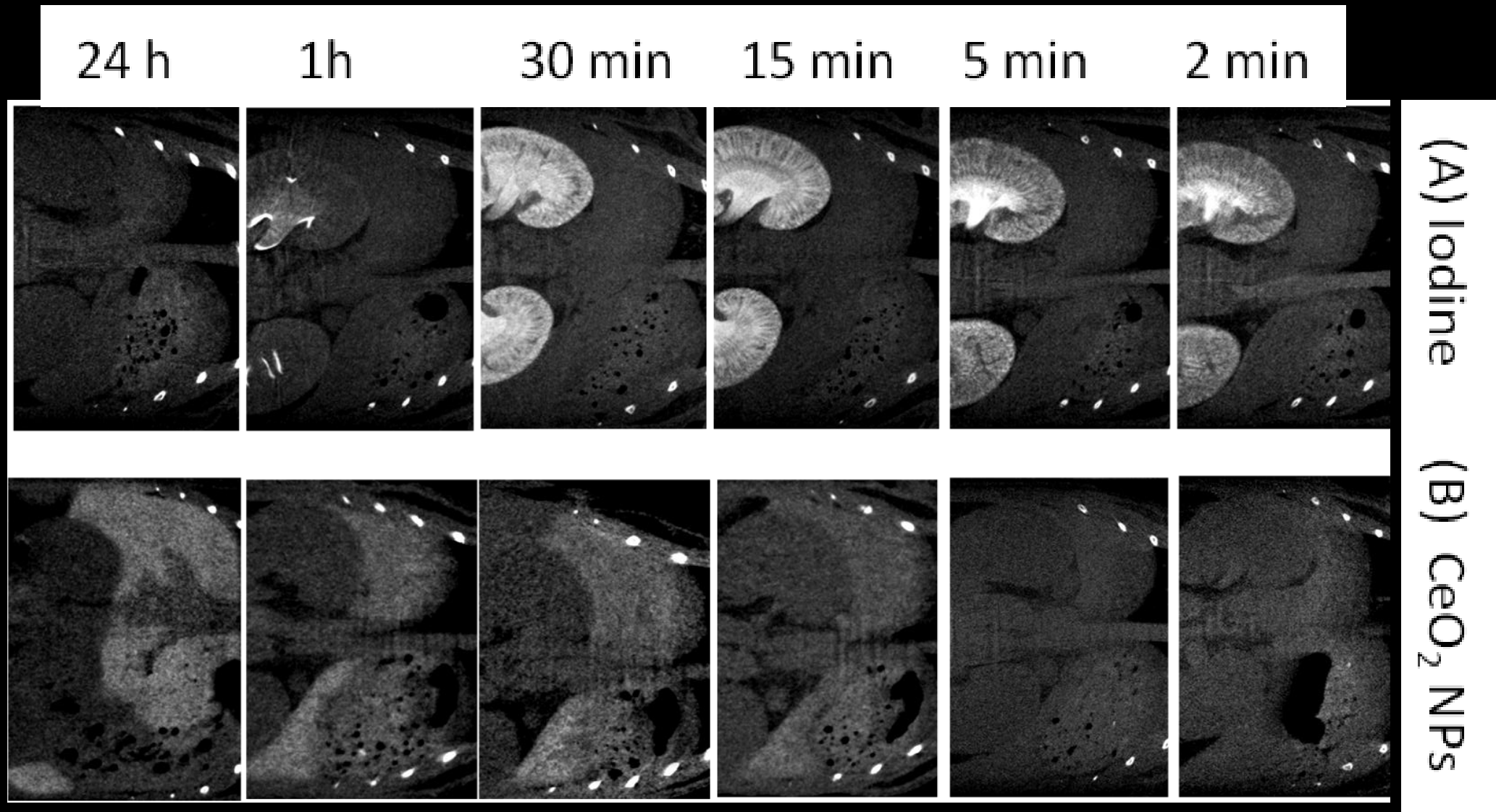
Hainfeld et al. The British Journal of Radiology, 79 (2006), 248-253

CAT (X-ray)

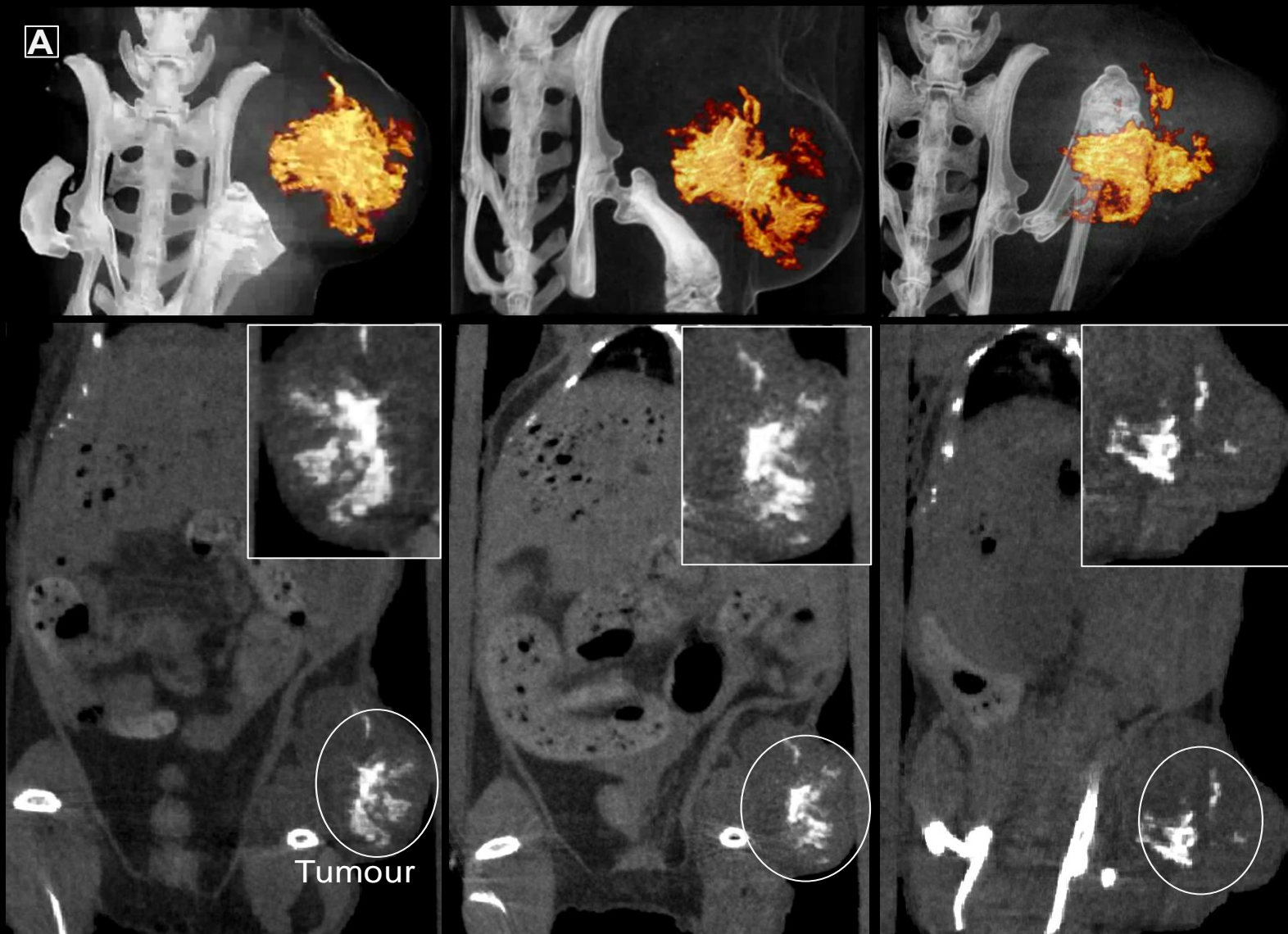
NANOCERIA AS SAFE CT CONTRAST AND PROTECTIVE AGENT



NANOCERIA AS CT CONTRAST AND PROTECTIVE AGENT



NANOCERIA AS CT CONTRAST AND PROTECTIVE AGENT



3.- SILVER NANOPARTICLES TO SENSITIZE BACTERIA TO ANTIBIOTICS

The
Economist

MAY 23RD - 27TH 2014

Do recoveries die, or are they killed?

Pinstriped greens take on Big Oil

Boss of the UN: worst job in the world

Win or lose, dark days for Cameron

How gangs suck El Salvador dry

When the drugs don't work

The rise of antibiotic resistance

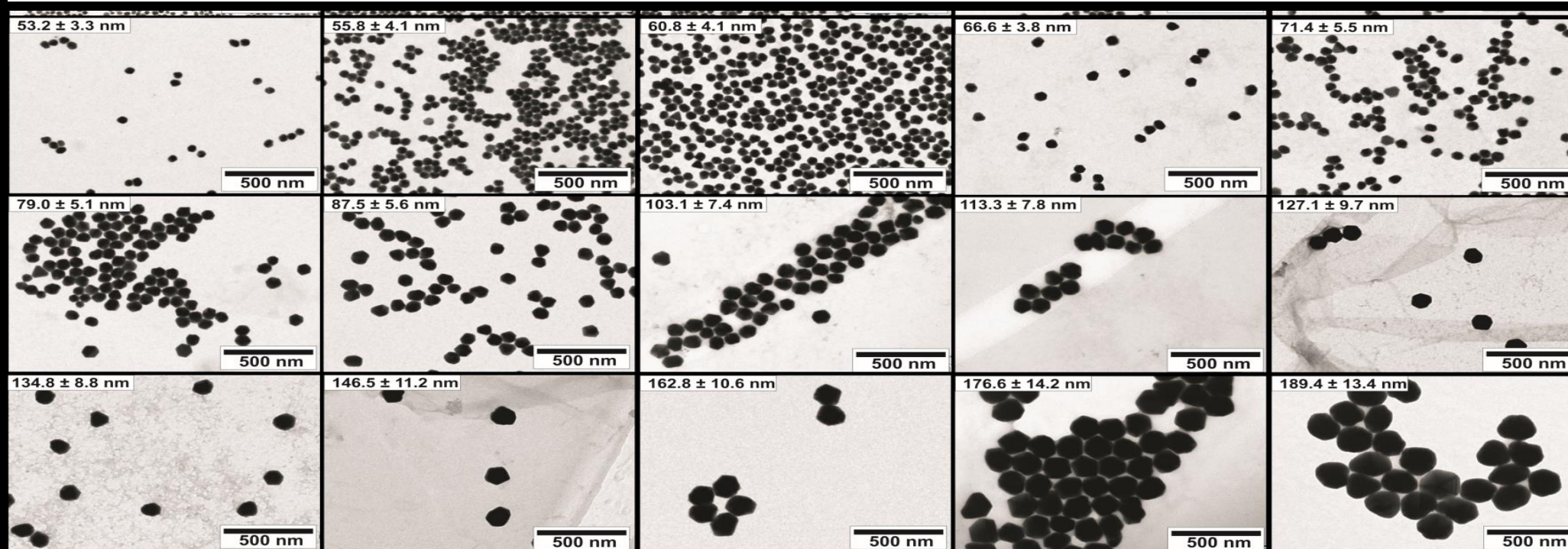


“there is the danger that the ignorant man may easily under dose himself and by exposing his microbes to non-lethal quantities of the drug make them resistant.”

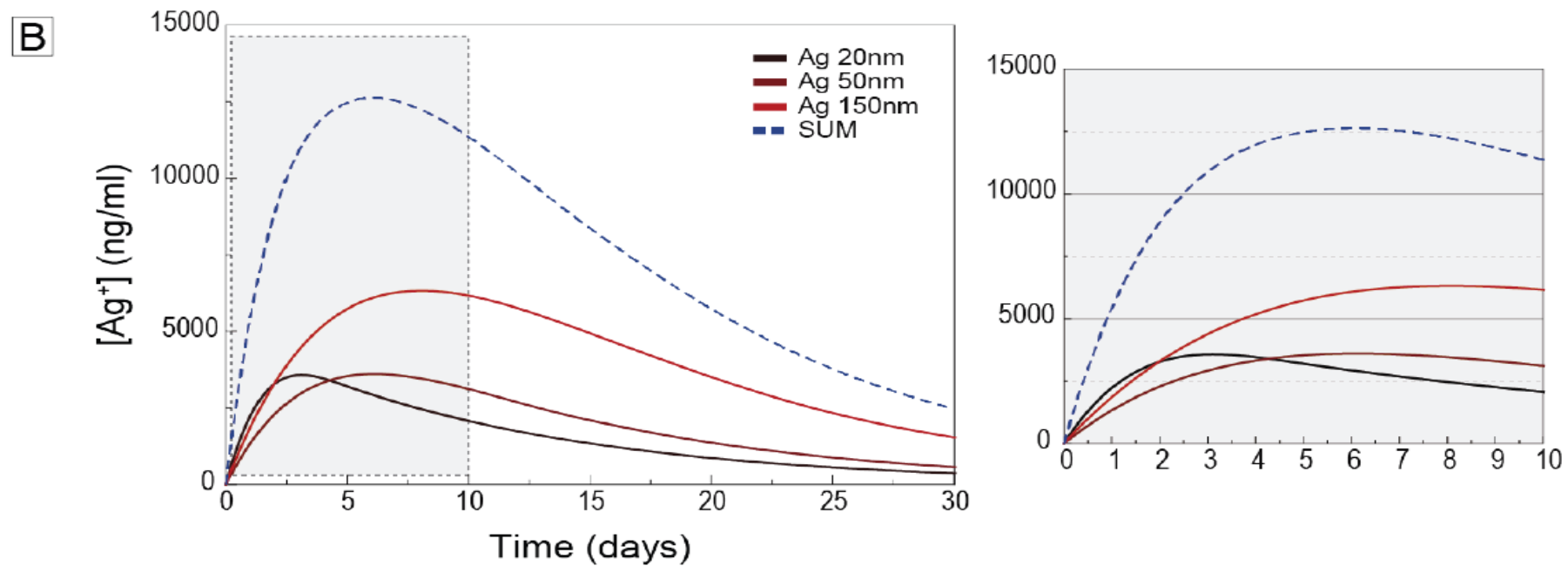
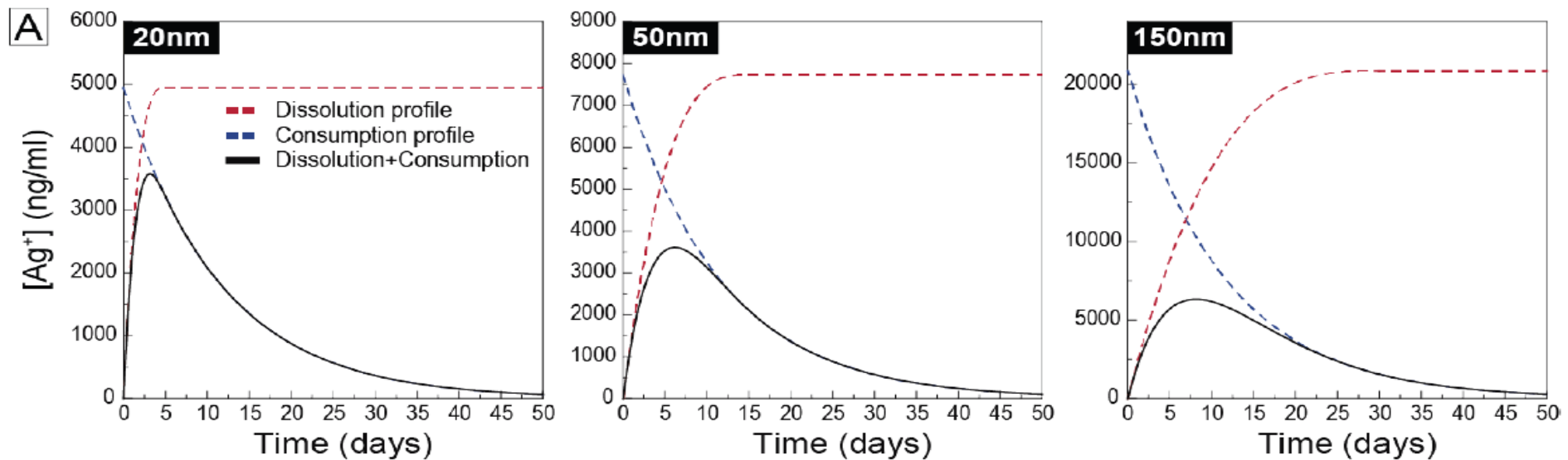
Alexander Fleming 1945 Stockholm

EXPLOITING SILVER IONS ANTIBIOTIC SYNERGY

Tested strain	Gram	FIC of Ag NO ₃ combined with				FIC of Ag NPs combined with			
		Col	Van	Ami	Te	Col	Van	Ami	Te
<i>E. coli</i>	-	0.5	0.5	0.25	0.125	2.0	2.0	2.0	0.125
<i>P. aeruginosa</i>	-	0.5	1.0	0.125	0.25	2.0	2.0	0.5	0.25
<i>S. aureus</i>	+	0.25	1.0	1.0	0.5	1.0	1.0	1.0	0.25



CONTROLLED SILVER IONS PROVISION



4- NANOPARTICLES AND THE IMMUNE SYSTEM.



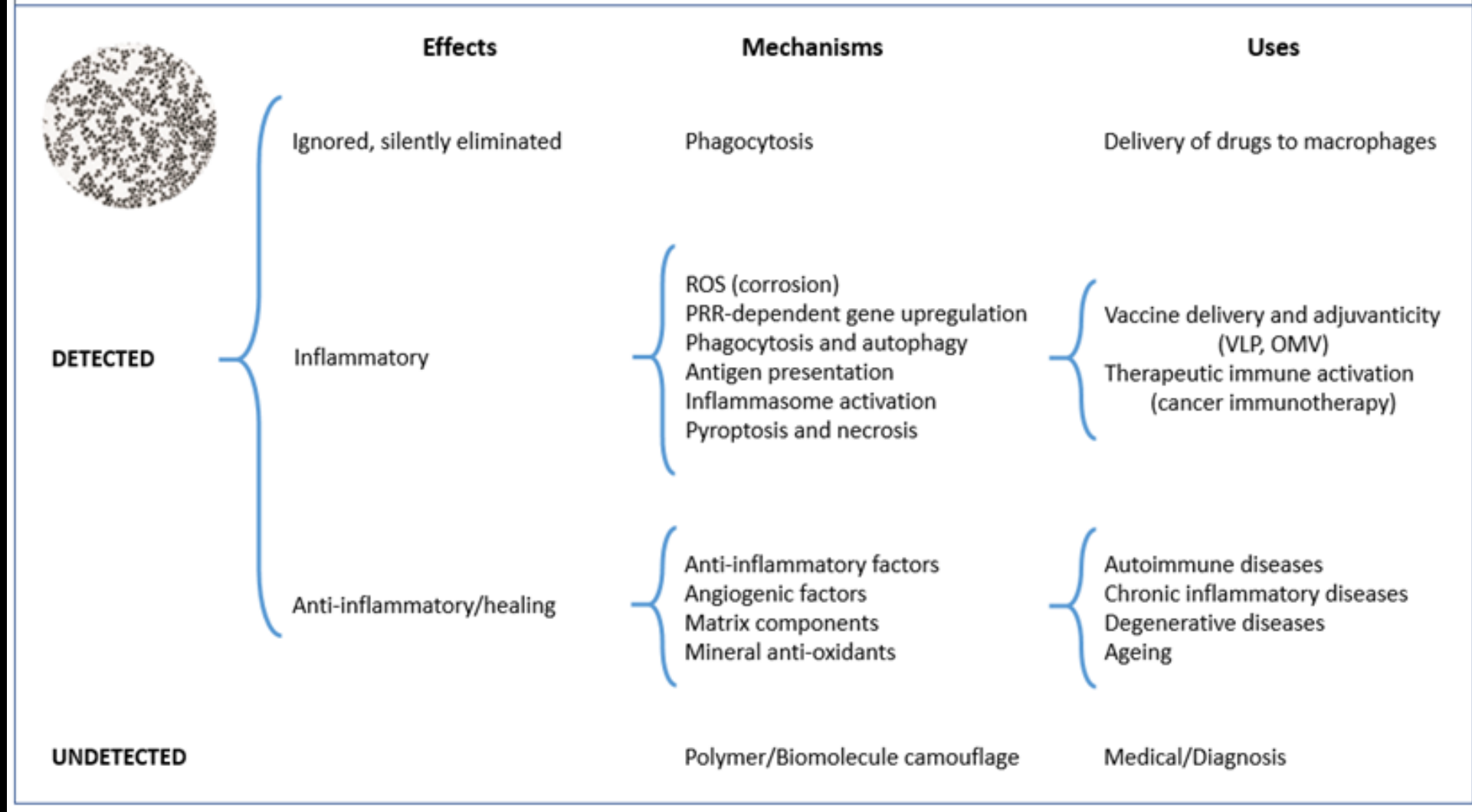
Hypothesis/perspective

The Interactions Between Nanoparticles and the Innate Immune System from a Nanotechnologist Perspective.

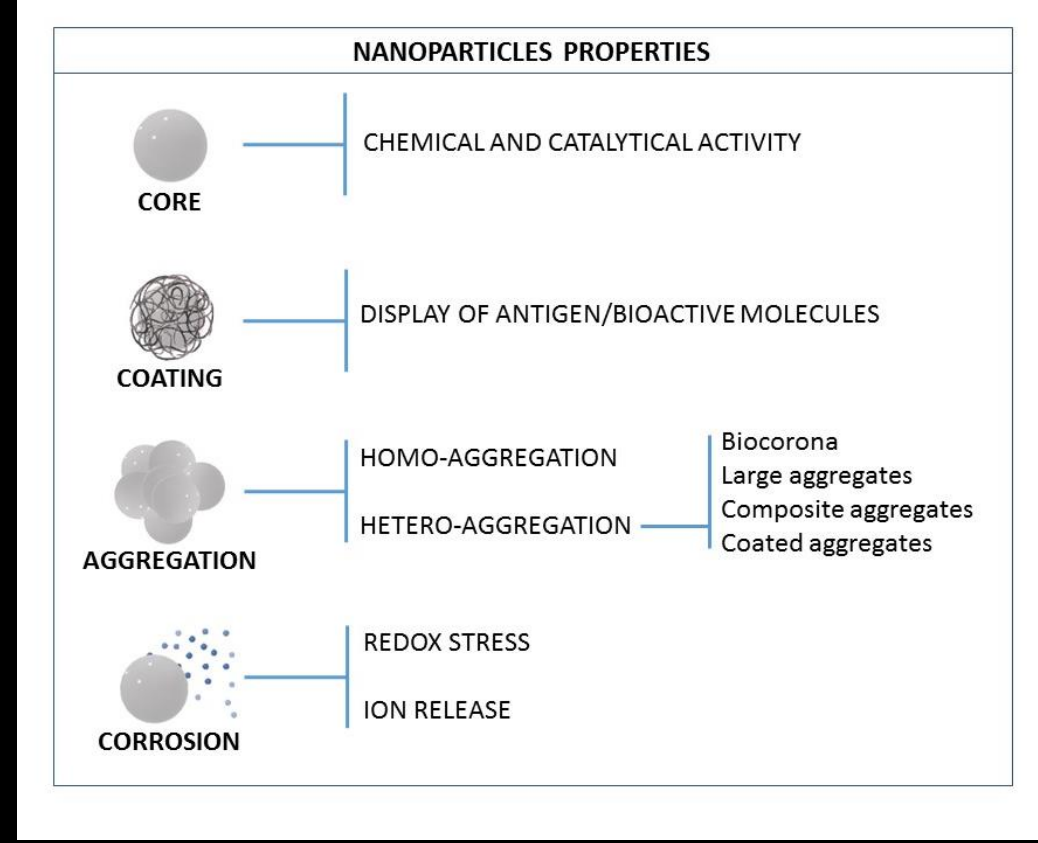
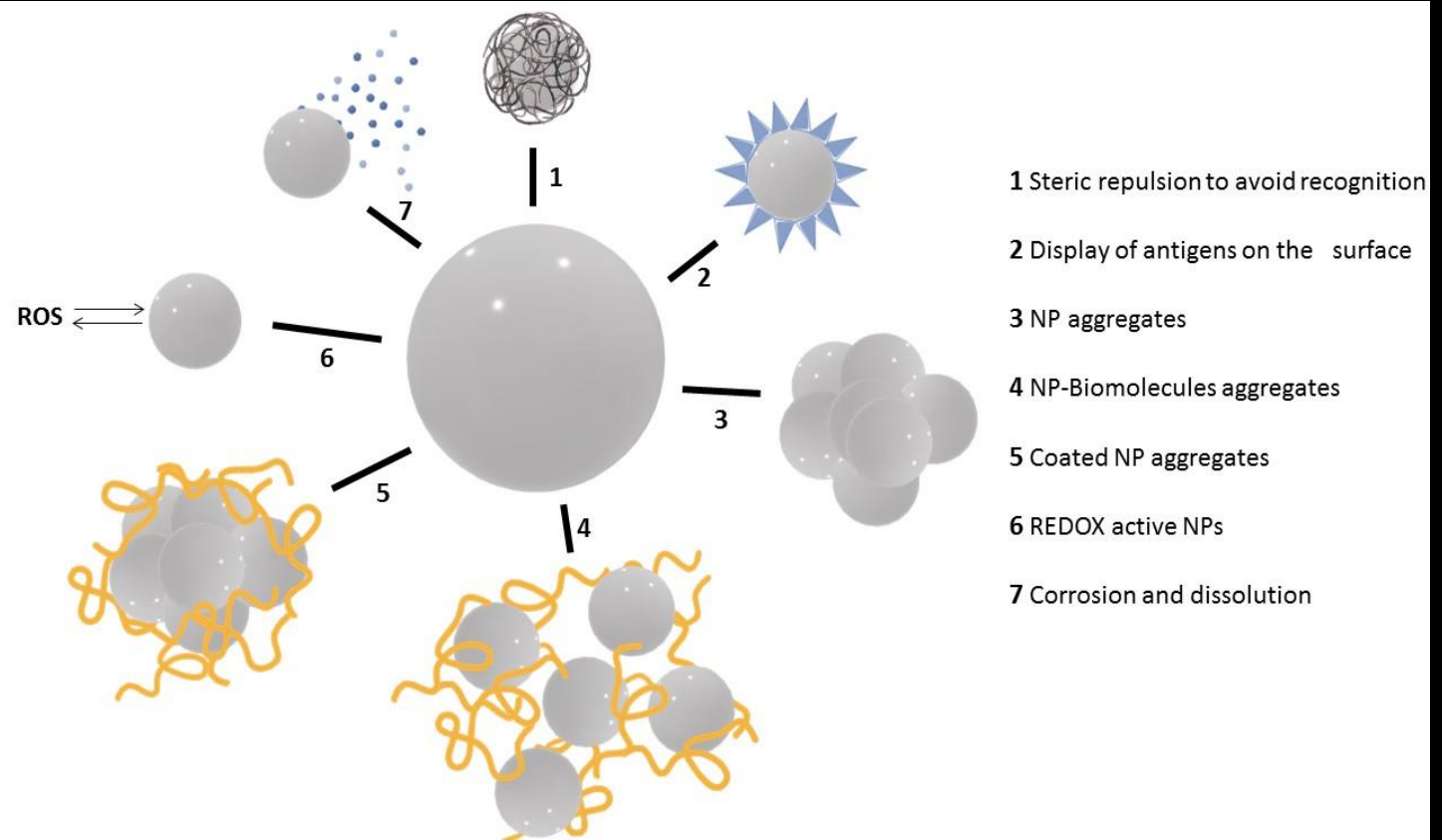
Lena M. Ernst ¹, Eudald Casals ², Paola Italiani³, Diana Boraschi ^{3,4,5} and Victor Puntès ^{1,6,7*}

- ¹ Vall d'Hebron Research Institute (VHIR), Barcelona, Spain; lena.montana@vhir.org (L.M.); ; victor.puntes@vhir.org (V.P.)
- ² School of Biotechnology and Health Sciences, Wuyi University, Jiangmen, 529020, China; wuyuchemecm@126.com (E.C.)
- ³ Institute of Protein Biochemistry and Cell Biology (IBBC), National Research Council (CNR), Napoli, Italy; paola.italiani@ibbc.cnr.it (P.I.); diana.boraschi@ibbc.cnr.it (D.B.)
- ⁴ Shenzhen Institute of Advanced Technology (SIAT), Chinese Academy of Science (CAS), Shenzhen, China; diana.boraschi@siat.ac.cn
- ⁵ Stazione Zoologica Anton Dohrn, Napoli, Italy; diana.boraschi@szn.it (D.B.)
- ⁶ Institut Català de Nanociència i Nanotecnologia (ICN2), CSIC and The Barcelona Institute of Science and Technology (BIST), Campus UAB, Bellaterra, Barcelona, Spain; victor.puntes@icn.cat (V.F.)
- ⁷ Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain victor.puntes@vhir.org (V.P.)
- * Correspondence: e-mail@e-mail.com (if there are multiple corresponding authors, add author initials)

NANOPARTICLES AND THE INNATE IMMUNE SYSTEM

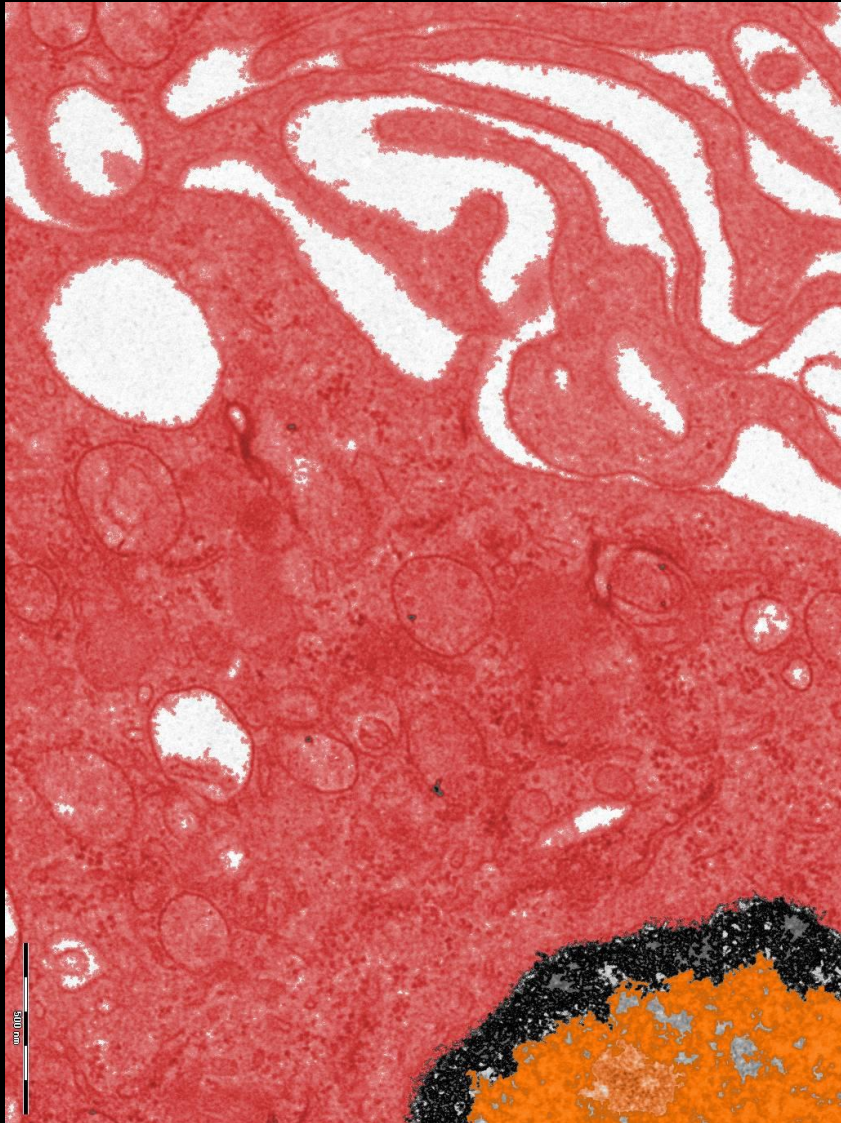


CHAPTER 3. NP AND THE IMMUNE SYSTEM



Intended or spontaneous NP modifications and their impact on immune responses.

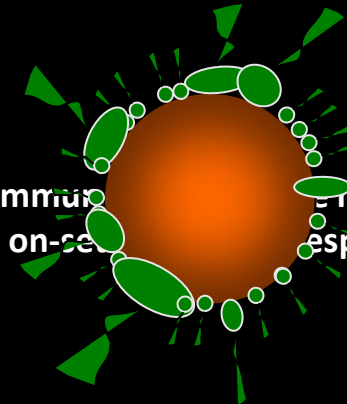
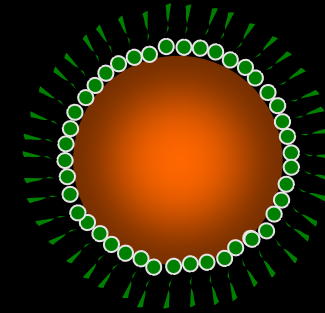
5.- NANOPARTICLES AS ANTIGEN PRESENTERS



MACROPHAGES (BIG EATERS)

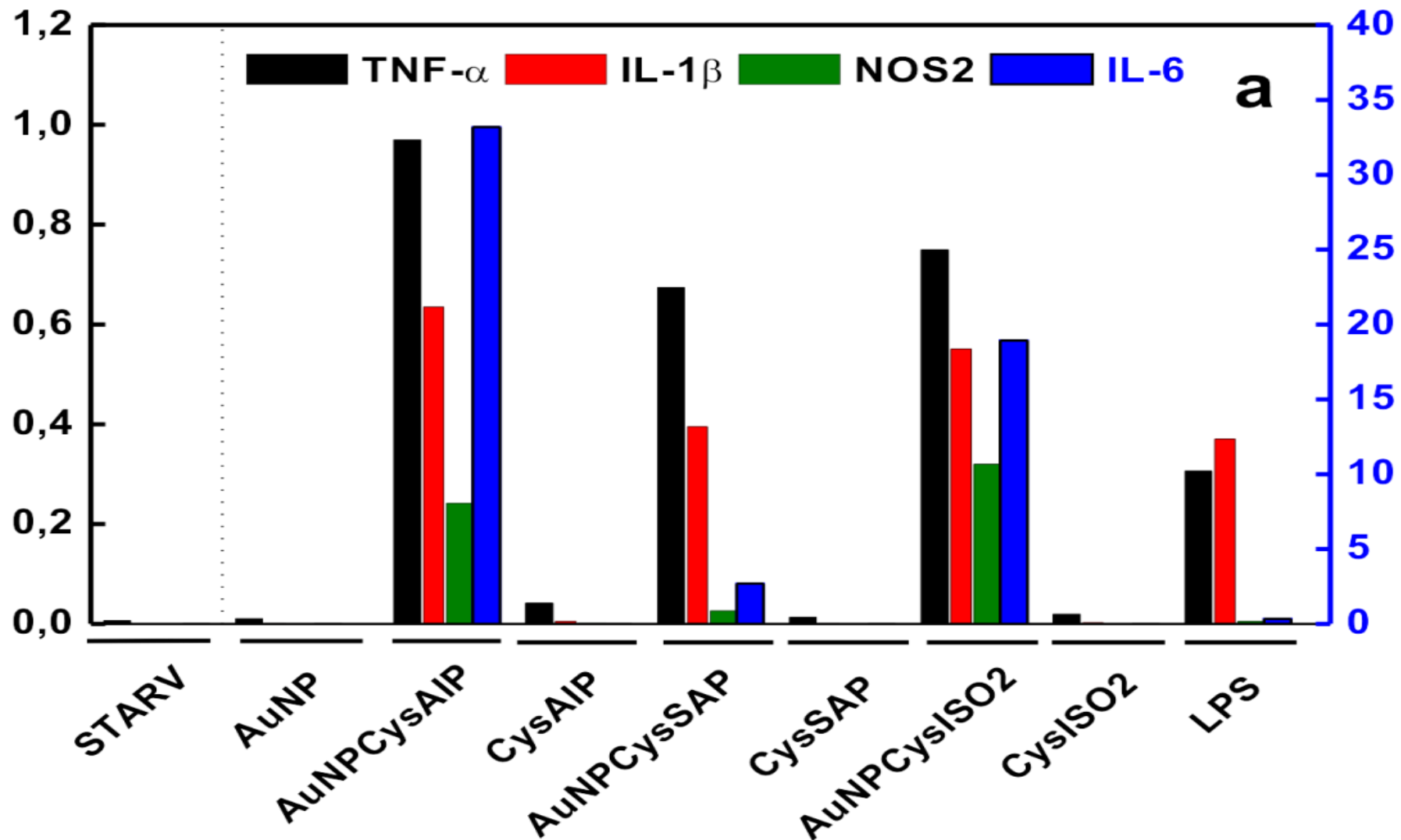
PRR (Pattern Recognition Receptors)

TLR (Toll Like Receptors)

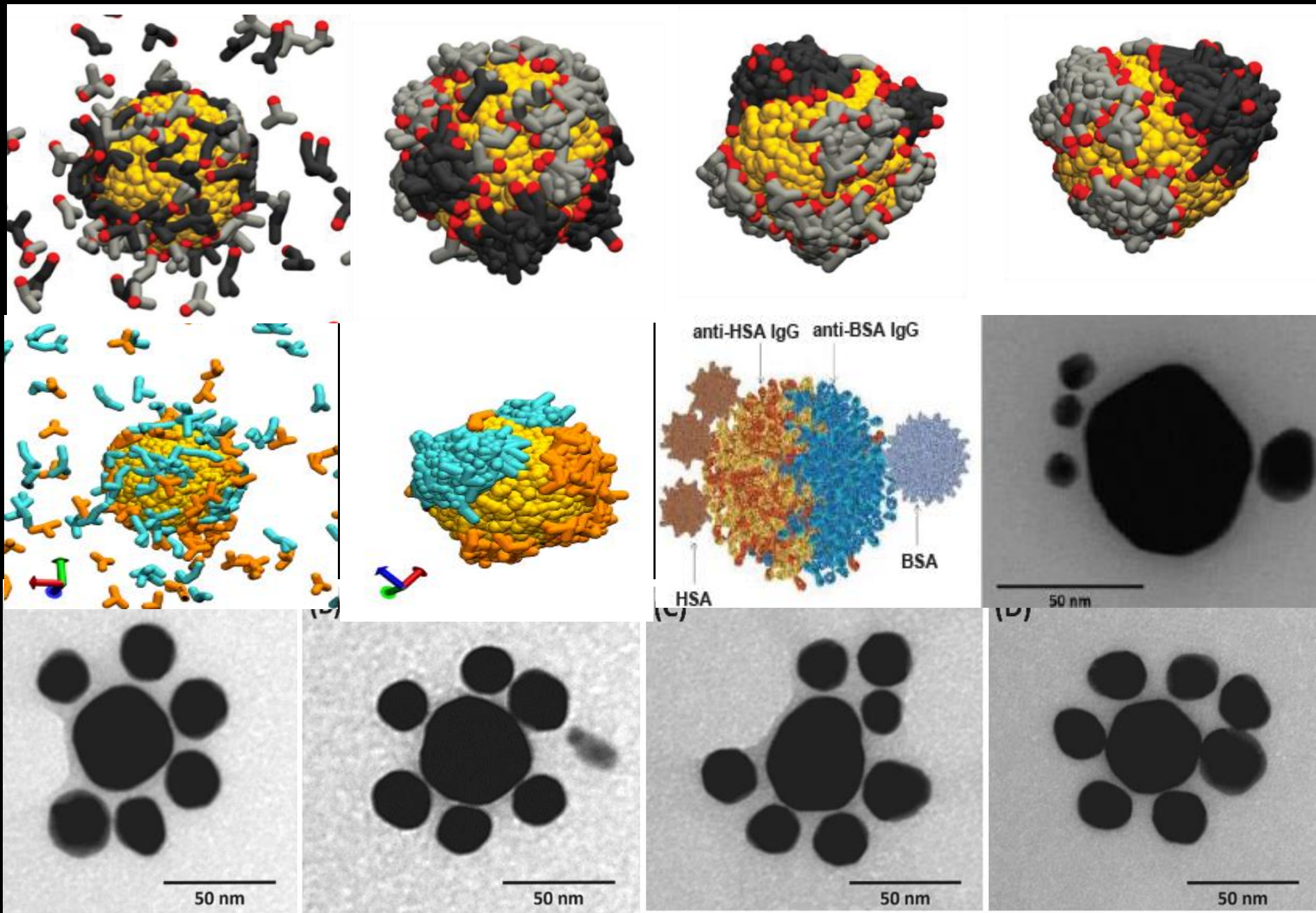


The innate immune response is responsible for the on-site response

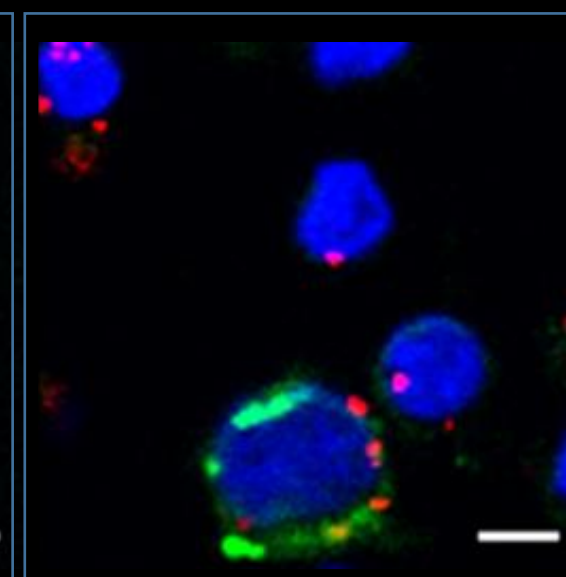
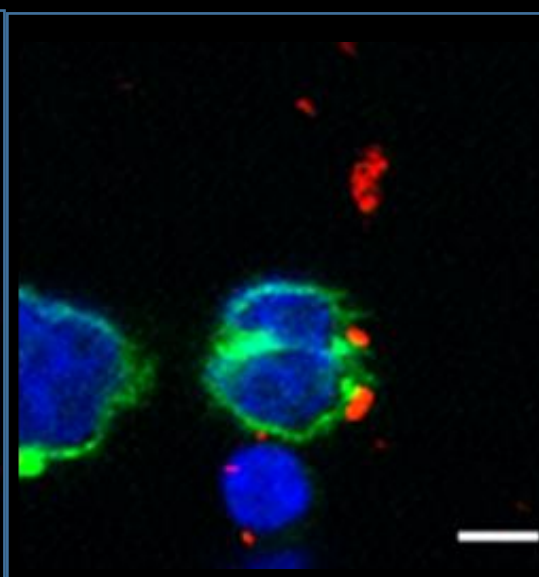
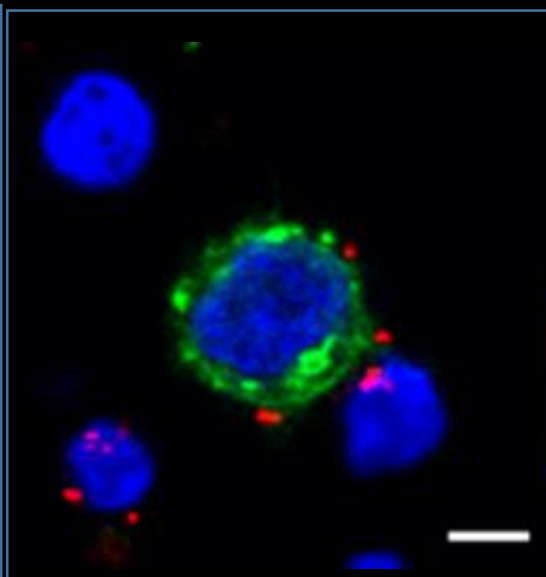
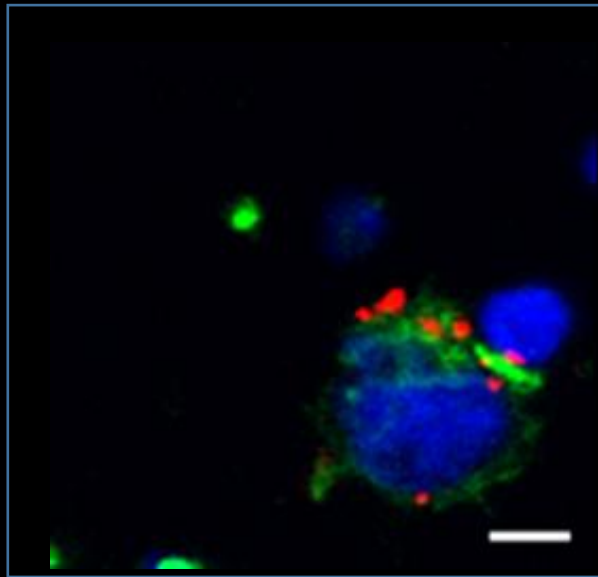
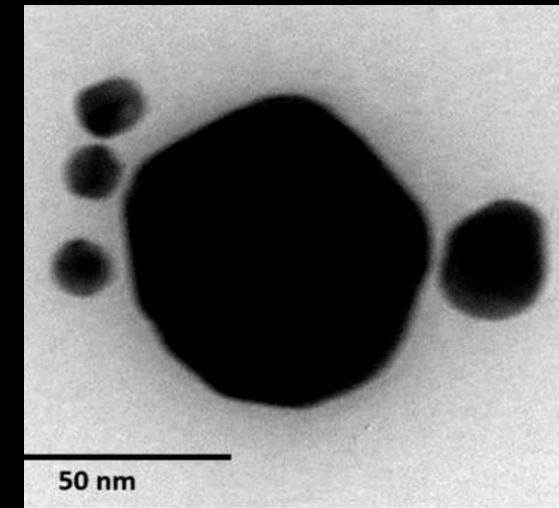
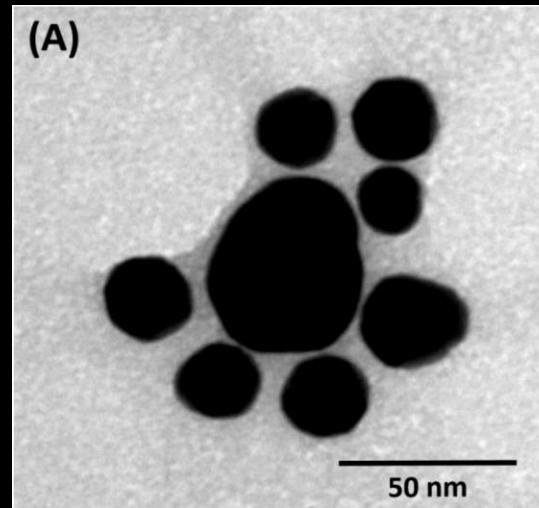
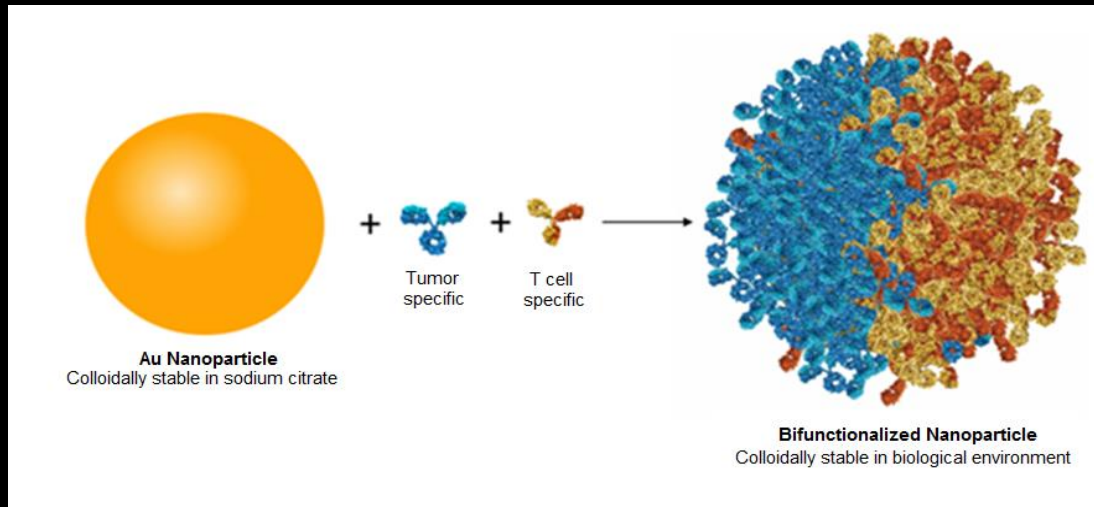
BIOCHEMICAL RESPONSE OF MACROPHAGES TO CONJUGATES



Random (enthalpy) vs. cooperative (entropy) Protein Corona formation.



Polarized Bispecific Au Nanoparticles for the Enhancement of Immune Responses against HIV



Antibody cooperative adsorption onto AuNPs and its exploitation to force natural killer cells to kill HIV-infected T cells *Nano Today* 36, 101056 (2021)

6.- NANOPARTICLES AS ACTIVE PRINCIPLE.



Review > Pharmacotherapy. 2010 Jan;30(1):70-9. doi: 10.1592/phco.30.1.70.

Ferumoxytol: a new intravenous iron preparation for the treatment of iron deficiency anemia in patients with chronic kidney disease

Michael H Schwenk¹

Affiliations: [collapse](#)

Affiliation

¹ Department of Pharmacy, North General Hospital, New York, New York 10035, USA.

PMID: 20030475 DOI: 10.1592/phco.30.1.70

Abstract

Ferumoxytol is an intravenous iron preparation for treatment of the anemia of chronic kidney disease (CKD). It is a carbohydrate-coated, superparamagnetic iron oxide nanoparticle. Because little free iron is present in the preparation, doses of 510 mg have been administered safely in as little as 17 seconds. Two prospective, randomized studies compared two doses of ferumoxytol 510 mg given in 5 +/- 3 days with 3 weeks of oral iron 200 mg/day (as ferrous fumarate) in anemic patients with CKD.

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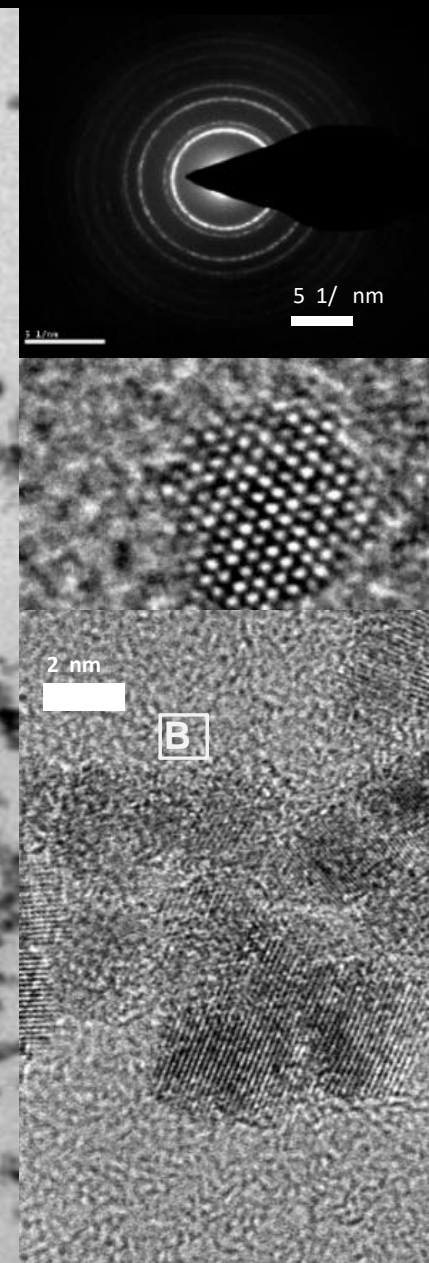
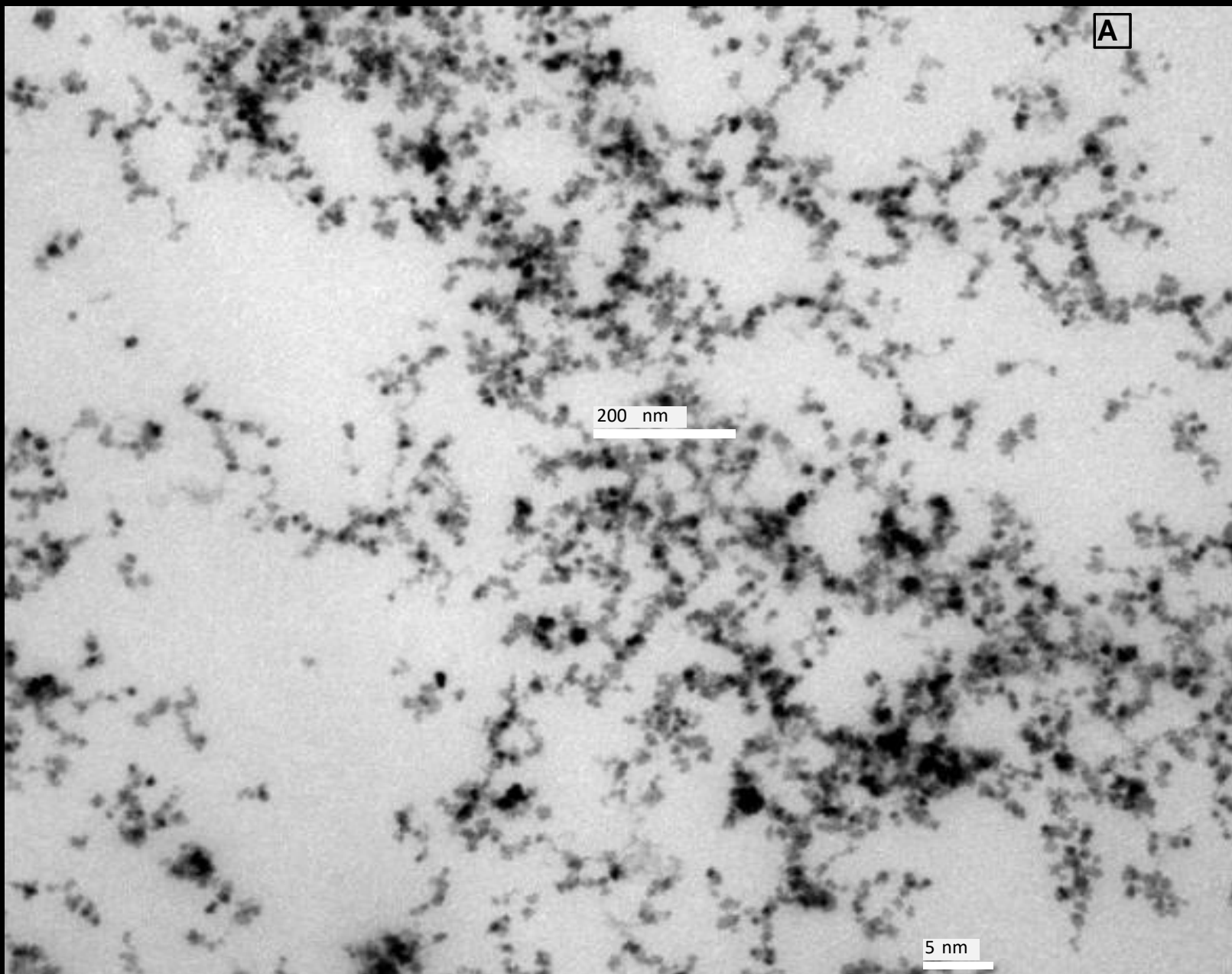
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IMMUNO(METABOLIC)MODULATION WITH NANOCERIA



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HEPATOLOGY

Original Article Open Access

Bespoken Nanoceria: An Effective Treatment in Experimental Hepatocellular Carcinoma

Guillermo Fernández-Varo, Meritxell Ferramón, Silvia Carvajal, Denise Oró, Eudald Casals, Loreto Bolx, Laura Oller, Laura Macías-Muñoz, Santi Marfà, Gregori Casals, Manuel Morales-Ruiz, ... See all authors

First published: 21 January 2020 | <https://doi.org/10.1002/hep.31139> | Citations: 6

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Figures References Related Information

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Journal of Hepatology Volume 64, Issue 3, March 2016, Pages 691-698

Graphical abstract Abbreviations Keywords Introduction Materials and methods Results Discussion Financial support Conflict of interest Authors' contributions Acknowledgements Supplementary data References

Cerium oxide nanoparticles reduce steatosis, portal hypertension and display anti-inflammatory properties in rats with liver fibrosis

Denise Oró¹, Tetyana Yudin², Guillermo Fernández-Varo^{1,5}, Eudald Casals², Vedrana Reichenbach¹, Gregori Casals¹, Bernardino González de la Presa¹, Silvia Sandalinas¹, Silvia Carvajal¹, Víctor Puentes^{2,3,4}, R. B. Wladimiro Jiménez^{1,5}, R. B.

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Cerium oxide nanoparticles improve liver regeneration after acetaminophen-induced liver injury and partial hepatectomy in rats

Bernat Córdoba-Jover, Altamira Arce-Cerezo, Jordi Ribera, Montse Pauta, Denise Oró, Gregori Casals, Guillermo Fernández-Varo, Eudald Casals, Víctor Puentes, Wladimiro Jiménez & Manuel Morales-Ruiz

Journal of Nanobiotechnology 17, Article number: 112 (2019) | [Cite this article](#)

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Abstract

Background and aims

Cerium oxide nanoparticles are effective scavengers of reactive oxygen species and have been proposed as a treatment for oxidative stress-related diseases. Consequently, we aimed to investigate the effect of these nanoparticles on hepatic regeneration after liver injury by partial hepatectomy and acetaminophen overdose.

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Sections Figures References

Abstract Background Results Discussion Conclusions Methods Availability of data and materials Abbreviations References Acknowledgements Funding

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Article | Open Access | Published: 06 September 2019

Cerium oxide nanoparticles display antilipogenic effect in rats with non-alcoholic fatty liver disease

Silvia Carvajal, Meritxell Ferramón, Denise Oró, Eudald Casals, Guillermo Fernández-Varo, Gregori Casals, Marina Parra, Bernardino González de la Presa, Jordi Ribera, Óscar Pastor, Manuel Morales-Ruiz, Víctor Puentes & Wladimiro Jiménez

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Abstract

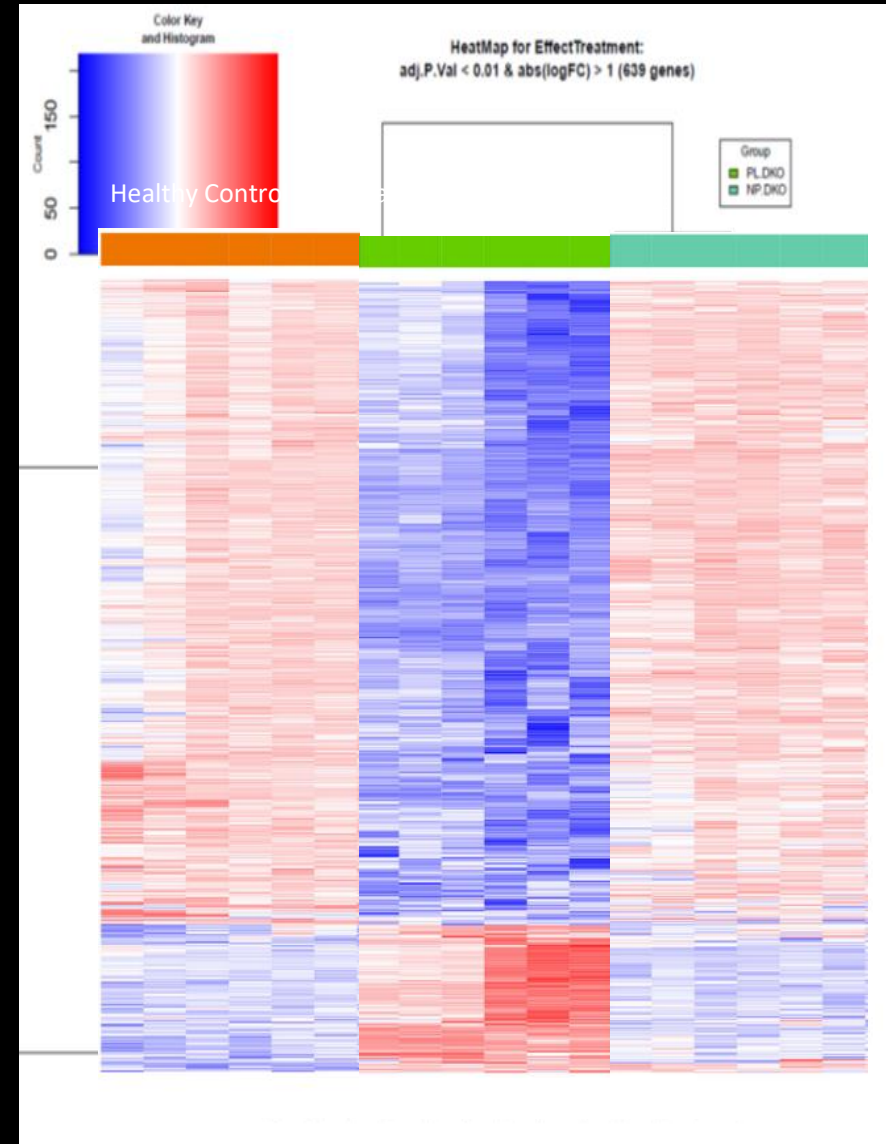
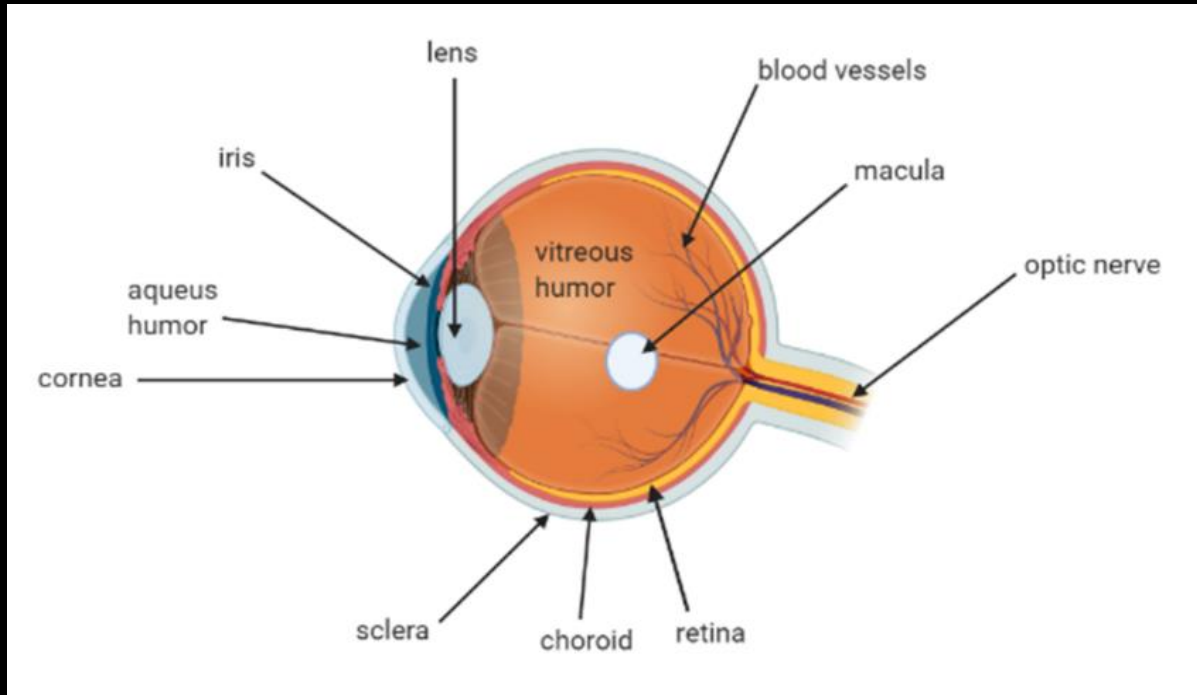
Non-alcoholic fatty liver disease (NAFLD) is the most common cause of chronic liver disease worldwide, ranging from steatosis to non-alcoholic steatohepatitis (NASH). Recently, cerium

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Abstract Introduction Results Discussion Methods Data Availability References Acknowledgements

3 nm CeO₂ NP COLLYRIUM TO PROTECT THE EYE FROM ROS



Duarri et al. Repeated Topical Administration of 3 nm Cerium Oxide Nanoparticles Reverts Disease Atrophic Phenotype and Arrests Neovascular Degeneration in AMD Mouse Models ACS nano 2023

NANOMEDICINE

i.- SERVICES PROVIDED BY NPs:

- Drug Delivery
- Radiomedicine
- Antigen Presenter
- Active Principle

ii.- NP EVOLUTION IN PHYSIOLOGICAL MEDIA. NANOPHARMACOKINETICS (nADME).

iii.- NANOIMMUNOLOGY

1.- Xenobiotic, Ortoprologic, Safe

2.- Biodegradable

3.- Accumulable

4.- Proton Sponge/
endosomal escape

5.- Contrast agent

6.- Affordable



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