

Nanomedicamentos: El futuro presente

ERNESTO CABALLERO-GARRIDO Ph.D

ÁREA DE EVALUACIÓN FÁRMACO-TOXICOLÓGICA

DEPARTAMENTO DE MEDICAMENTOS DE USO HUMANO

AGENCIA ESPAÑOLA DE MEDICAMENTOS Y PRODUCTOS SANITARIOS

Trivial científico

¿Qué es un medicamento?

Según la legislación Española (**RD 1/2015 de 24 Julio**)
***Ley de garantías y uso racional de los medicamentos y
productos sanitarios***

*Toda sustancia o combinación de sustancias que se presenta
como poseedora de propiedades para el tratamiento o
prevención de enfermedades en seres humanos [...]*

¿Cómo se define “nano”?

La Comisión Europea recomendó en 2011 una definición de los nanomateriales basados en el tamaño del material:

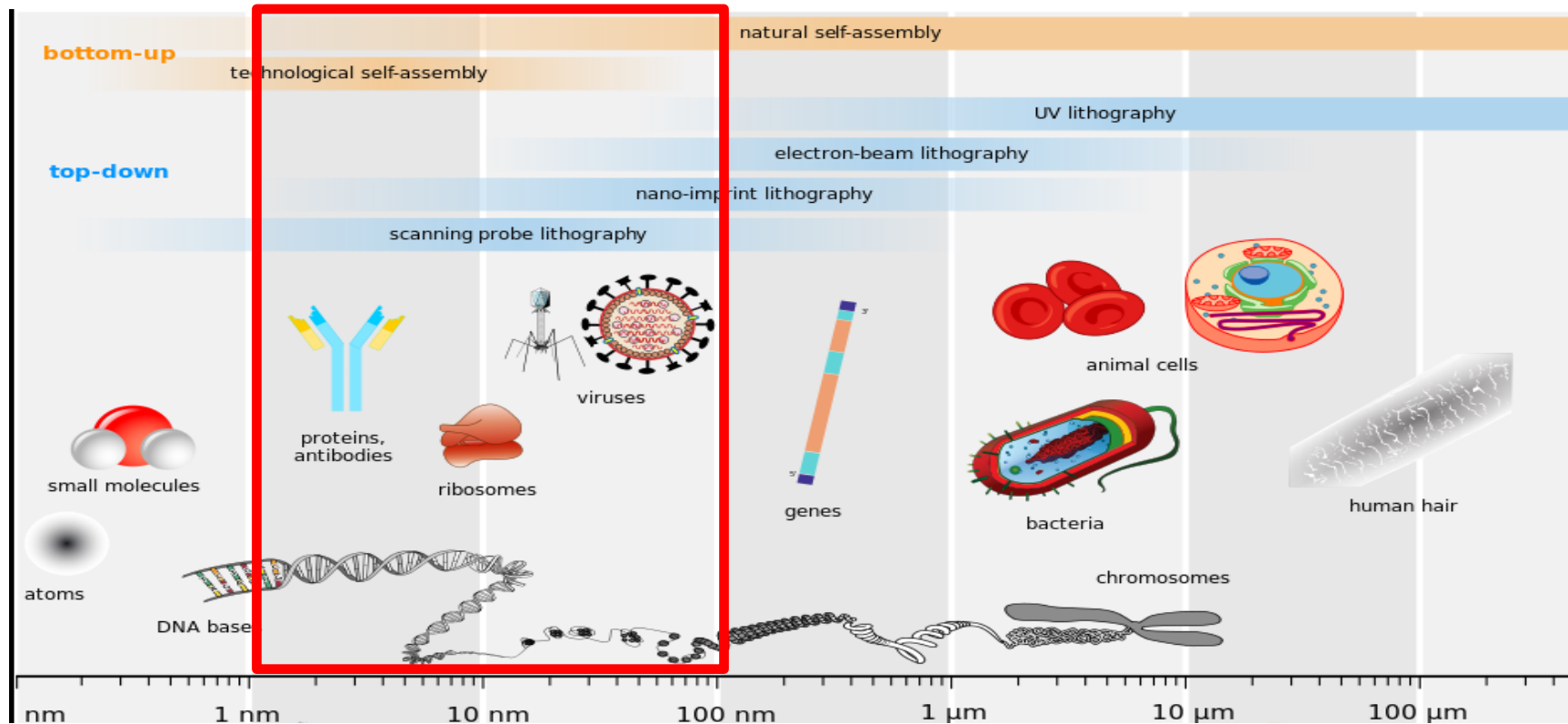
The **lower limit** was proposed at **1 nm**.

An **upper limit** of **100 nm** is commonly used by general consensus [...]

Given the special circumstances prevailing in the pharmaceutical sector [...], (the previous definition) should not prejudice the use of term nano” when defining certain pharmaceuticals [...]



Escala de la vida @ Wikipedia

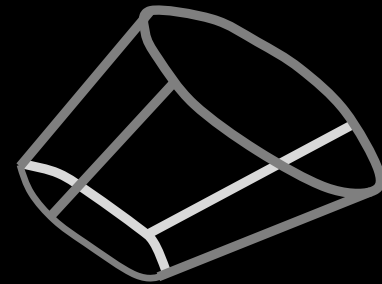
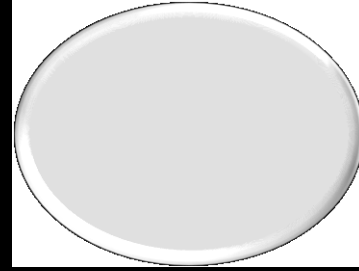
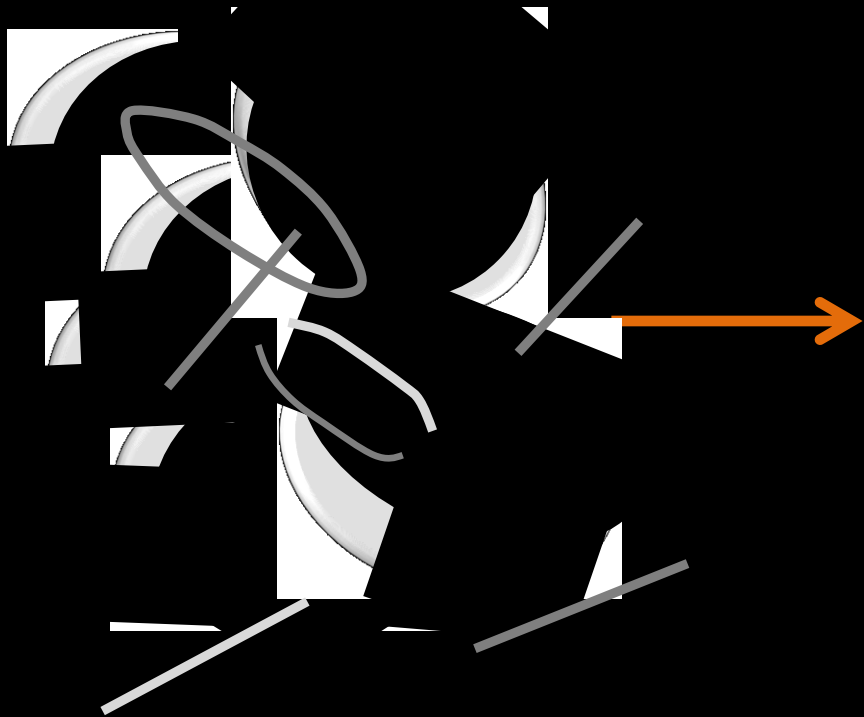






¿qué es y cómo se produce?

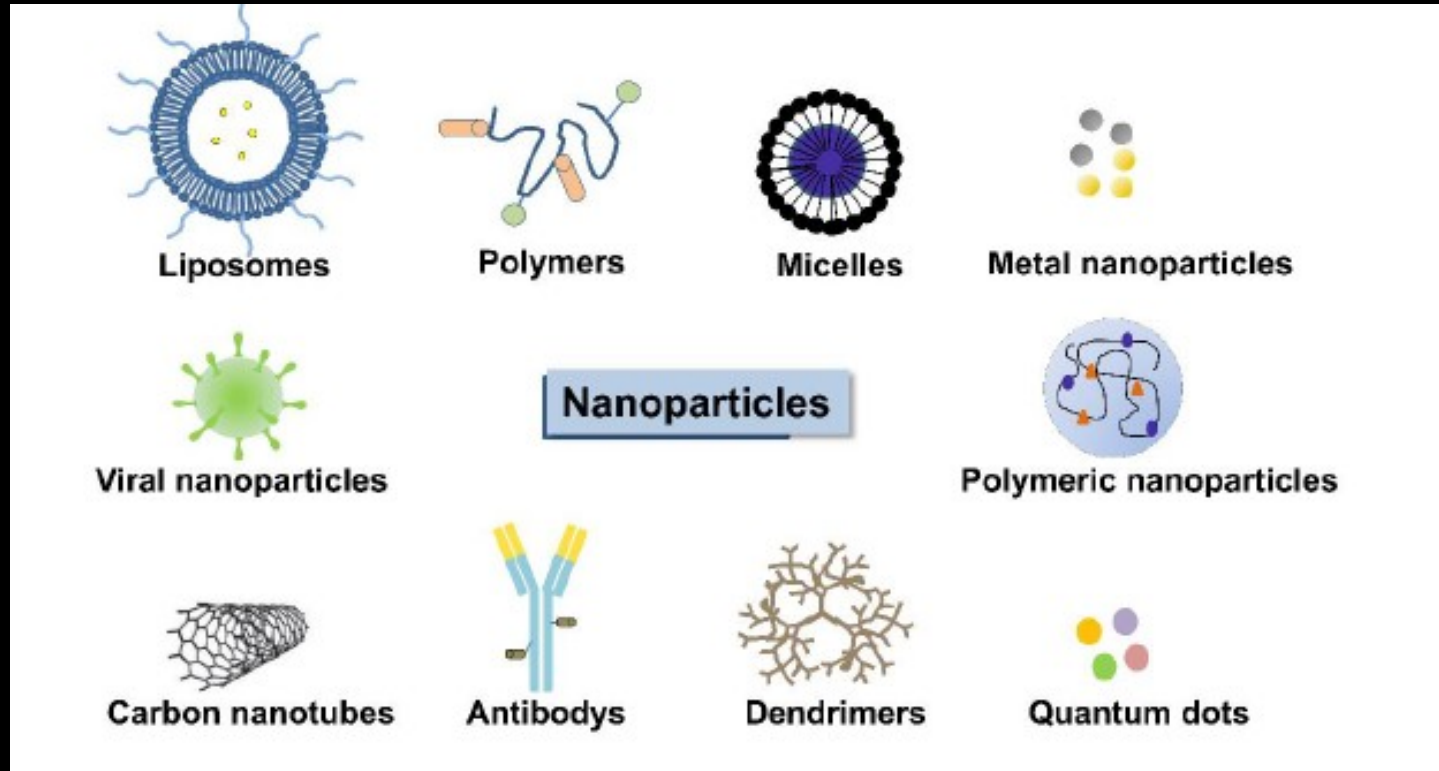
Síntesis química



[Life Sci.](#) 2018 May 15;201:37-44. doi: 10.1016/j.lfs.2018.03.044. Epub 2018 Mar 22.

Nanoparticles designed to regulate tumor microenvironment for cancer therapy.

[Li M](#)¹, [Zhang F](#)¹, [Su Y](#)¹, [Zhou J](#)², [Wang W](#)³.

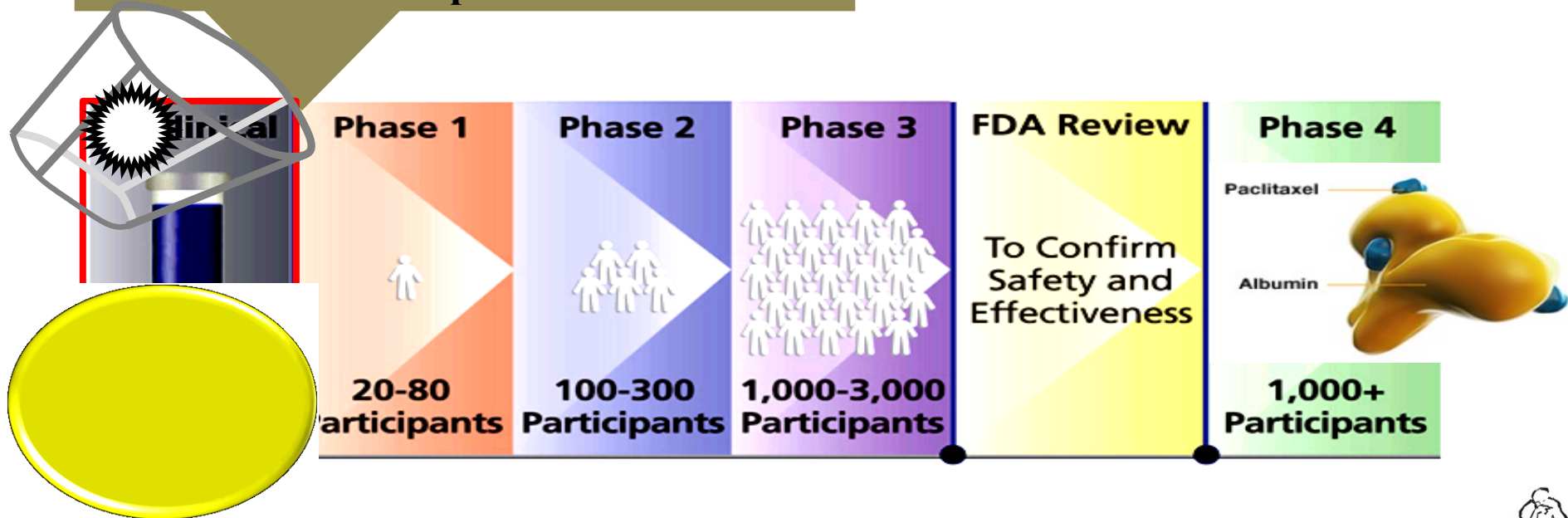




¿Cómo se desarrolla un medicamento / nano-medicamento?



Inicio de la fase de pruebas en humanos



Unos ejemplos de investigaciones preclínicas recientes con nanomedicamentos



Published online: July 16, 2018

Research Article



SOURCE
DATA



OPEN
ACCESS

EMBO
Molecular Medicine

A versatile drug delivery system targeting senescent cells

Daniel Muñoz-Espín^{1,2,*†} , Miguel Rovira^{1,3†} , Irene Galiana^{4,5}, Cristina Giménez⁴, Beatriz Lozano-Torres^{4,5}, Marta Paez-Ribes², Susana Llanos¹, Selim Chaib^{1,3}, Maribel Muñoz-Martín^{1,3}, Alvaro C Ucero⁶, Guillermo Garaulet⁷, Francisca Mulero⁷, Stephen G Dann⁸, Todd VanArsdale⁸, David J Shields⁸, Andrea Bernardos^{4,5}, José Ramón Murguía^{4,5}, Ramón Martínez-Máñez^{4,5,9} & Manuel Serrano^{1,3,10,**}

- 1 Tumor Suppression Group, Spanish National Cancer Research Centre (CNIO), Madrid, Spain
- 2 CRUK Cambridge Centre Early Detection Programme, Department of Oncology, Hutchison/MRC Research Centre, University of Cambridge, Cambridge, UK
- 3 Cellular Plasticity and Disease Group, Institute for Research in Biomedicine (IRB Barcelona), Barcelona Institute of Science and Technology (BIST), Barcelona, Spain
- 4 Instituto Interuniversitario de Investigación de Reconocimiento Molecular y Desarrollo Tecnológico (IDM), Universitat Politècnica de València, Universitat de València, Valencia, Spain
- 5 CIBER de Bioingeniería, Biomateriales y Nanomedicina (CIBER-BBN), Spain
- 6 Genes, Development and Disease Group, Spanish National Cancer Research Centre (CNIO), Madrid, Spain
- 7 Molecular Imaging Unit, Spanish National Cancer Research Centre (CNIO), Madrid, Spain
- 8 Oncology R&D Group, Pfizer Worldwide Research & Development, Pfizer Inc., La Jolla, CA, USA
- 9 Departamento de Química, Universitat Politècnica de València, Valencia, Spain
- 10 Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain

*Corresponding author. Tel: +44 1223763337; E-mail: d.m742@cam.ac.uk

**Corresponding author. Tel: +34 94020287; E-mail: manuel.serrano@irb-barcelona.org

†These authors contributed equally to this work



semana
de la ciencia
y la innovación
mioc



- Las **células senescentes** están presentes en múltiples enfermedades y se trata de eliminar estas como una prometedora terapia.
- Estas células presentan una *elevada* actividad enzimática *beta-galactosidasa*.
- En este artículo los investigadores probaron una nanomedicina para tratar la **fibrosis pulmonar**.

1

Síntesis

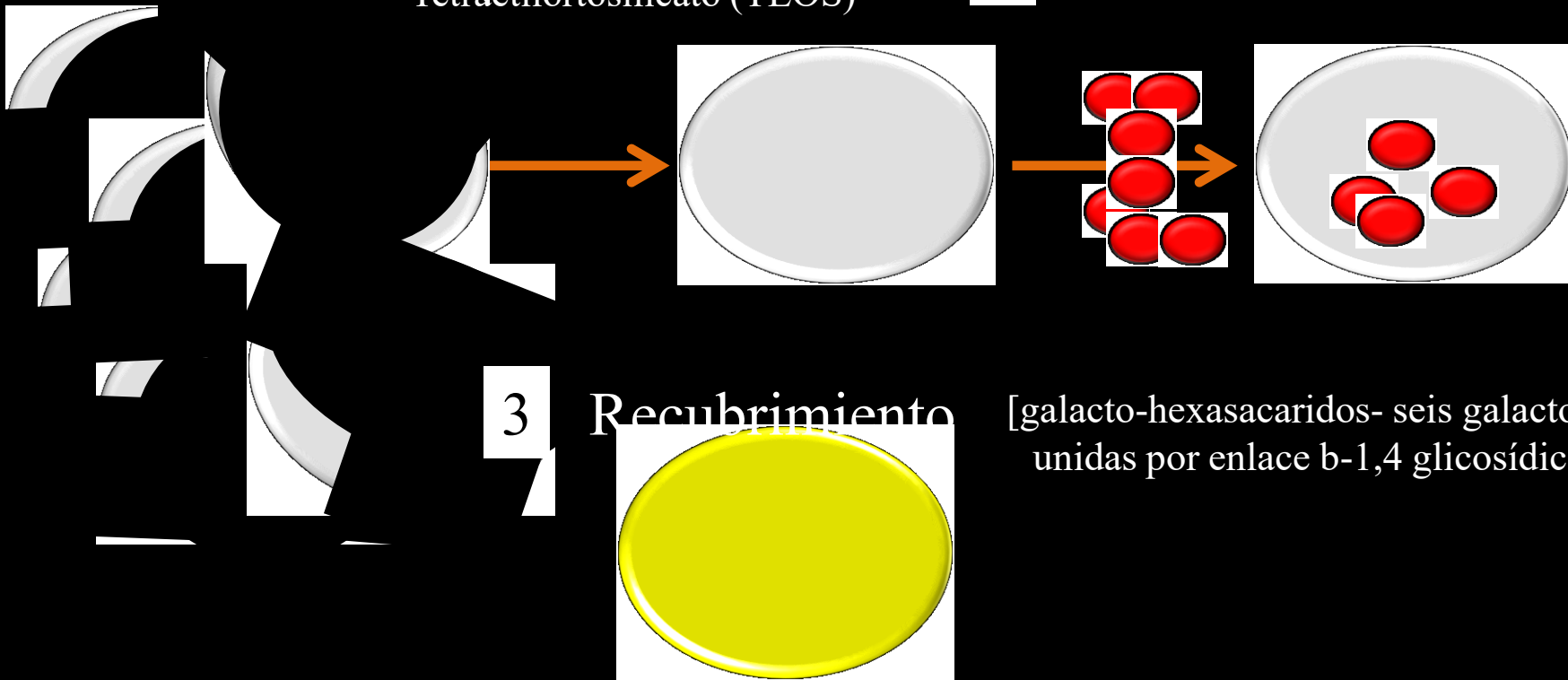
Precursor polimérico
-Tetraetilortosilicato (TEOS)-

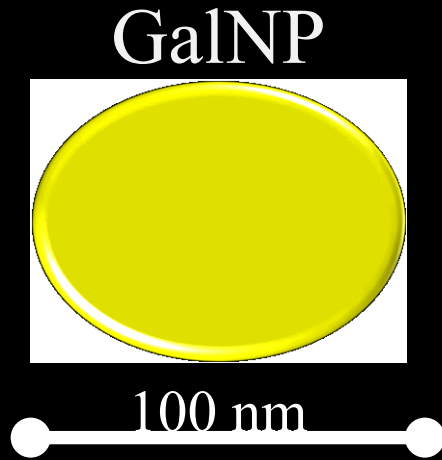
2

carga

3

Recubrimiento

[galacto-hexasacaridos- seis galactosas
unidas por enlace β -1,4 glicosídico]



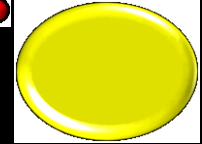
Armadura de Silicato



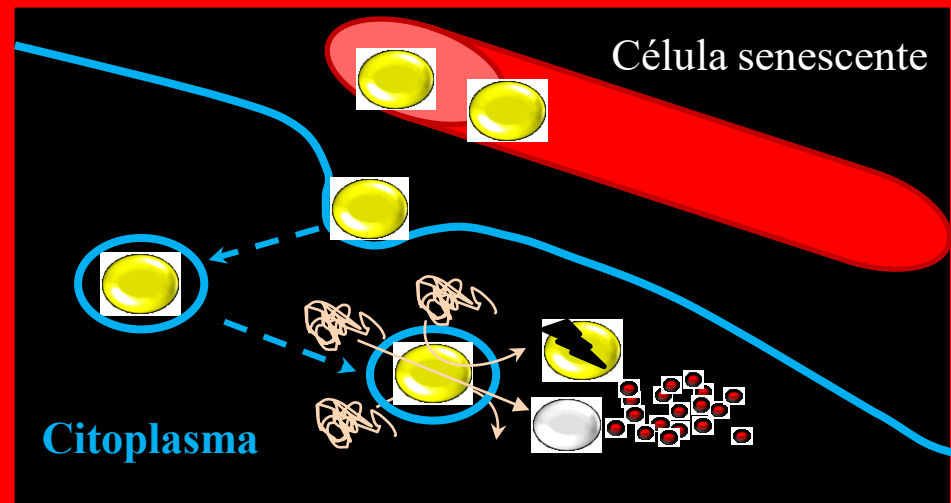
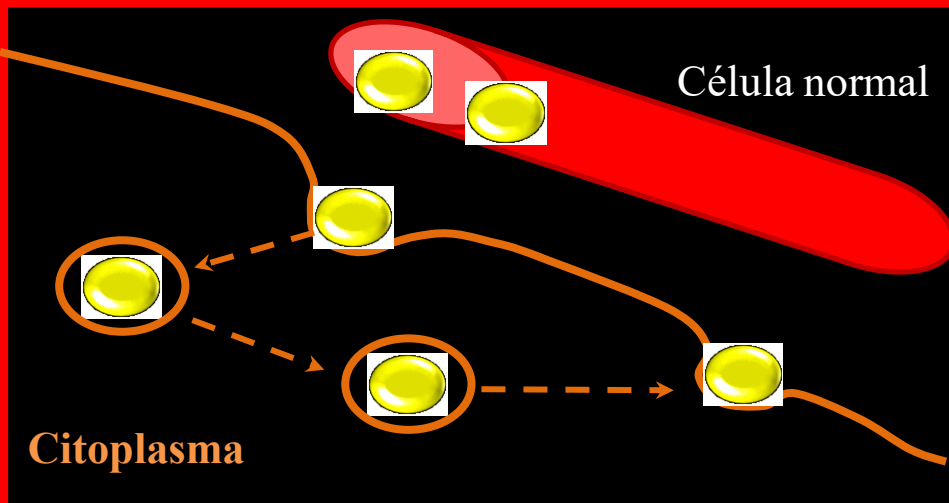
Carga terapéutica



Escudo oligomérico de “Gal 6”



β - Galactosidasa





Published: March 1, 2019

Intrinsic Antibacterial Activity of Nanoparticles Made of β -Cyclodextrins Potentiates Their Effect as Drug Nanocarriers against Tuberculosis

Arnaud Machelart,[†] Giuseppina Salzano,[‡] Xue Li,[‡] Aurore Demars,[§] Anne-Sophie Debie,[†] Mario Menendez-Miranda,[‡] Elisabetta Pancani,[‡] Samuel Jouny,[†] Eik Hoffmann,[†] Nathalie Deboosere,[†] Imène Belhaouane,[†] Carine Rouanet,[†] Sophie Simar,^{||} Smail Talahari,^{||} Valerie Giannini,[⊥] Baptiste Villemagne,[#] Marion Flipo,[#] Roland Brosch,[⊥] Fabrice Nessler,^{||} Benoit Deprez,[#] Eric Muraille,^{§,||} Camille Locht,[†] Alain R. Baulard,[†] Nicolas Willand,[#] Laleh Majlessi,^{⊥,□} Duxandra Gref,^{*,‡,Ⓜ} and Priscille Brodin^{*,†,Ⓜ}

ARTICLE



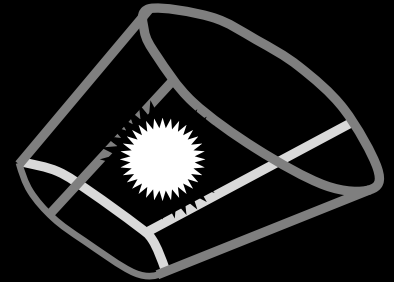
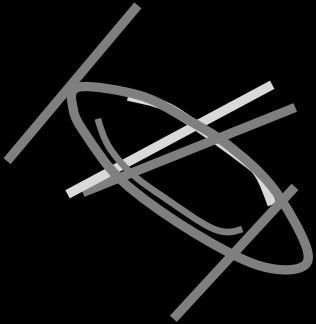
- Las bacterias de la tuberculosis resistentes a antibióticos son un problema grave de salud pública.
- Se está experimentando con Nanopartículas para distribuir los antibióticos.
- Una nanopartícula ha dado resultados **sorprendentes**. La “*ciclo-dextrina*.”

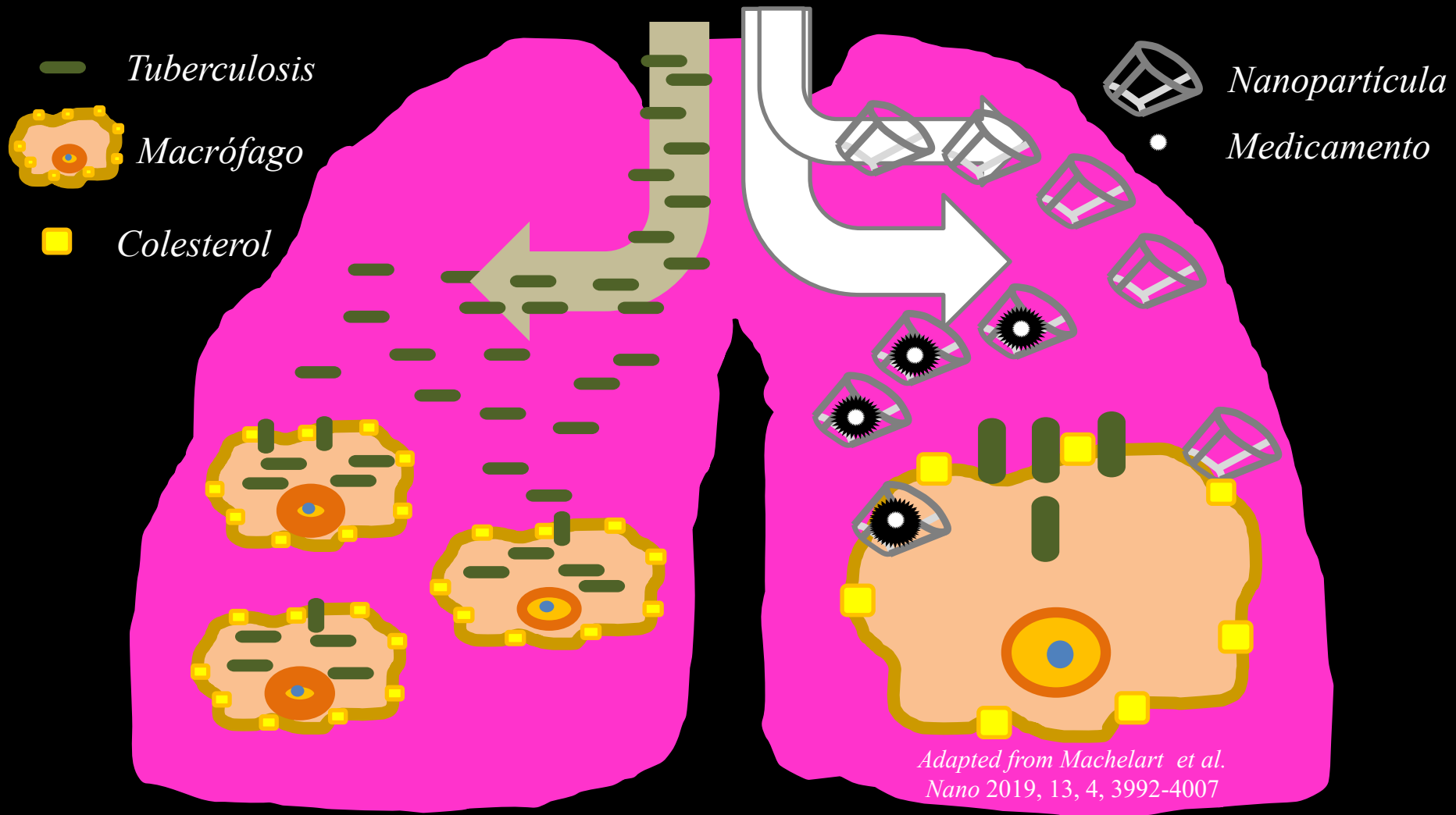
1

Síntesis β - Cyclodextrin (β CD)

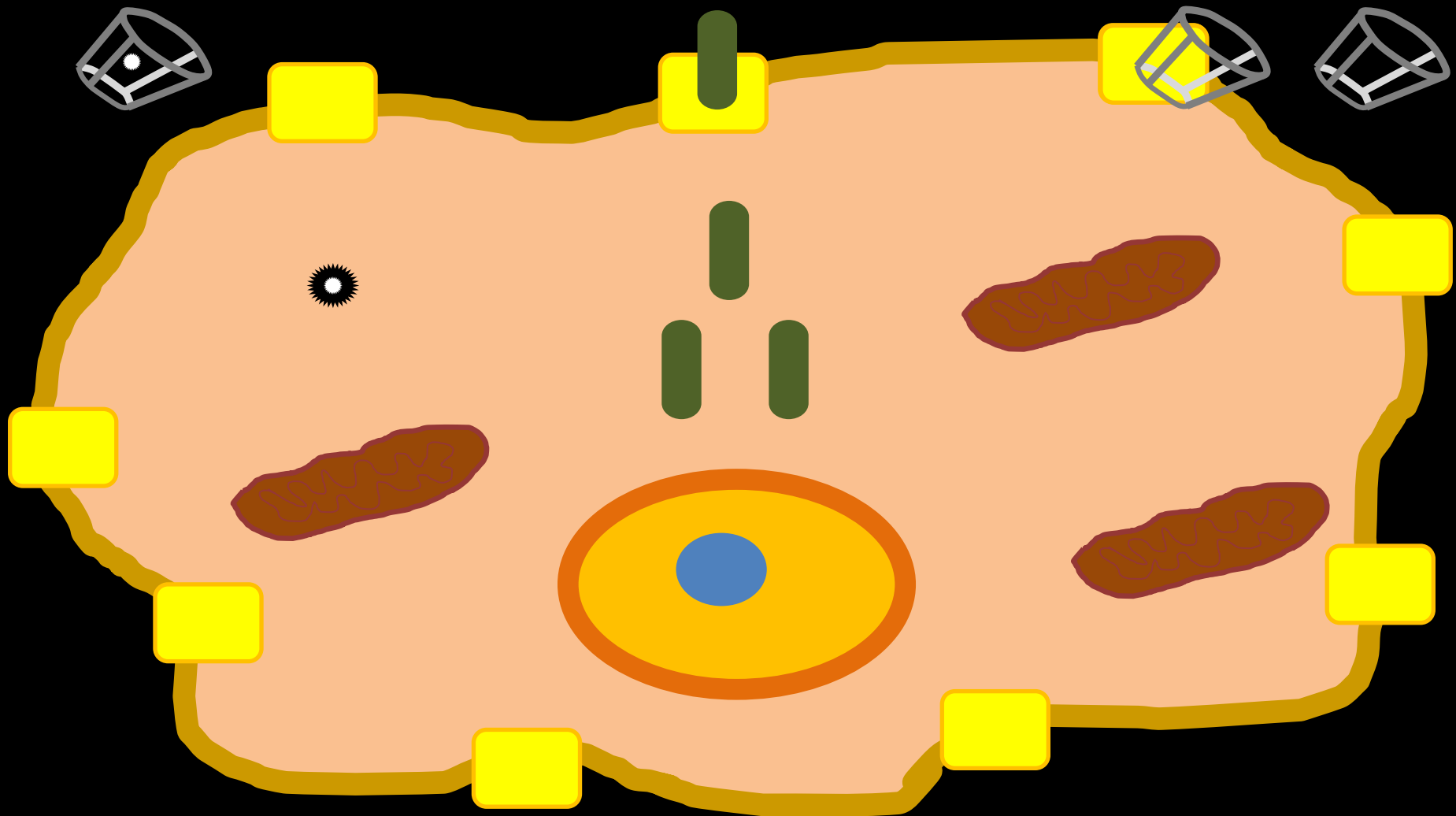
2

Carga (antibiótico)





*Adapted from Machelart et al.
Nano 2019, 13, 4, 3992-4007*



UN EJEMPLO de nanomedicamento EL ABRAXANE



How does Abraxane work?

Paclitaxel blocks a stage of cell division.

Paclitaxel has been available as a cancer medicine since 1993.

Nanoparticles (Paclitaxel +Albumin) since 2009

In Abraxane, the paclitaxel is attached to a human protein called albumin in tiny particles known as ‘nanoparticles’.



Ventajas de las *Nanopartículas* frente al *paclitaxel*

Nanopartícula $\rightarrow$ (*Paclitaxel* + *albúmina*)

- Mejora solubilidad y facilita la inyectabilidad.
- En monoterapia es más eficaz tratando el cáncer de mama metastático.
- En combinación con otras quimioterapias aumenta la supervivencia en pacientes con adenocarcinoma de páncreas metastásico.

En resumen: *funciona mejor*

A microscopic view of several red blood cells (erythrocytes) in a blood smear. The cells are biconcave discs, appearing as reddish-orange structures against a dark, textured background. One cell is particularly large and prominent in the upper right foreground.

Created with a
non-activated version
www.avs4you.com



2



MINISTERIO
DE SANIDAD, CONSUMO
Y BIENESTAR SOCIAL



agencia española de
medicamentos y
productos sanitarios

Muchas gracias a todo el mundo por vuestra atención

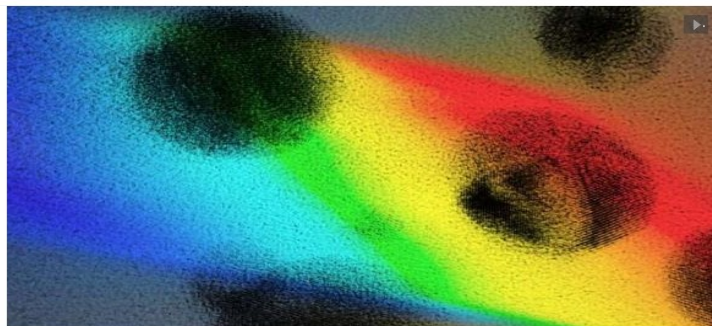


Nanomedicamentos: El futuro presente



Researchers use nanoparticles to make photodetectors better able to handle the ultraviolet radiation

Particle physicists are on the hunt for light. [Read more](#)



SlideShow Archive



Nano Film

Enter the Nano Film Contest! **Deadline February 8, 2019**

Nano Film is a video contest for undergraduate and graduate students that are conducting nanotechnology research in the United States and U.S. territories. Participating students should submit short videos that tell a general audience about nanotechnology. How do you hope your work will help the world? What's the greatest promise in nanotechnology? Where do you hope nanotechnology will make the greatest impact? What do you think is cool about nanotechnology? Be creative! See the 2017 winning video [here](#)!

Federal agencies funding research and development activities in nanotechnology under the auspices of the National Nanotechnology Initiative (NNI), with support from the National Nanotechnology Coordination Office (NNCO), are working to highlight the accomplishments of and build community around the NNI, and to educate the general public about nanotechnology. One such effort is Nano Film, a video contest that asks people to talk about nanotechnology.