

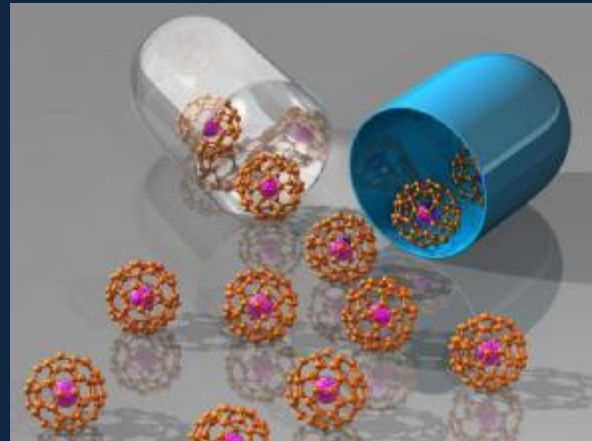


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# Les Nanoparticules

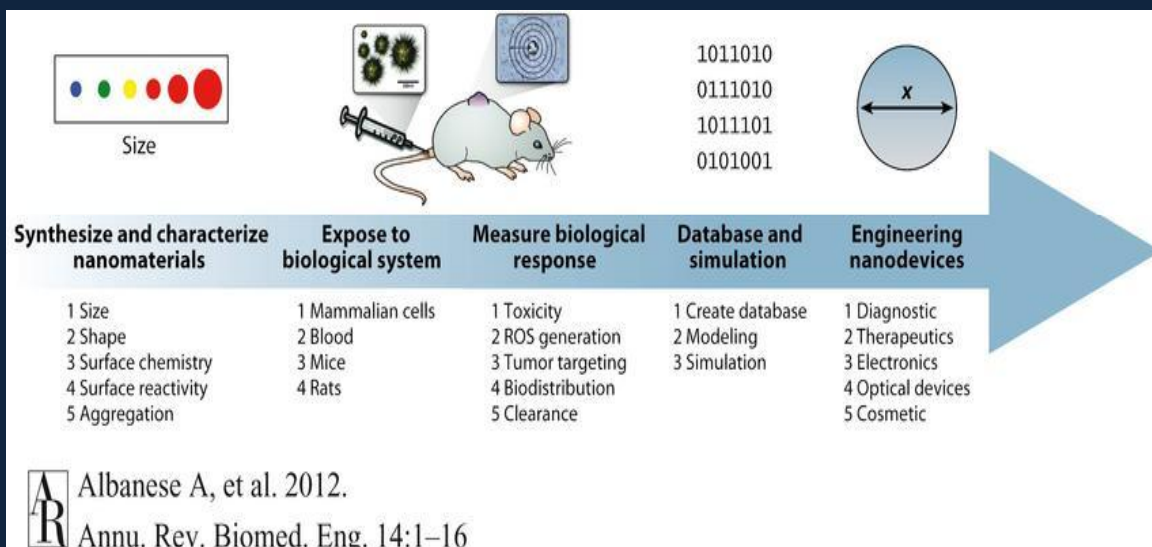
3 :  
Interactions moléculaires  
& cellulaires, évaluation  
de la toxicité et sécurité  
des nanoparticules



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## Nanoparticules : Etapes de Recherches Pré-cliniques

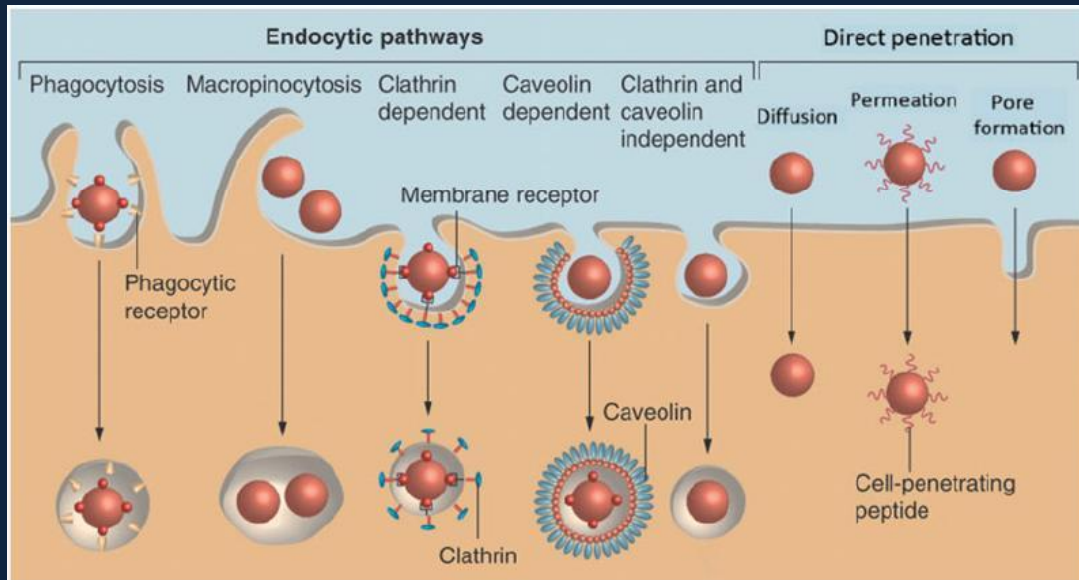




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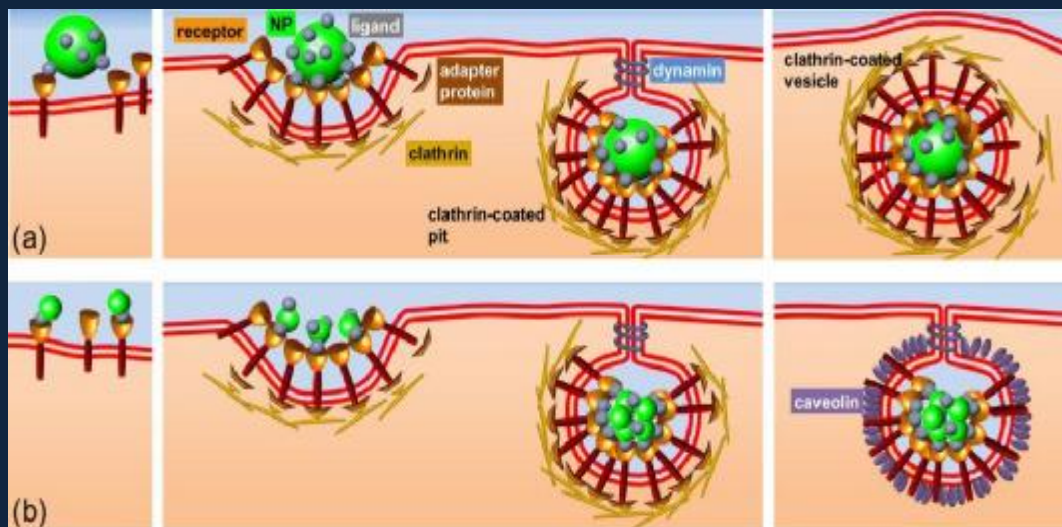
## Mécanismes d'Incorporation Cellulaires des Nanoparticules



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## Mécanismes d'Endocytose des Nanoparticules



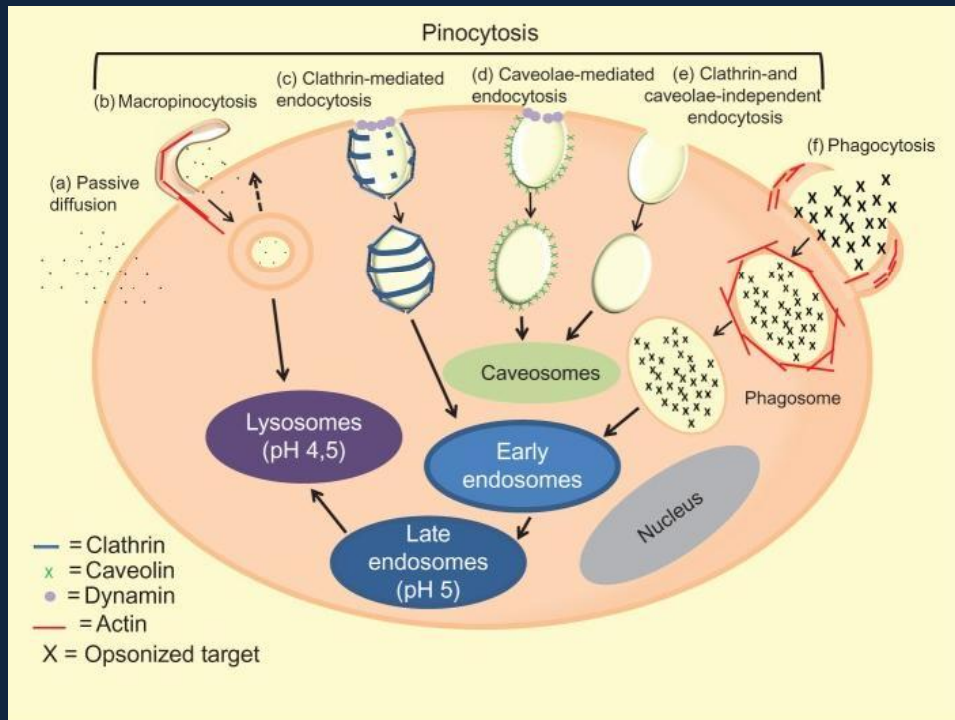
**Figure 1:** Schematic representation of the cellular uptake of (a) large and (b) small NPs. Whereas larger NPs exert interactions with the cell membrane that are sufficiently strong to trigger internalization of one NP at a time, smaller NPs have to form a cluster of a certain size to induce membrane invagination.



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## Localisations Intracellulaires des Nanoparticules

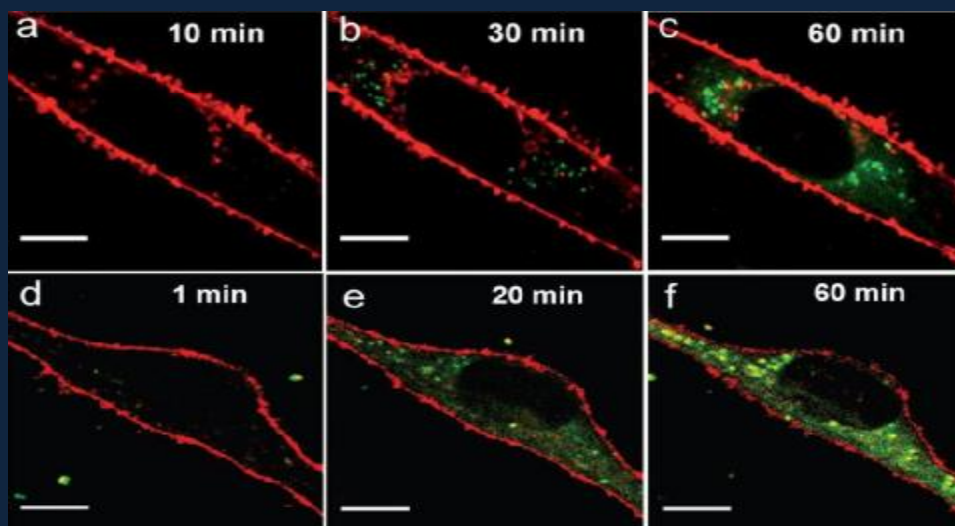


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## Incorporation Intracellulaire de Nanoparticules

**Figure 4:** Two-color merged confocal images of live human MSCs exposed to NPs (green) in PBS for different times. (a–c) PS<sup>-</sup> NPs, 75 µg/mL; (d–f) PS<sup>+</sup> NPs, 7.5 µg/mL. Scale bar, 10 µm. Cell membranes (in red) are stained with CellMask DeepRed. Images in panels a–c were reproduced with permission from [32]. Copyright 2011 Royal Society of Chemistry. Images in panels d–f were reproduced with permission from [33]. Copyright 2010 American Chemical Society.

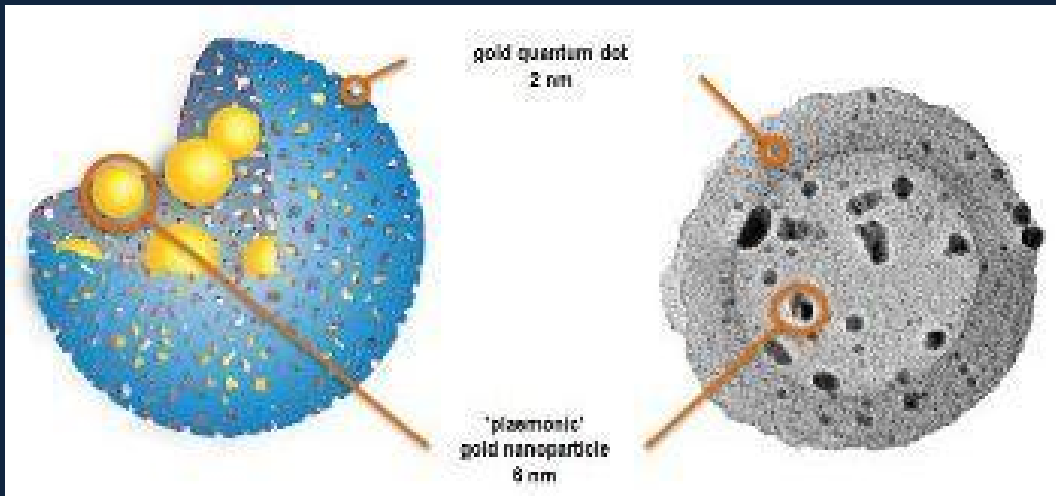




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## Localisations Intracellulaires des Nanoparticules d'Or



Modèle

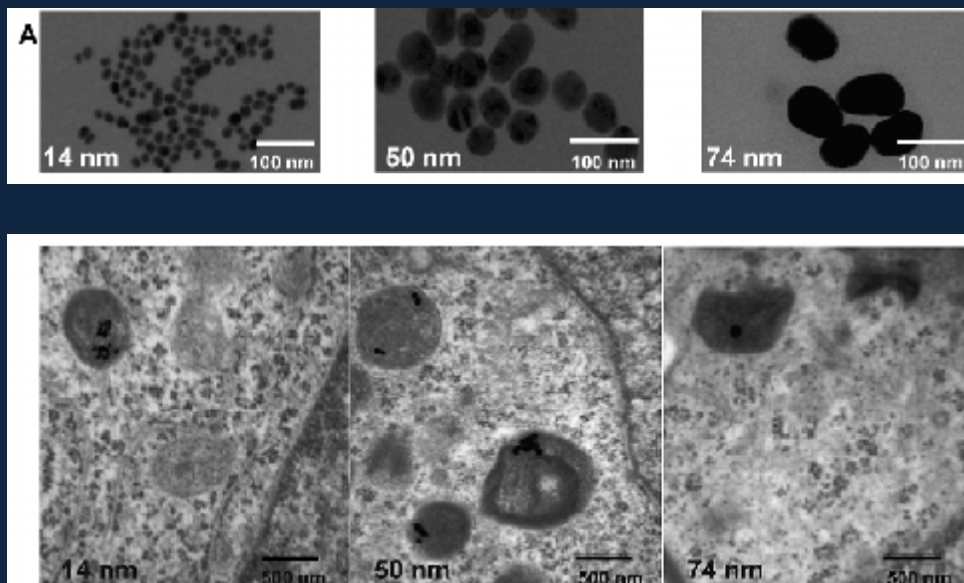
Microscopie  
Electronique



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## Effets de la Taille des Nanoparticules d'Or sur leur Incorporation Cellulaires



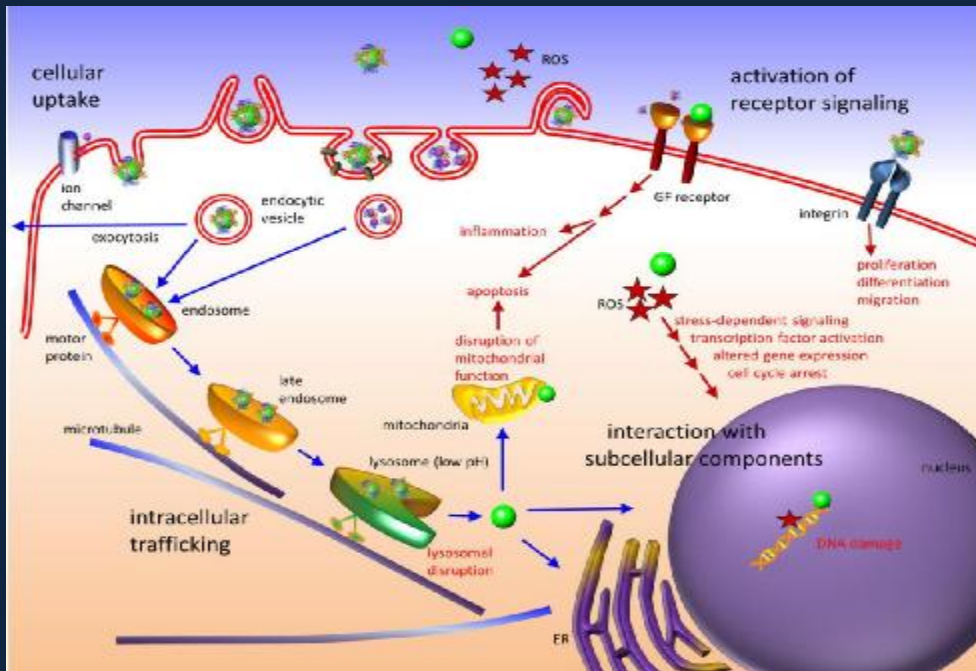




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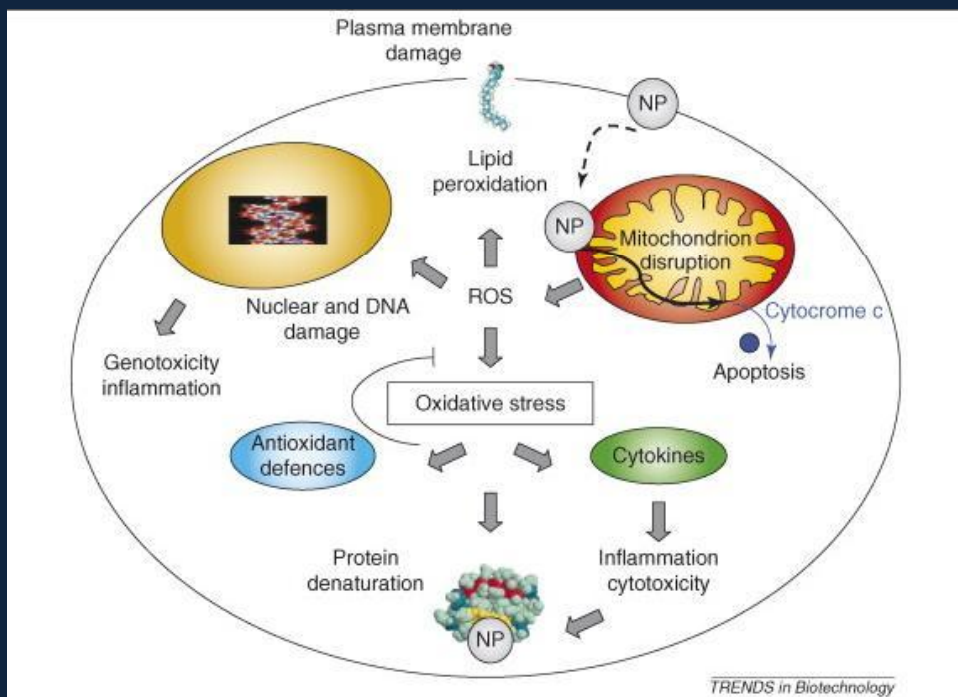
## Effets Cellulaires Potentiels des Nanoparticules



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## Composante Radicalaire des Effets Cellulaires Potentiels des Nanoparticules





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## Incorporation de Nanoparticules chez l'Animal

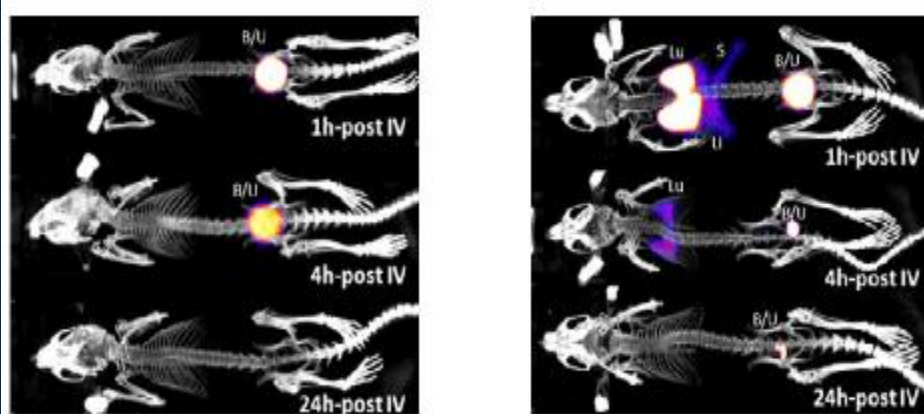


FIGURE 16.15

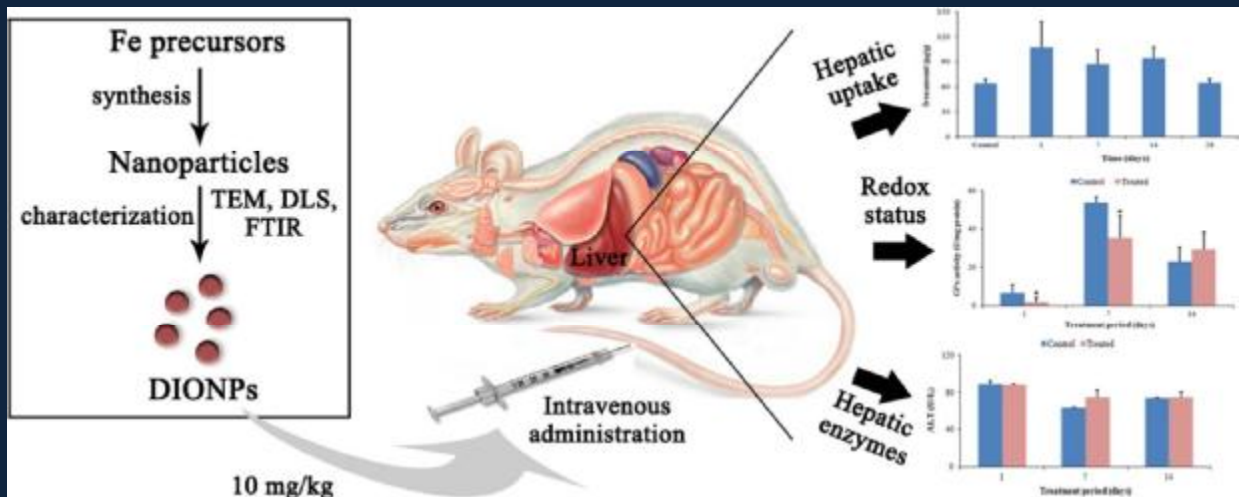
Reconstructed images of *in vivo* SPECT/CT dual imaging of Swiss nude mice intravenously injected with 15 MBq DOTA[<sup>111</sup>In] (left panel), TIONts-DOTA[<sup>111</sup>In] (right panel), at 1 h, 4 h and 24 h post-injection



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## Distribution et Effets de Nanoparticules de Fer chez l'Animal

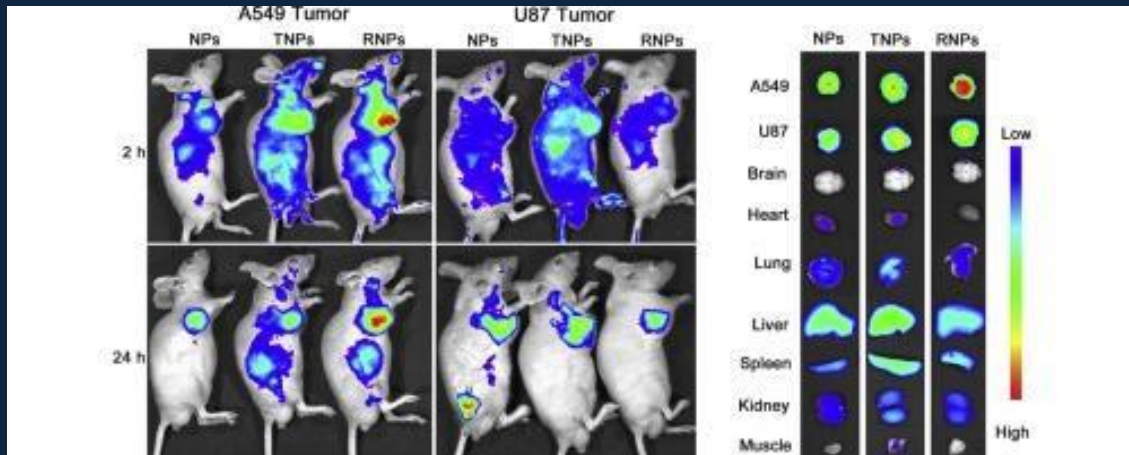




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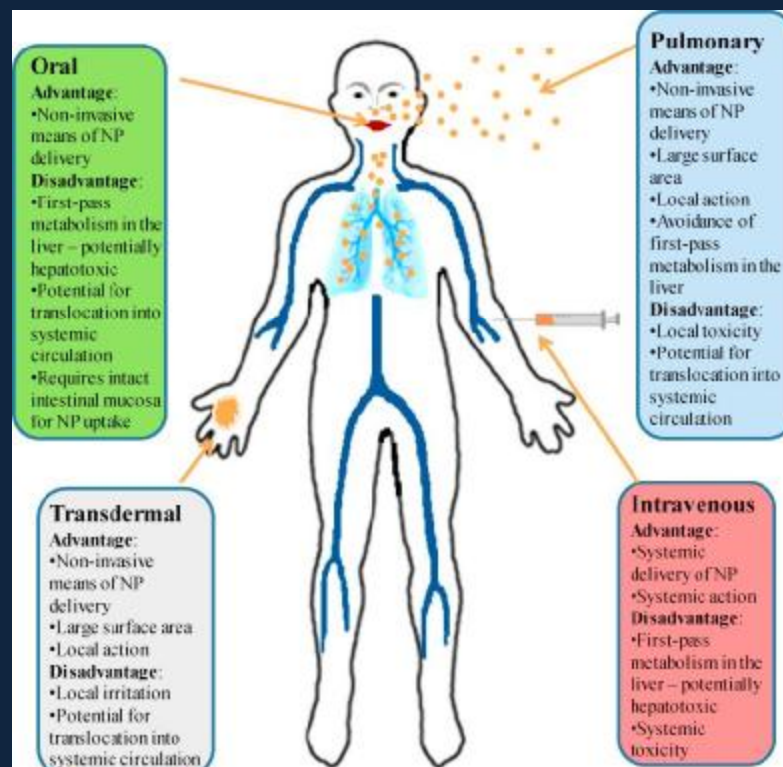
## Distribution et Captation tumorale de Nanoparticules chez l'Animal



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## Voies d'Administration de Nanoparticules chez l'Homme





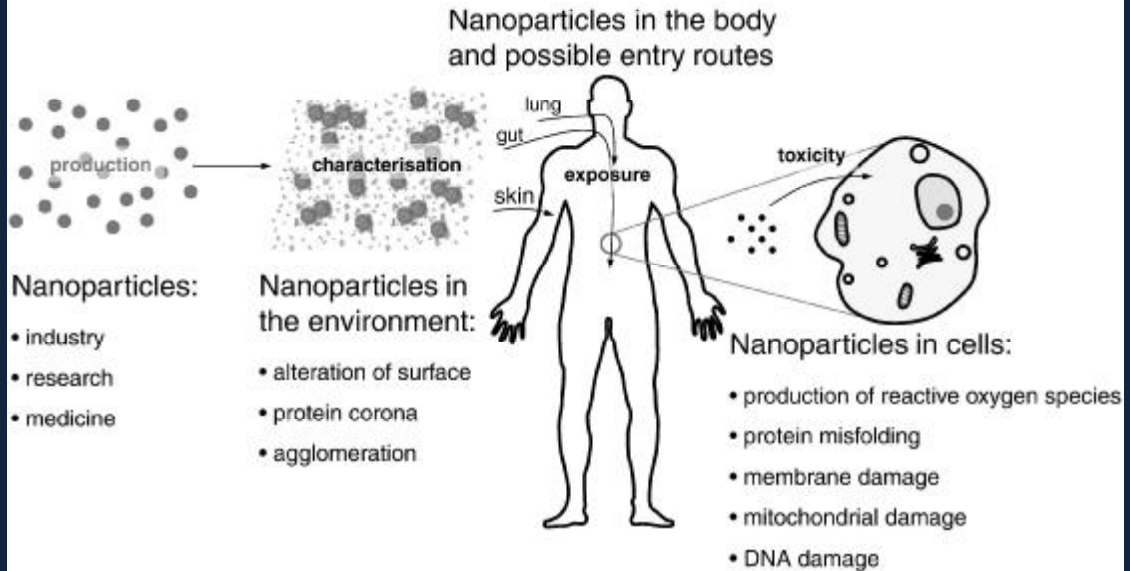


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## Exposition et Effets Potentiels des Nanoparticules chez l'Homme

### Nanoparticle characterisation, pathways and toxicological impact

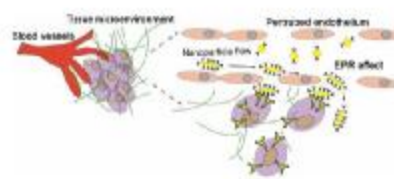


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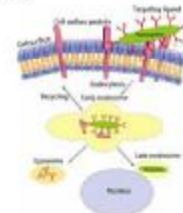
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## Barrières Naturelles de l'Incorporation de Nanoparticules chez l'Homme

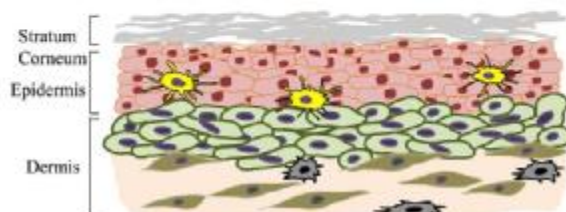
### (A) Endothelial Barrier



### (B) Cellular Barrier



### (C) Skin And Mucosal Barrier



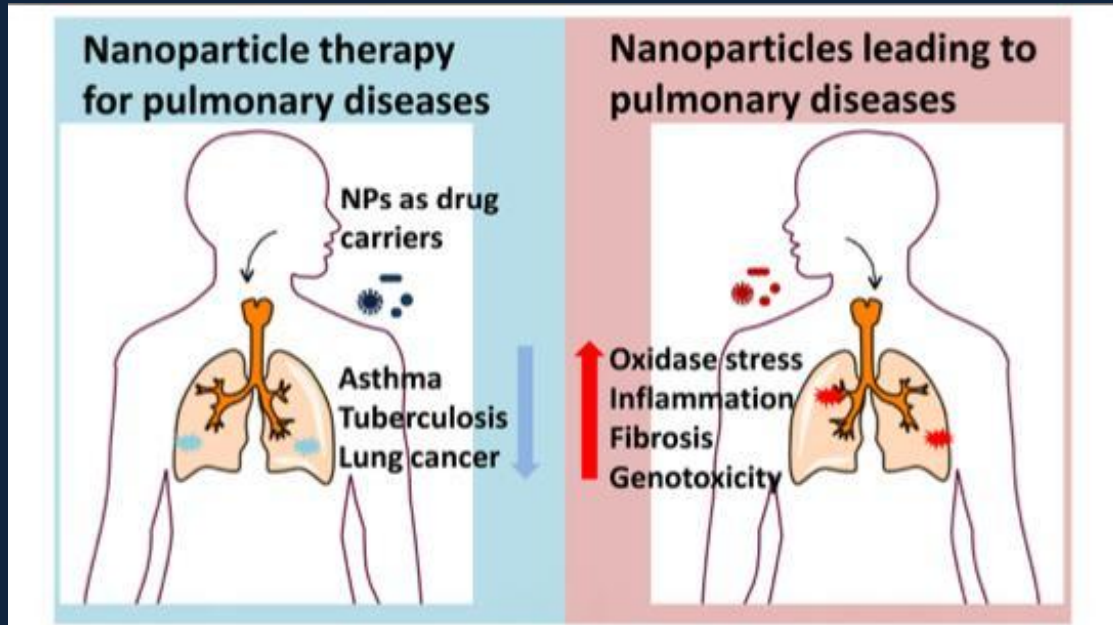




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## Bénéfices/Risques des Nanoparticules chez l'Homme



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## Types d'Etudes des Nanoparticules chez l'Homme

**ClinicalTrials.gov**  
A service of the U.S. National Institutes of Health  
Developed by the National Library of Medicine

**Drug Supplement Device**

1. Presence of Nanoparticles in the Amniotic Fluid
2. Radiosensitization of Multiple Brain Metastases Using AGuIX Gadolinium Based Nanoparticles
3. Exhaled Breath Olfactory Signature of Pulmonary Arterial Hypertension
4. Clinical and Genetic Study of Familial Sarcoidosis (SARCFAM)
5. Nanoparticles Emitted by Aircraft Engines, Impact on the Respiratory Function (Air France Company's Employees Working in the Marseilles and Paris Airports)
6. Evolution of Albumin on AOA1 Patients Supplemented With Coenzyme Q10
7. NBTXR3 Crystalline Nanoparticles and Radiation Therapy in Treating Patients With Locally Advanced Squamous Cell Carcinoma of the Oral Cavity or Oropharynx
8. NBTXR3 Crystalline Nanoparticles and Stereotactic Body Radiation Therapy in the Treatment of Liver Cancers
9. NBTXR3 Crystalline Nanoparticles and Radiation Therapy in Two Arms With Soft Tissue Sarcoma of the Extremity and Trunk

Étude  
Épidémiol.

Essais  
Cliniques