Cytotoxicity of nanoparticles released from titanium implants

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Titanium implants

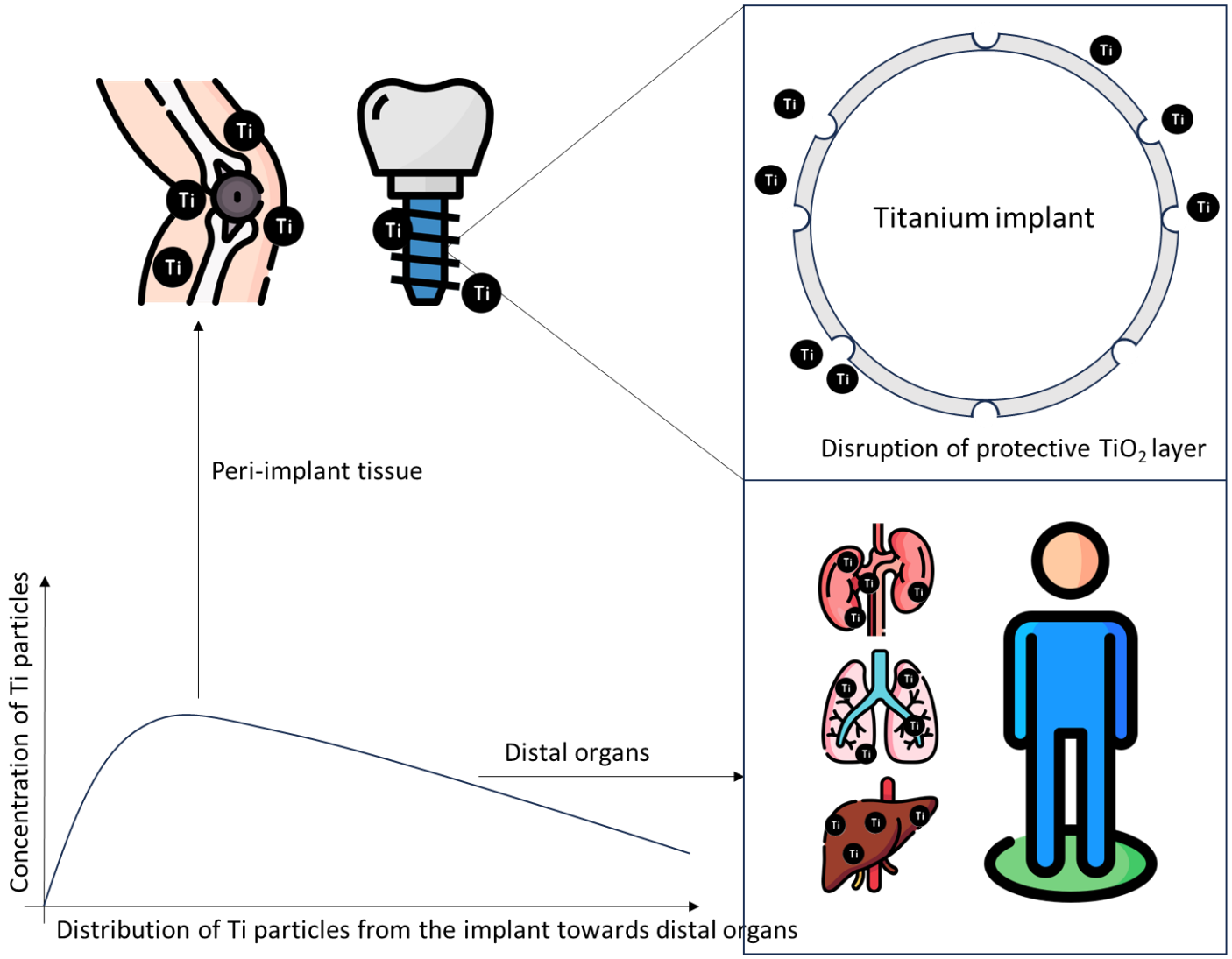
- Implant → nanoparticle (TiO_2)
- Distribution of released particles

Chemical wear

- Disruption of protective TiO_2 layer by corrosive molecules

Mechanical wear

- Micromovements
- *peri-implantitis* and *peri-implant mucositis (loss of the implant)*



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What causes the toxicity?

Production of ROS

- Ti ions can catalyze the formation of a reactive hydroxyl radical (•OH) from H2O2
- Fenton reaction:

$$H_2O_2 + Fe^{2+} \rightarrow Fe^{3+} + HO^- + {}^{\bullet}OH$$

- Damage to the membranes, DNA,...

Mechanical interaction

- Direct contact between NP and the cell → rupture
- Interaction with cellular organelles upon internalization

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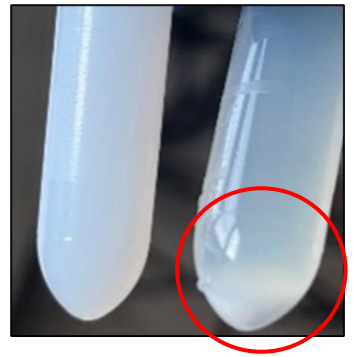
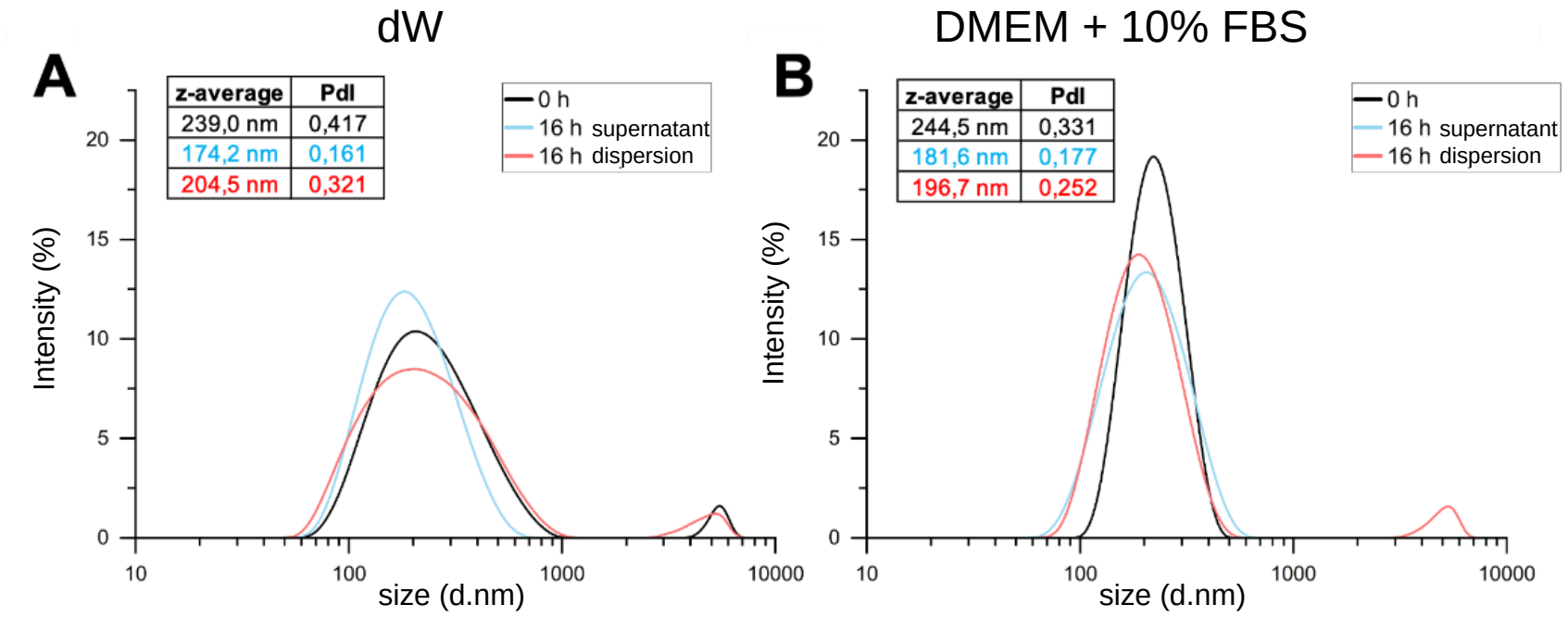
Toxicity testing

- Stable dispersion of TiO_2 to predict relevant LC
- Modification with BSA

Bare NP



dW medium



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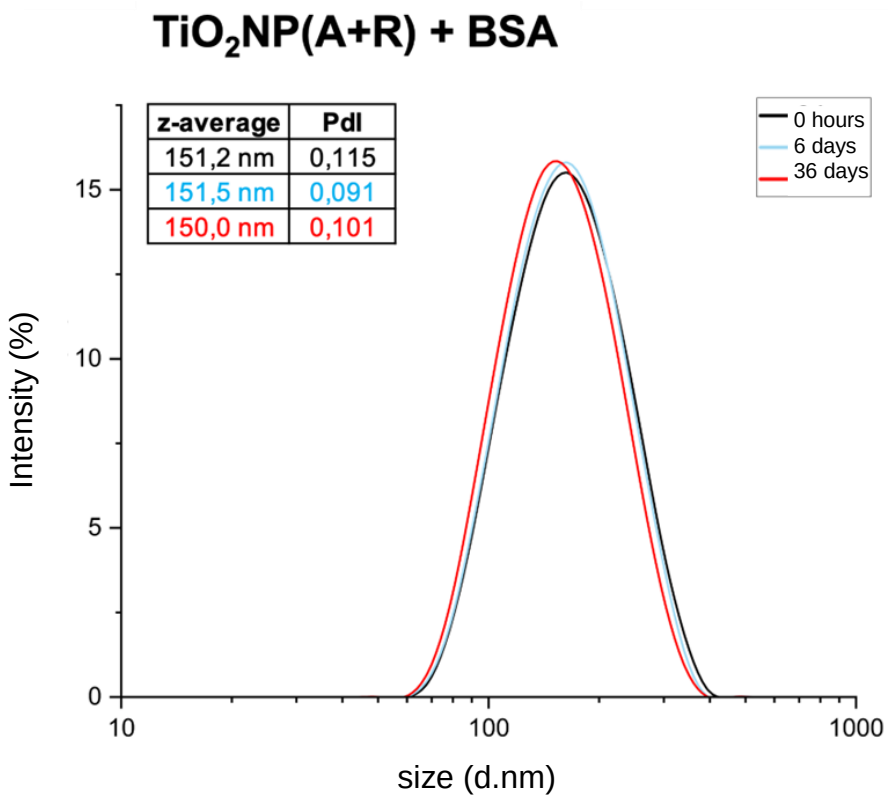
Optimalized dispersion

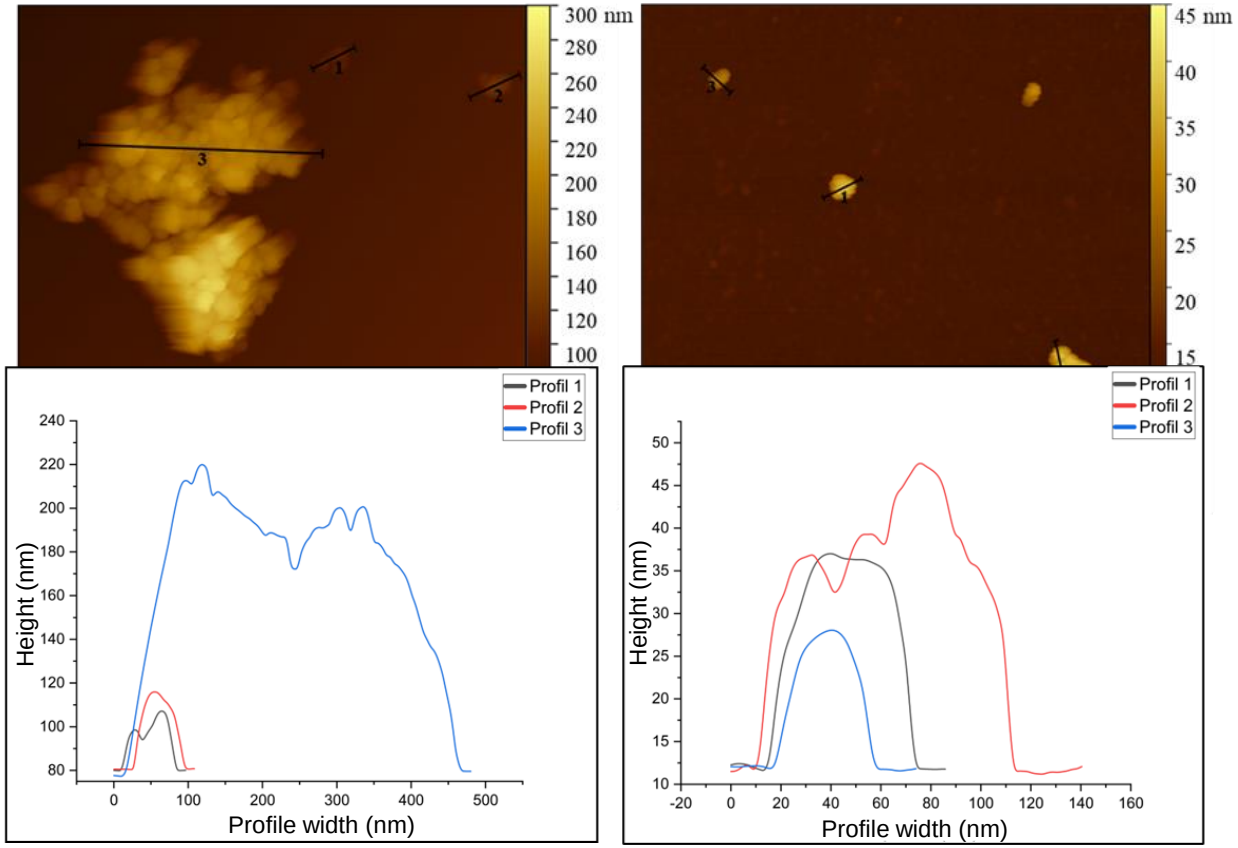
Stock solution stable 36 days (151 nm) - DLS

dW



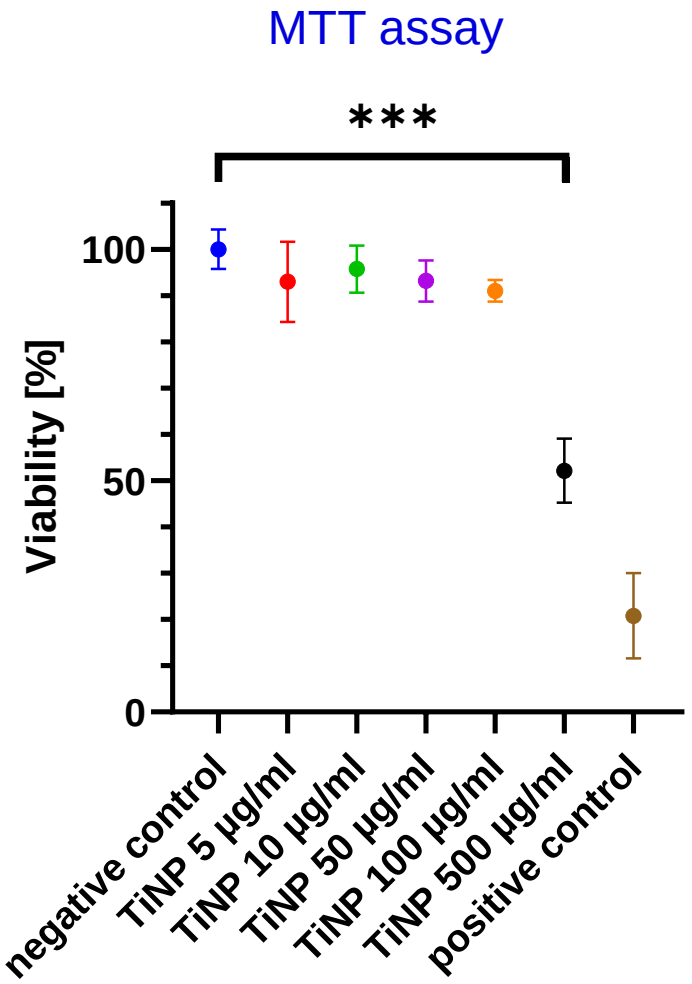
bare TiO_2NP

BSA modified TiO_2NP



Osteoblasts viability

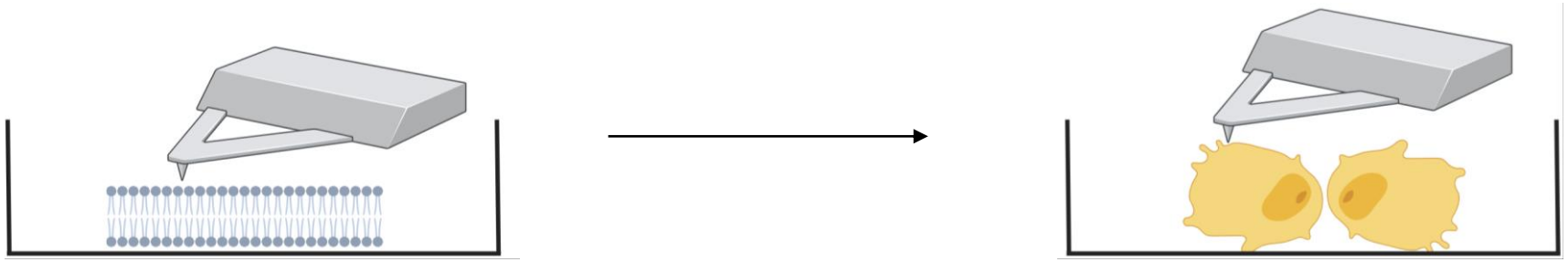
- Decreased viability of primary culture of patients osteoblasst
- Short term exposure (72 h)



How is it connected to AFM?

- We want to use the stabilized dispersion of TiO^2NP an observe the potential mechanical (AFM) and chemical (Raman) changes and compare it with effect of other nanomaterials

Step-by-step procedure



Bilayer

Eukaryotic cell

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