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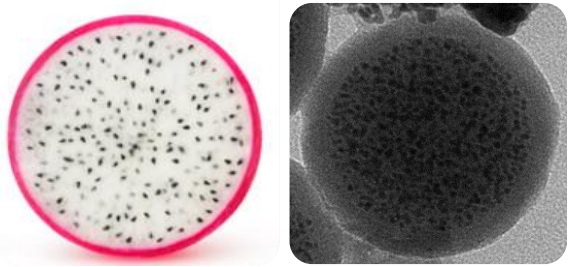
Nanoscience

Second Year PhD exam

Ultrasmall-in-Nano approach: Boosting the clinical translation of metal nanoparticles

Giulia Giannone



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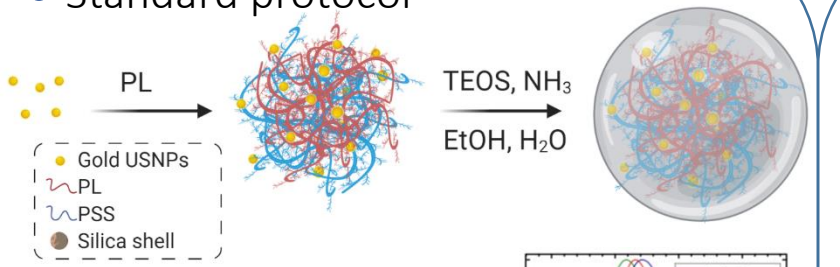
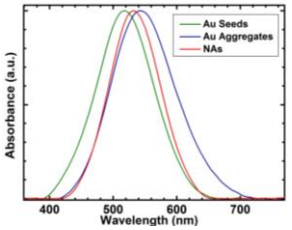
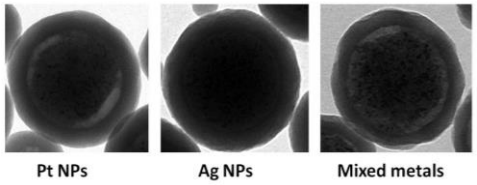
Ultrasmall-in-nano architecture: A Simple all-in-one platform

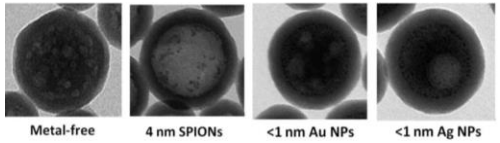
Standard protocol

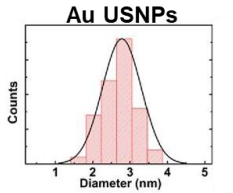




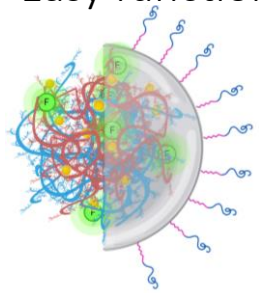
Versatile



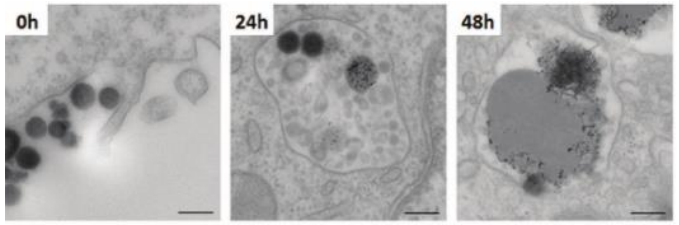




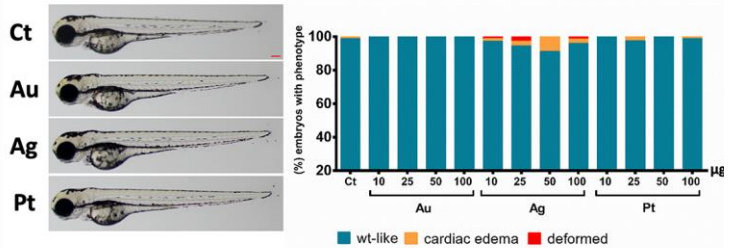
Easy functionalization



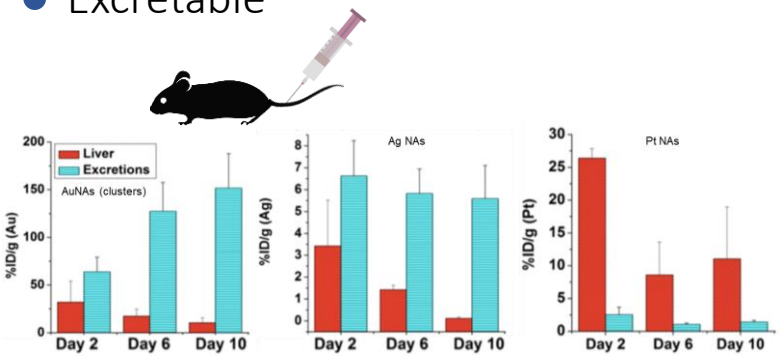
Biodegradable



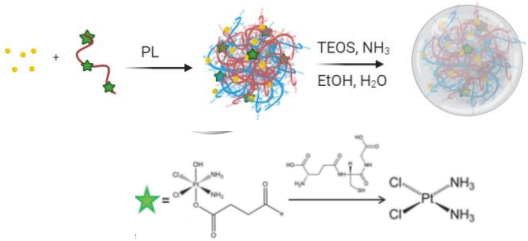
Biocompatible

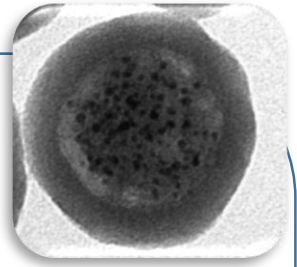


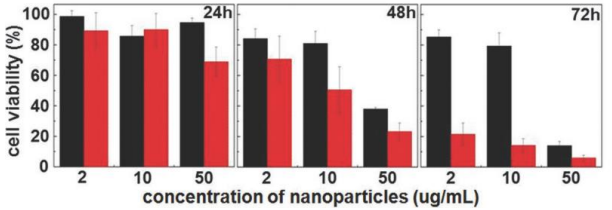
Excretable



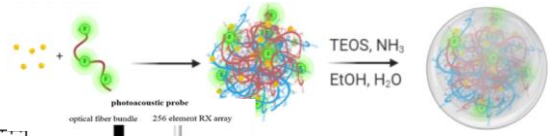
Drug delivery

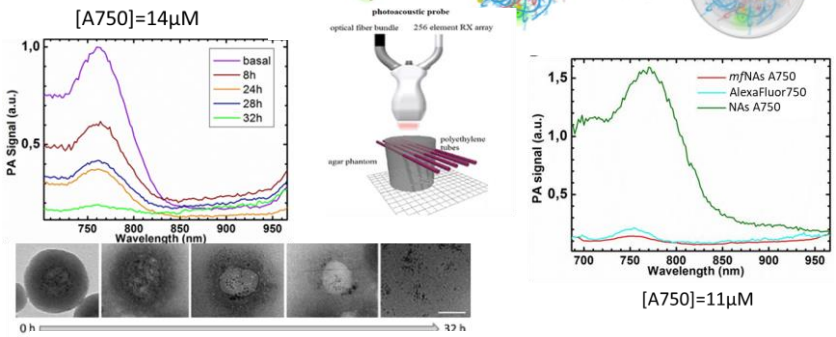






Imaging





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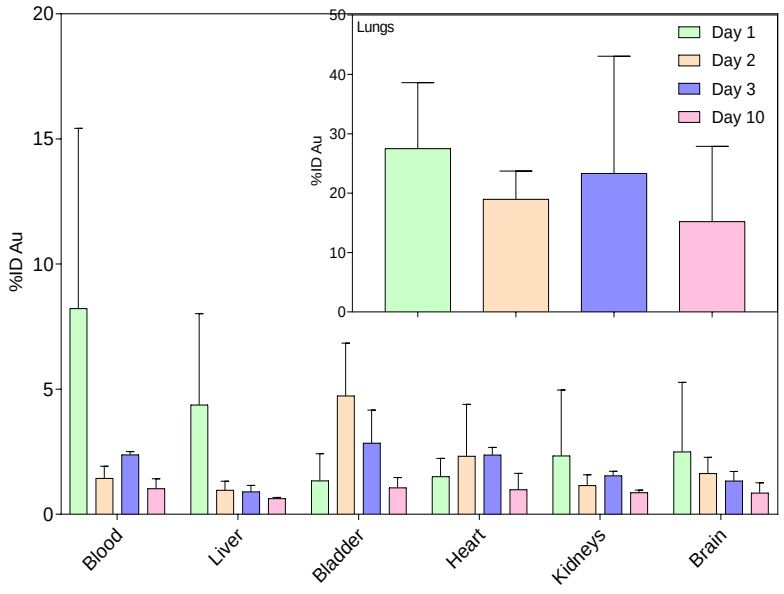
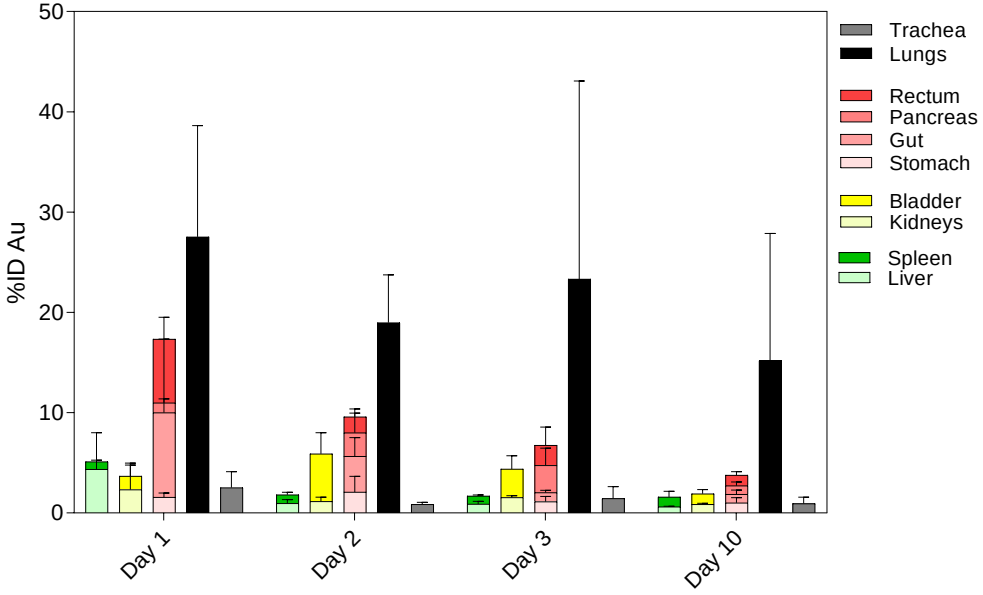
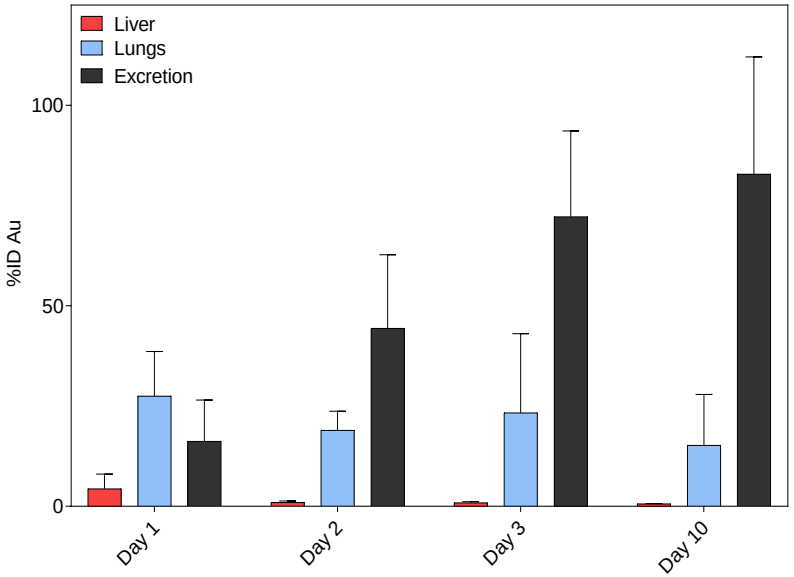
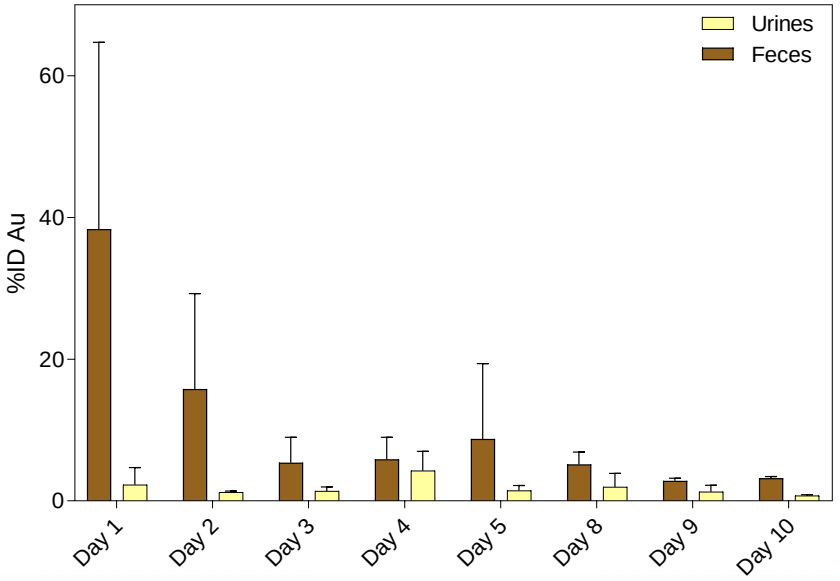
Biokinetics and clearance of inhaled gold ultrasmall-in-nano architectures









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Biokinetics and clearance of inhaled gold ultrasmall-in-nano architectures†

Ana Katrina Mapanao,‡[ab] Giulia Giannone,‡[ab] Maria Summa,‡[c] Maria Laura Ermini,[a] Agata Zamborlin,[ab] Melissa Santi,[a] Domenico Cassano,[a] Rosalia Bertorelli[c] and Valerio Voliani*[a]

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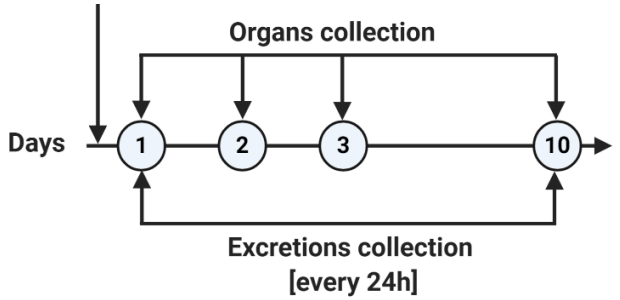

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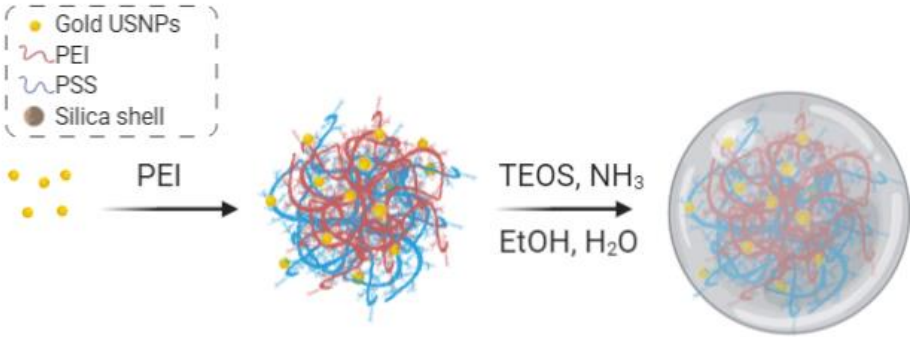
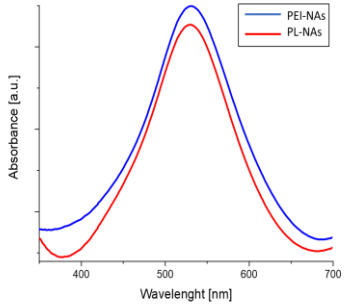
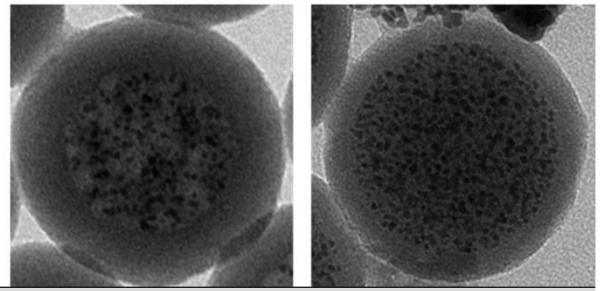
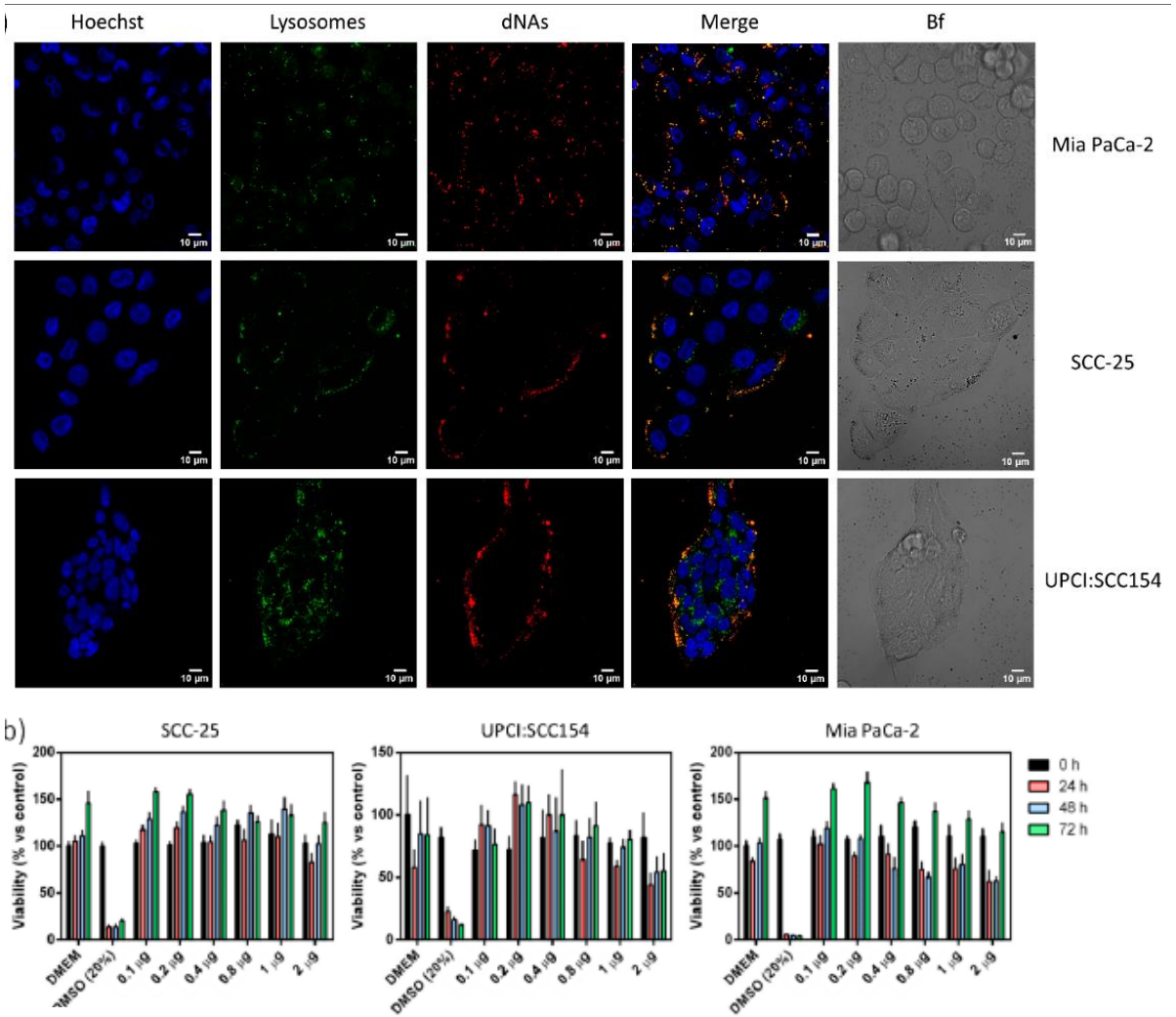
A Cost-Effective Approach for Non-Persistent Gold Nano-Architectures Production







	NAs	*d*NAs
DLS Size [nm]	203.1 ± 1.9	222.3 ± 6.3
TEM Size [nm]	107.6 ± 16.1	107.5 ± 16.6
Shell thickness [nm]	18.9 ± 2.2	12.0 ± 0.9
Au loading [w/w%]	5.9 ± 1.3	9.6 ± 0.8
Z- potential [mV]	-20.6 ± 0.4	-20.6 ± 0.6
UV absorbance plasmon [nm]	532	531



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A Cost-Effective Approach for Non-persistent Gold Nano-Architectures Production

Giulia Giannone [1,2], Melissa Santi [1], Maria Laura Ermini [1], Domenico Cassano [1] and Valerio Voliani [1,*]

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Microfluidics for mass-produced ultrasmall-in-nano architectures

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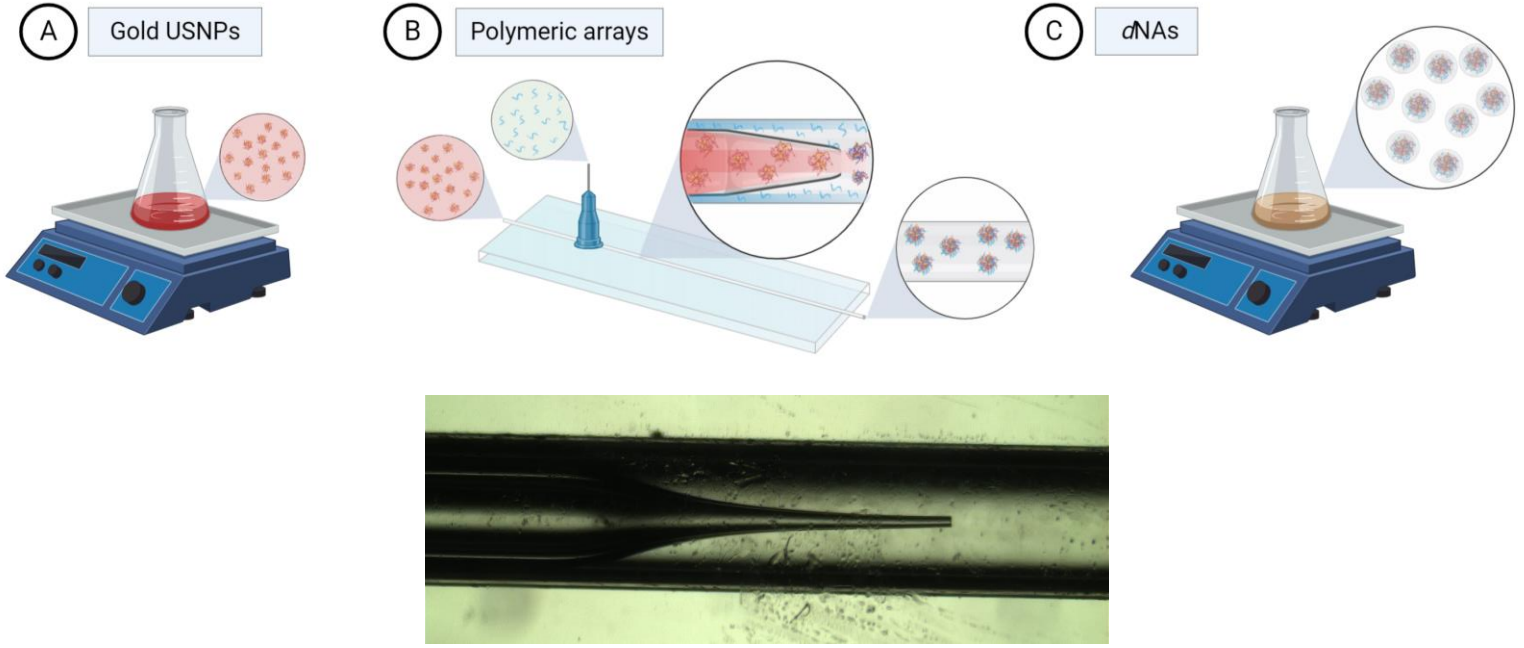

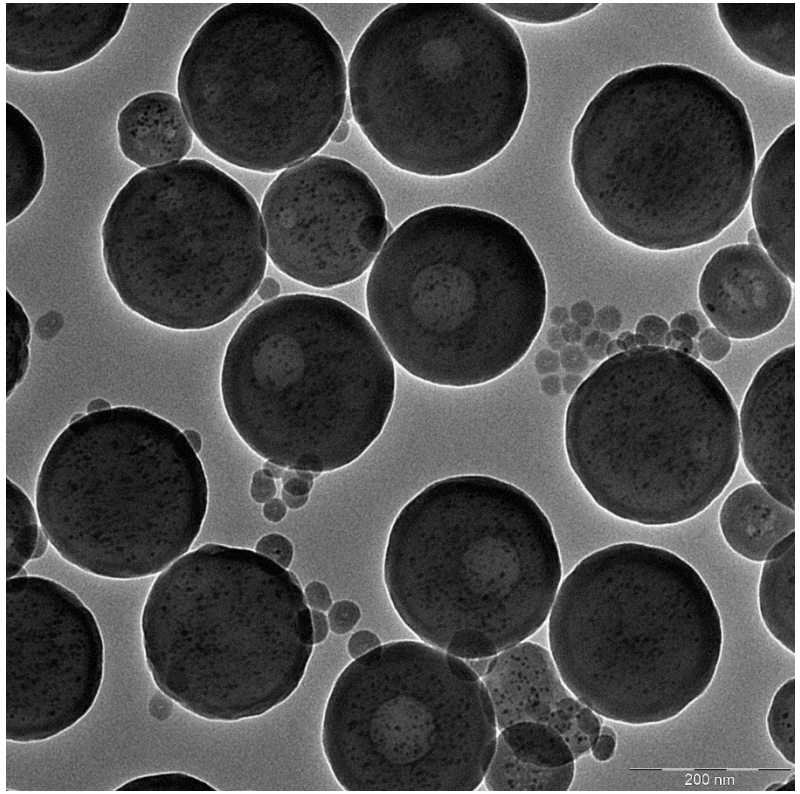

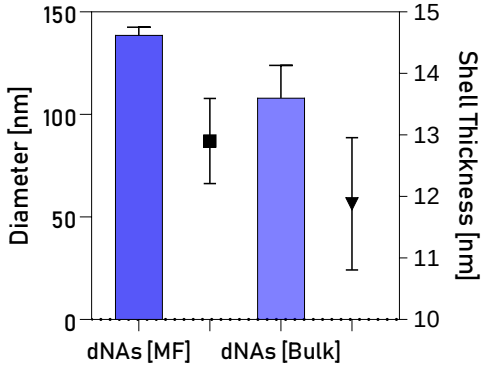

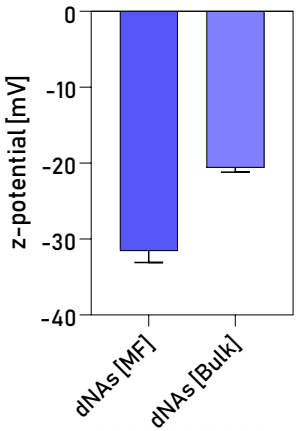

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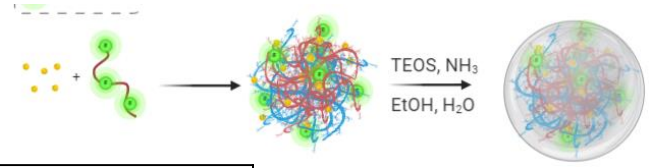
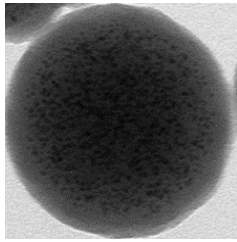
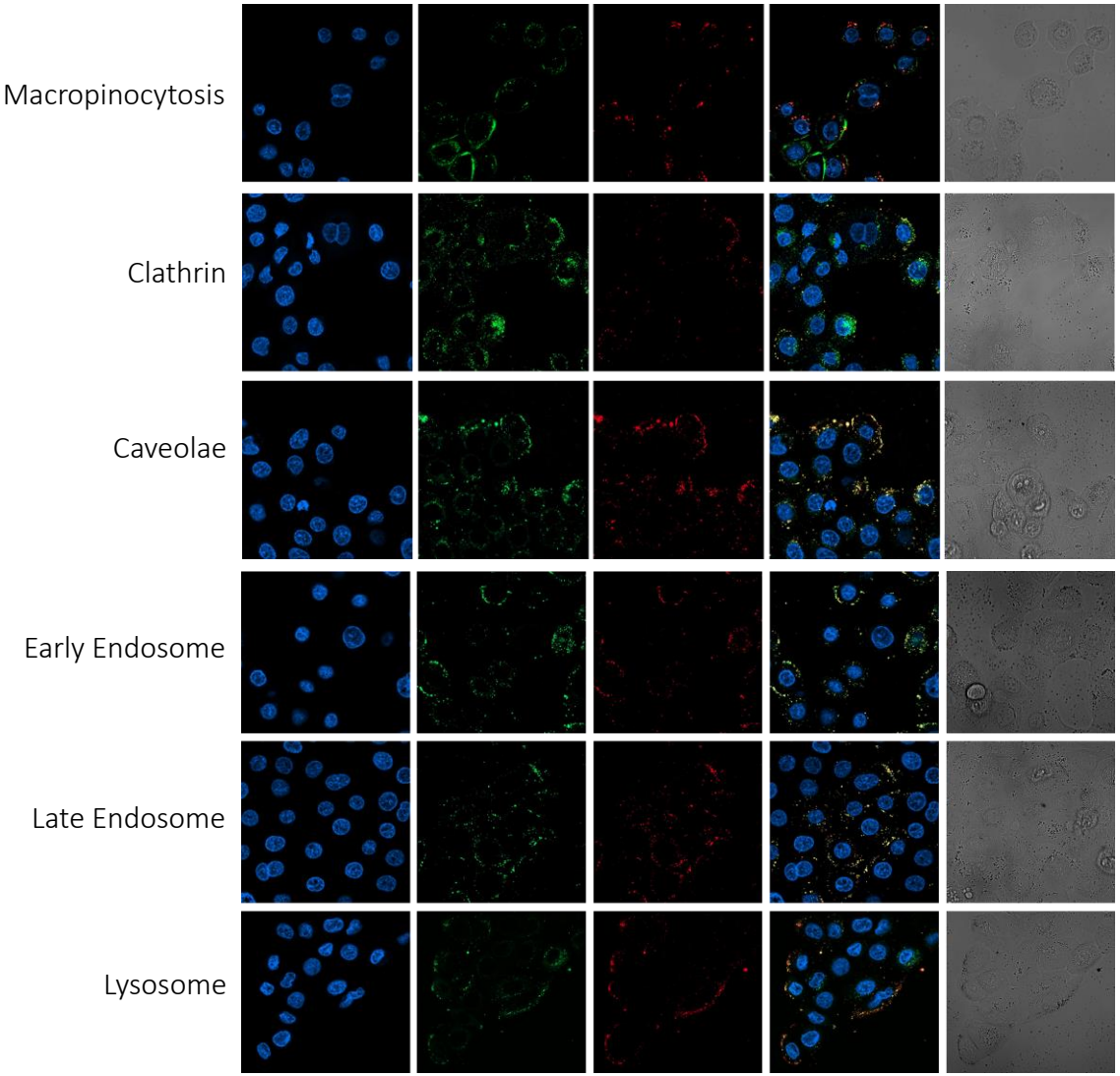
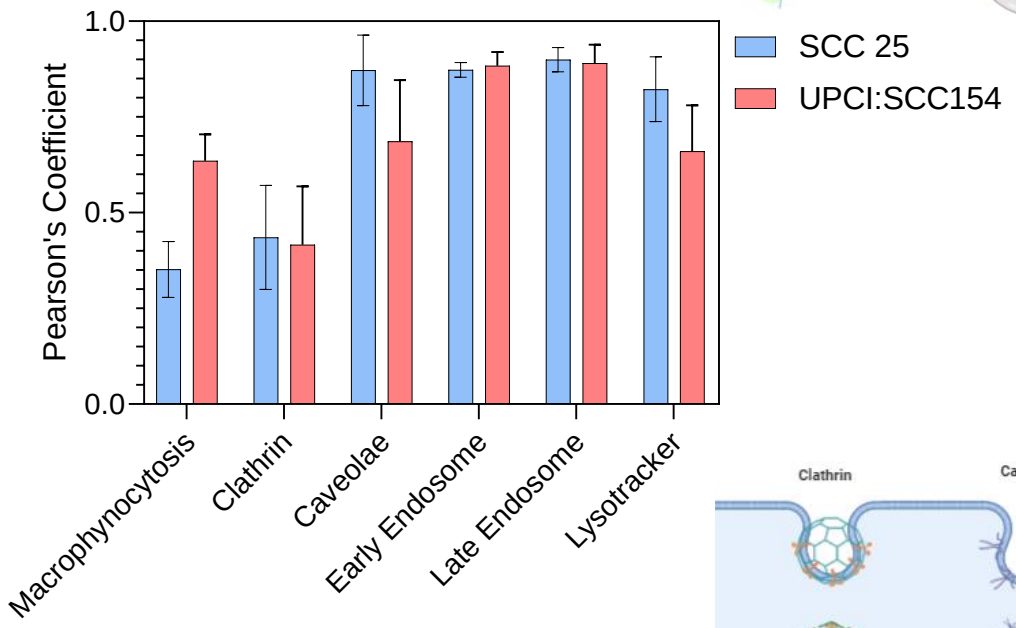
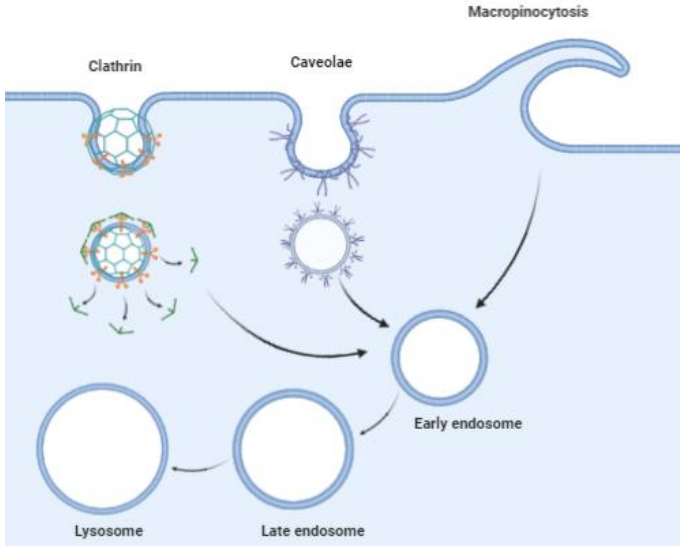
Biological behavior and fate of untargeted ultrasmall-in-nano architecture in Head and Neck cancer cells











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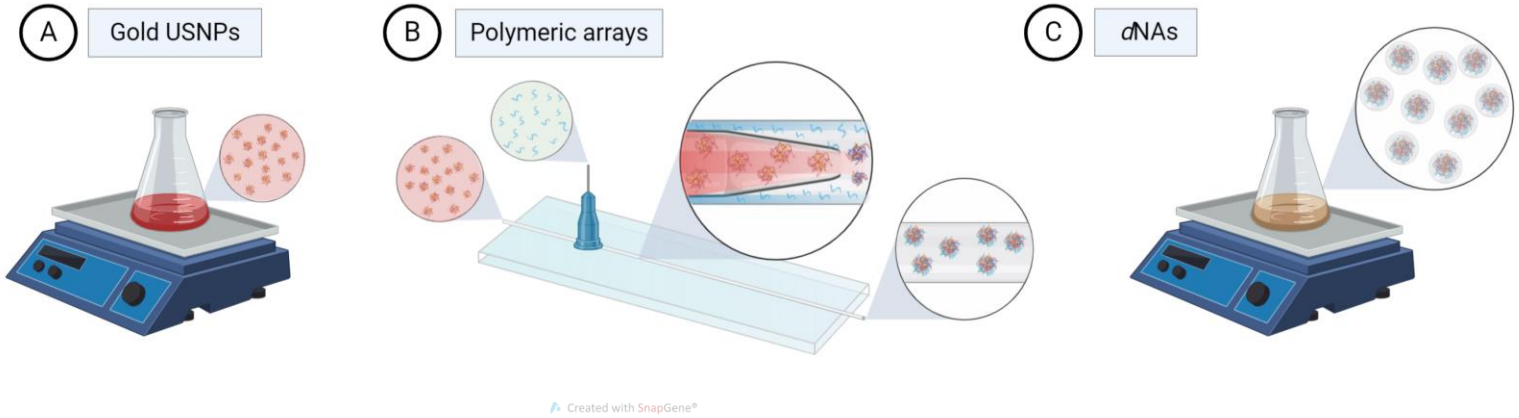
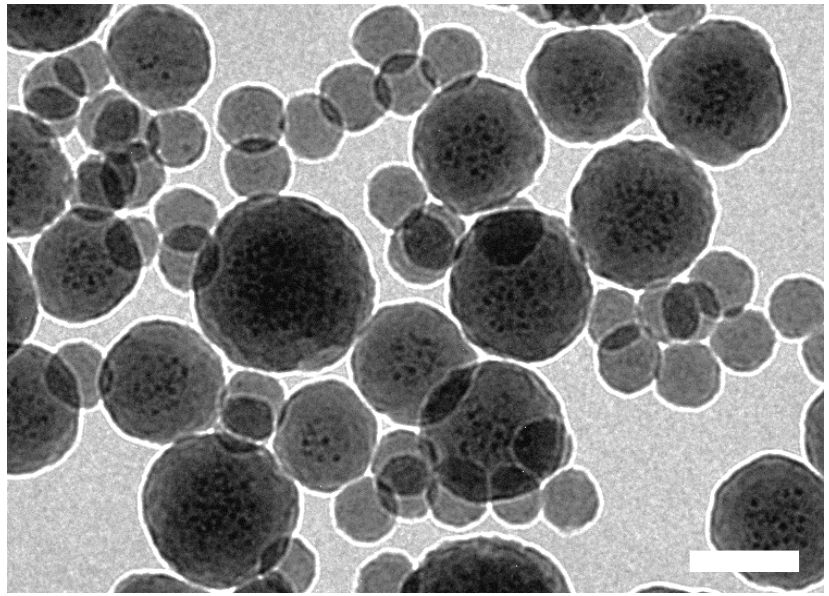
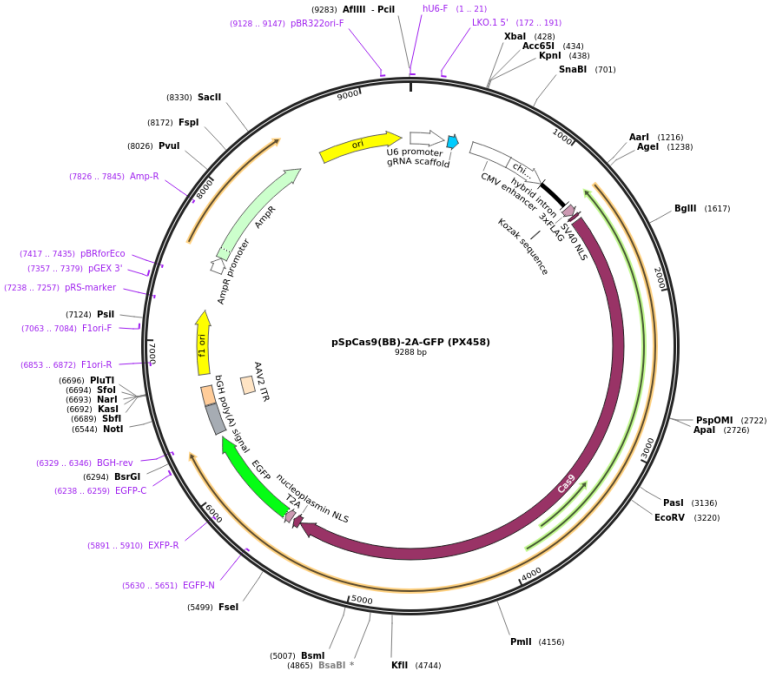
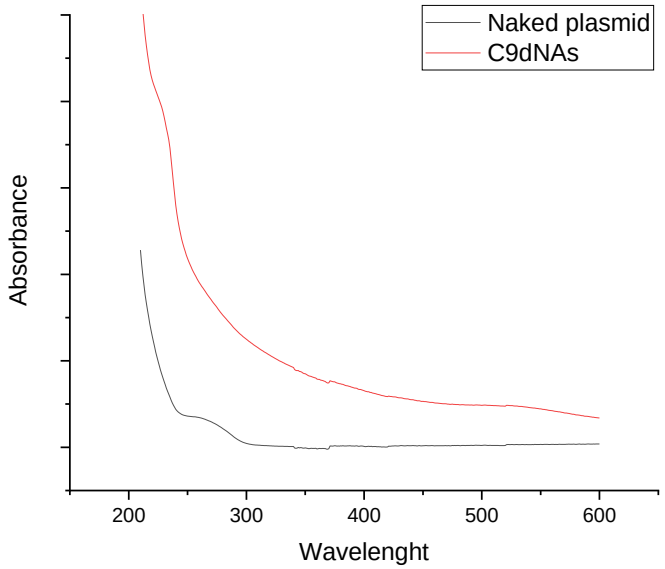
Smart delivery of CRISPR-Cas9









	*d*NAs-CRISPR-Cas9
DLS Size [nm]	144.13 ± 11.15
Z-potential [mV]	+23.5 ± 0.6

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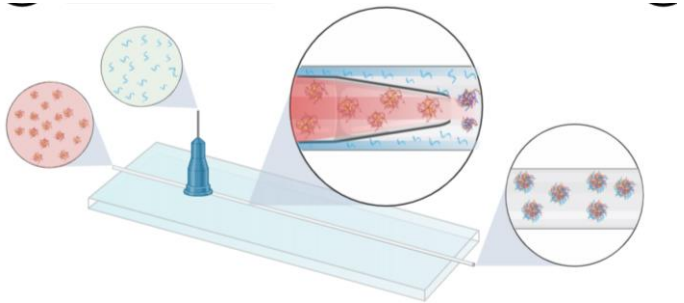
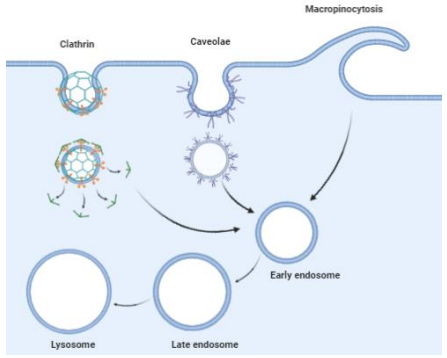
What's next?

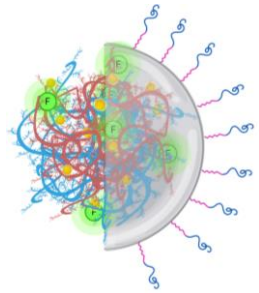
Microfluidics for mass-produced ultrasmall-in-nano architectures



- Optimization and validation of the synthetic protocol
- Optimization of the chip architecture
- Validation of the synthetic protocol for the production of different types of loaded and unloaded nanoarchitecture

Biological behavior and fate of ultrasmall-in-nano architecture in Head and Neck cancer cells





- High resolution imaging of intracellular fate of dNAs
- Targeting of dNAs

Smart delivery of CRISPR-Cas9

- Quantification of loaded plasmid
- Transfection efficacy compared to commercial reagents
- Cells studies

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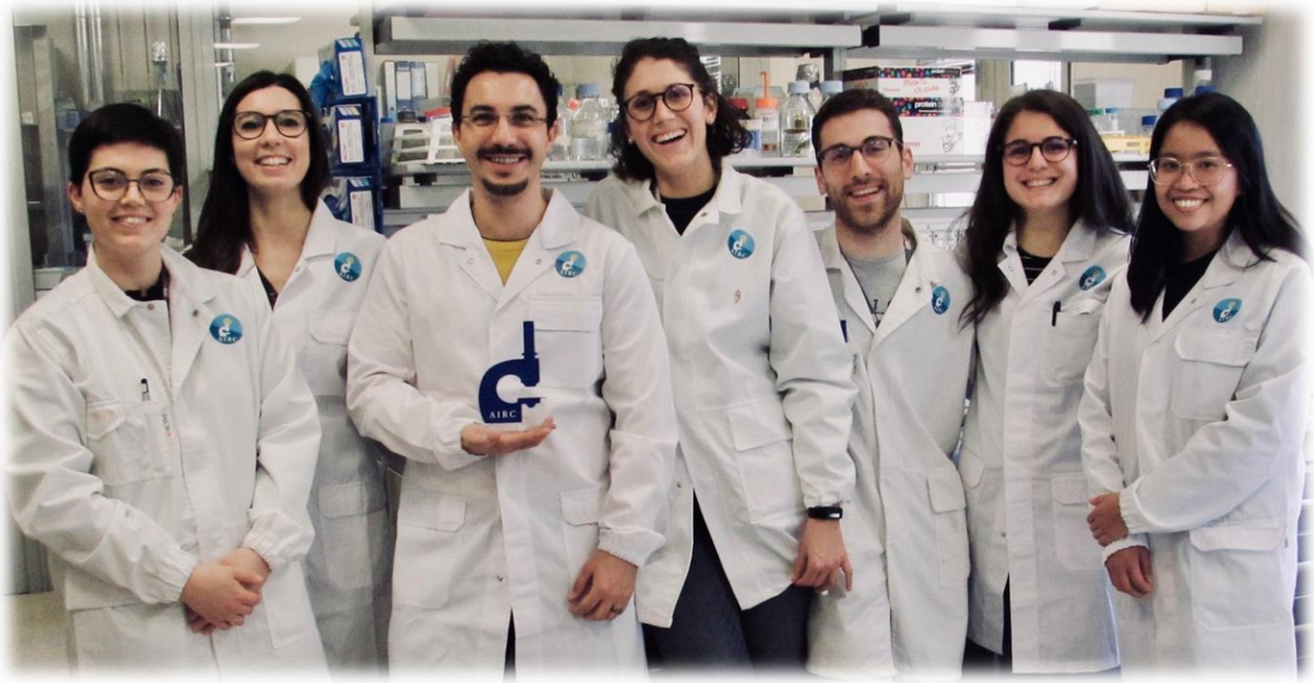

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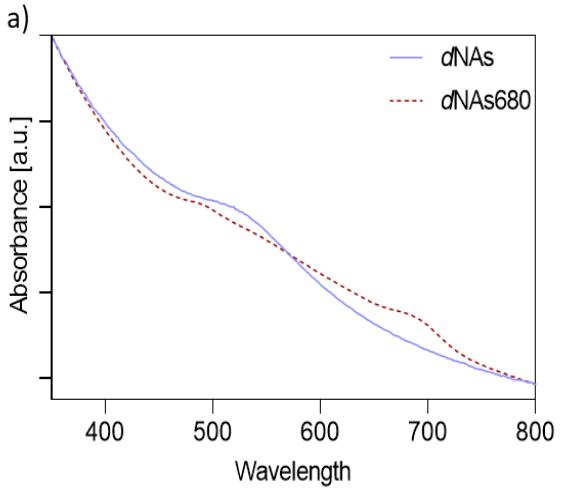
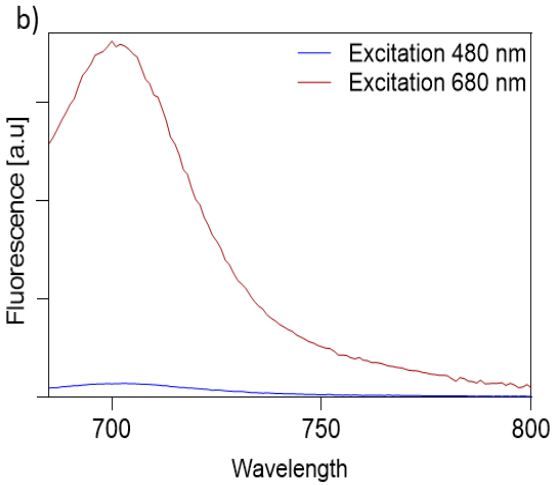
Supplementary slides

	*d*NAs-Alexa680
DLS Size [nm]	272.97 ± 2.38
TEM Size [nm]	135.85 **± 16.37**
Shell thickness [nm]	13.9 ± 1.7
Au concentration	265 µg/ml
Z-potential [mV]	-21.7 ± 0.4