An insight into the potential of nano-based drug delivery systems for improved cancer therapeutics

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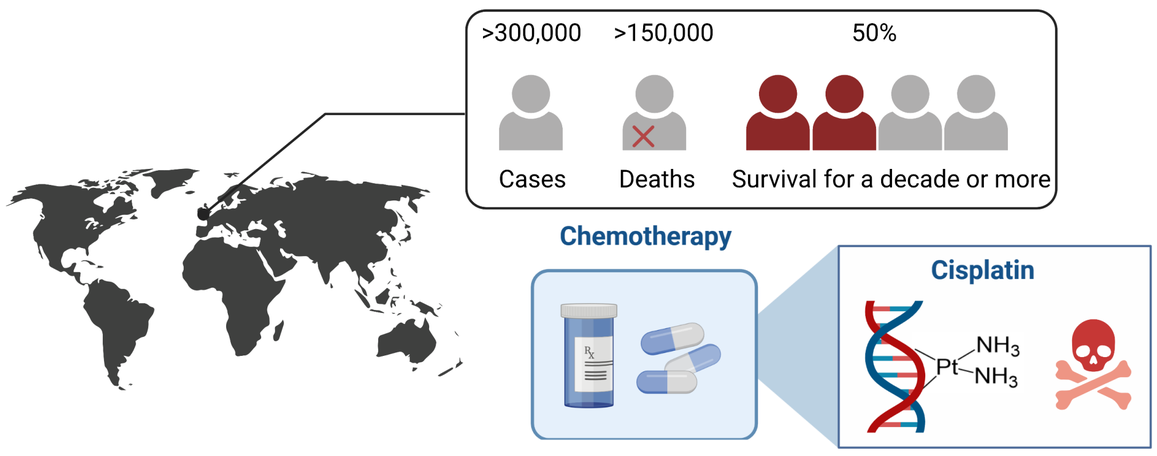
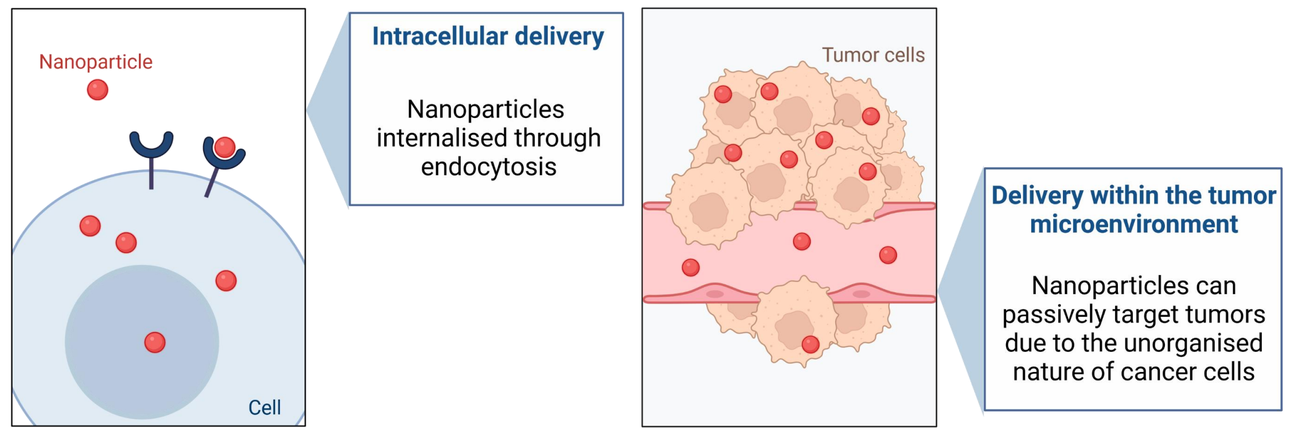
Project Focus: Cancer therapeutics

Cancer treatment remains a challenge. Although chemical agents such as cisplatin, exist for systemic treatment, their clinical use is hindered by their toxicity.



Project Methods: Nanotechnology

This work investigates the use of nanoparticles as delivery vehicles (nanocarriers) for the anticancer drug cisplatin. Such vehicles can offer a more targeted delivery and better uptake of drug into cells.



Research Objectives: Targeted drug delivery approach

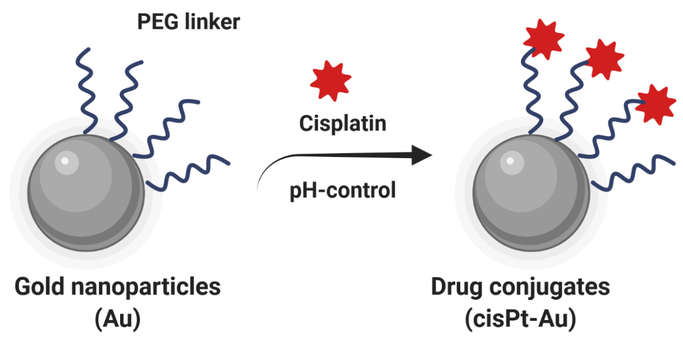
- **Design** drug-nanoparticle conjugates
- **Characterization** to ensure their suitability
- **Cellular toxicity** of conjugates compared to bare cisplatin
- **Intracellular tracking** of both drug and nanocarrier

Results: New delivery method for cisplatin?

DESIGN

A pH-controlled drug attachment was adopted, maximizing the drug loading by 50-fold (A). The drug attachment was verified by mass spectrometry (B).

A.



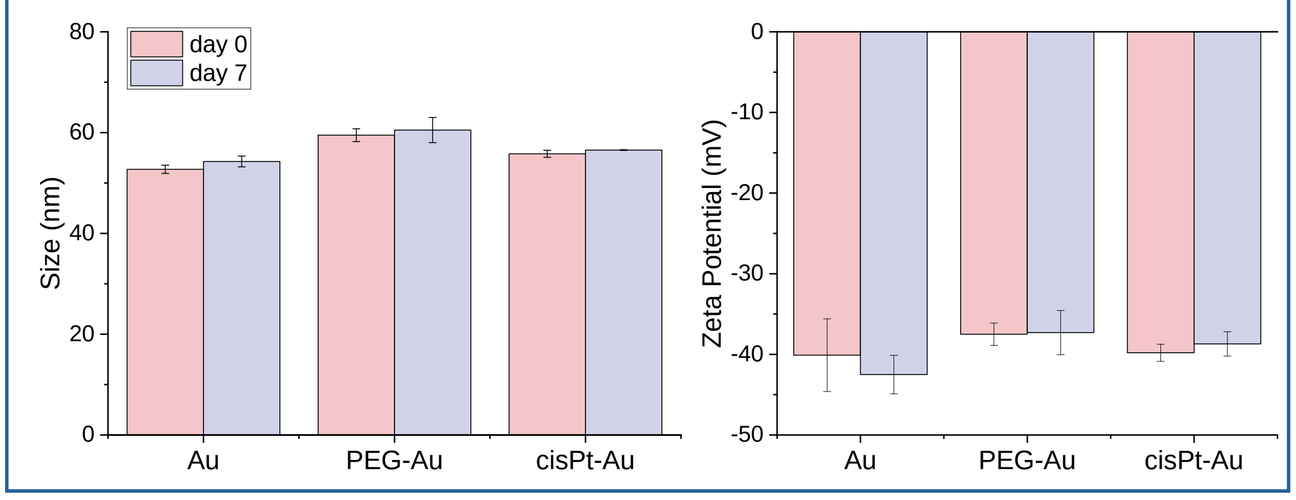
B.

Sample	Cisplatin concentration (µM)
Au	<LOQ
PEG-Au	<LOQ
cisPt-Au	3.7

**cisPt limit of quantification (LOQ): 0.36*

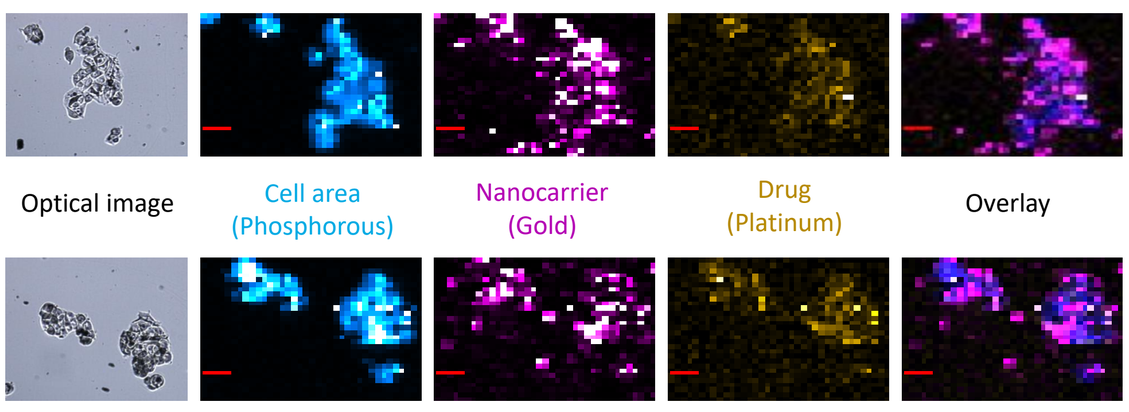
CHARACTERIZATION

The colloidal short-term stability of conjugates was demonstrated by size and zeta potential measurements. Error bars represent ± SD.



INTRACELLULAR TRACKING

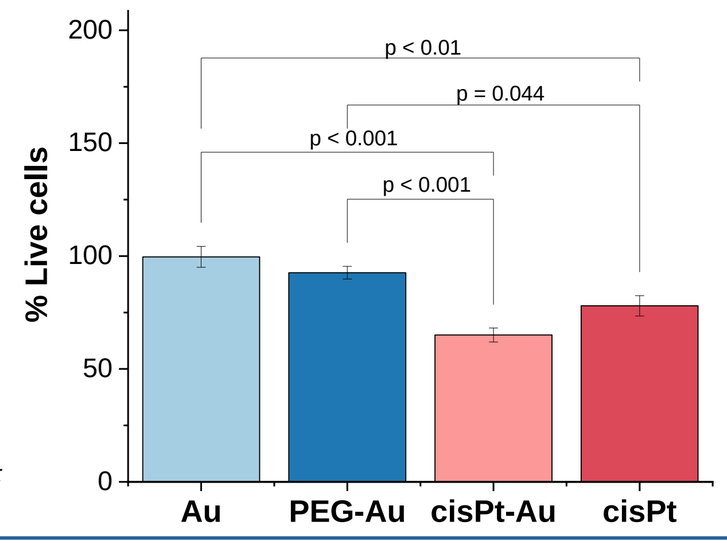
Elemental mapping (resolution = 2 µm) of conjugate treated cells by state-of-the-art laser ablation-ICP-ToFMS shows colocalization of both the drug and the nanocarrier with the tumor cells.



**Pixel color corresponds to the elemental intensity (P: 0-2000, Au: 0-500 and Pt: 0-65 counts) and a scale bar of 50 µm is shown in red.*

CYTOTOXICITY

The drug conjugates induced similar levels of cytotoxicity when compared to equimolar concentrations of bare cisplatin, demonstrating their effectiveness towards cancer cells. Control groups did not impact the cell viability.



**P<0.05 means a significant statistical difference*

Potential impact to cancer therapeutics

- This study illustrates how nanomaterials can be adopted as delivery vehicles, offering the additional benefit of targeted delivery to tumor sites. The drug-conjugates were as effective as cisplatin treatments, inducing similar cancer cell death. The question to be answered is: are the conjugates as toxic as cisPt?
- The advantages of laser ablation-ICP-ToFMS were demonstrated for studying the internalization of cisplatin in cells. Capabilities for real-time imaging of drug release and action will be investigated in the future.

References and Acknowledgments

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