Hyaluronate-Au@Pt Bimetallic Nanoparticles for Non-Invasive Skin Cancer Theranosis

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CONTROLLED RELEASE SOCIETY
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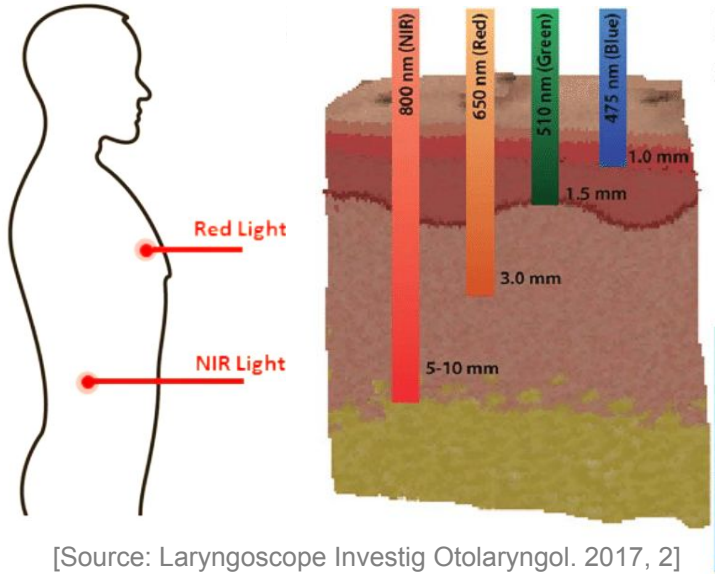
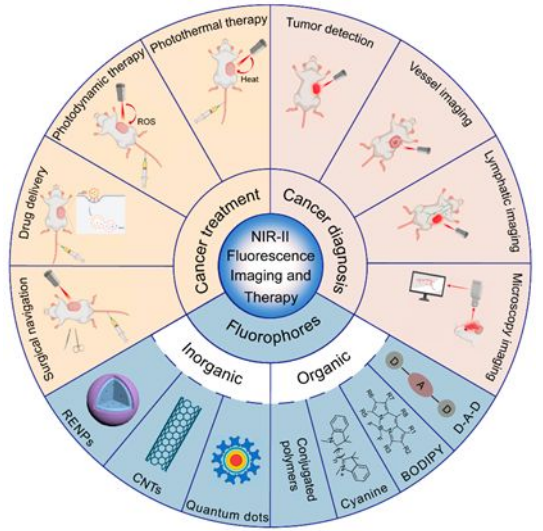
THE FUTURE OF DELIVERY SCIENCE

Near Infrared (NIR) Light



[Source: Laryngoscope Investig Otolaryngol. 2017, 2]

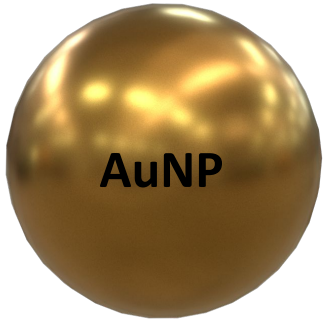
Various cancer theranosis

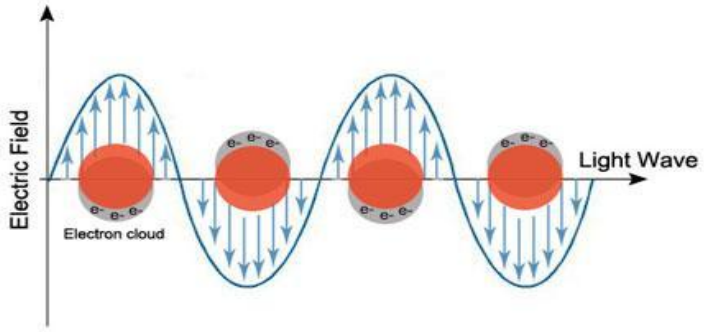


[Source: Biomolecules 2022, 12, 8]

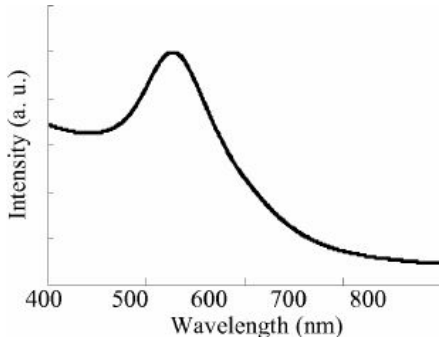
- Deliver sufficient energy to the **deep tissues** with reduced scattering and absorption
- **Optical imaging** with low tissue-autofluorescence background and high signal-to-background ratio

Gold Nanoparticles

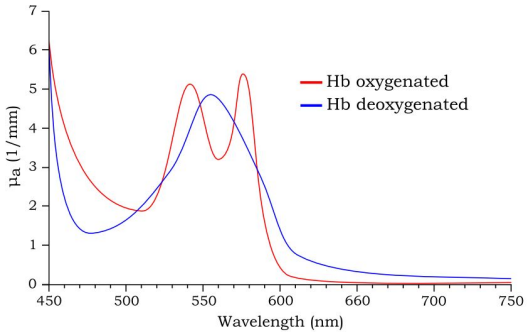




- Biophotonic agents due to **photostability, biocompatibility, and easy surface modification**
- Strong **surface plasmon resonance (SPR)** in visible region
- **Negligible absorbance** in NIR region

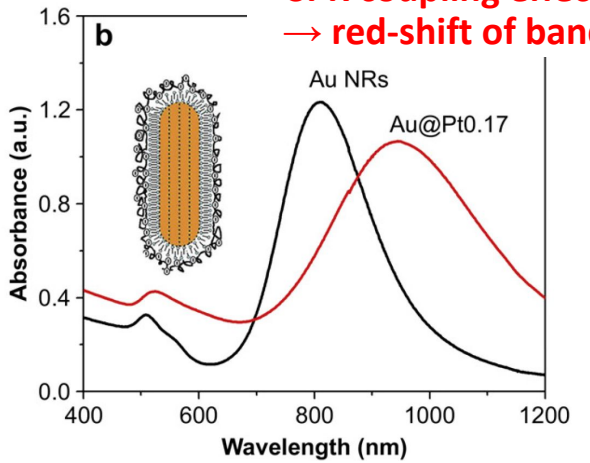


[Source: Z. Naturforsch. 2009,64b]

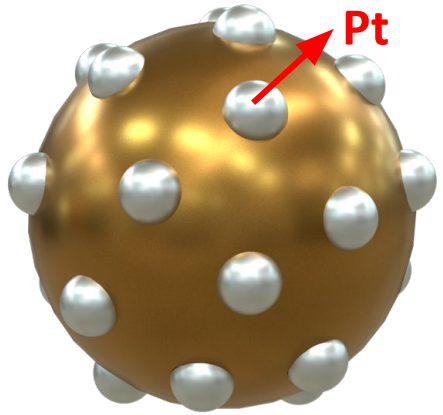


[Source: Avantesusa.com]

SPR coupling effect
→ red-shift of band



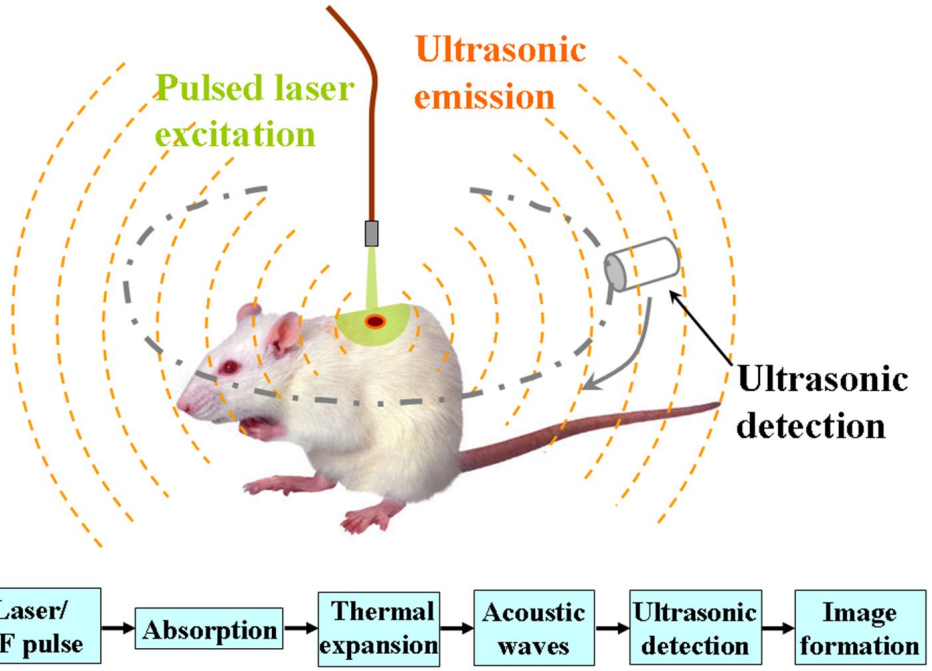
[Biomaterials, 2011, 32, 1139]



Au@Pt

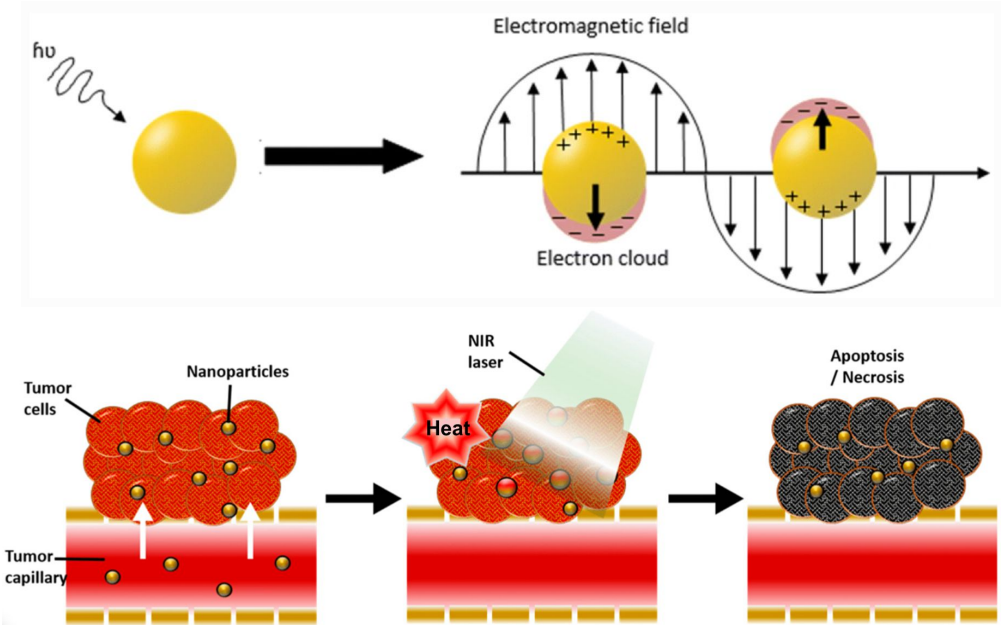
Light Absorption in NIR Region

Photoacoustic effect



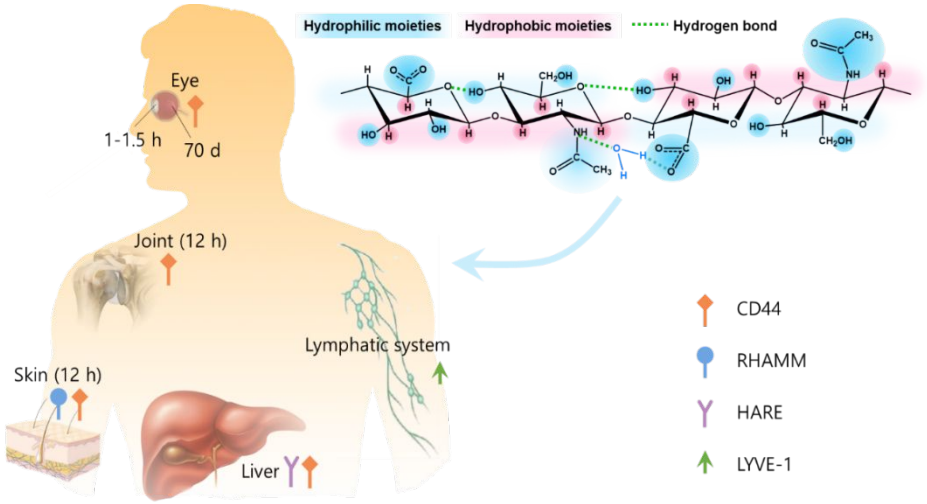
[Source: Wikipedia]

Photothermal effect

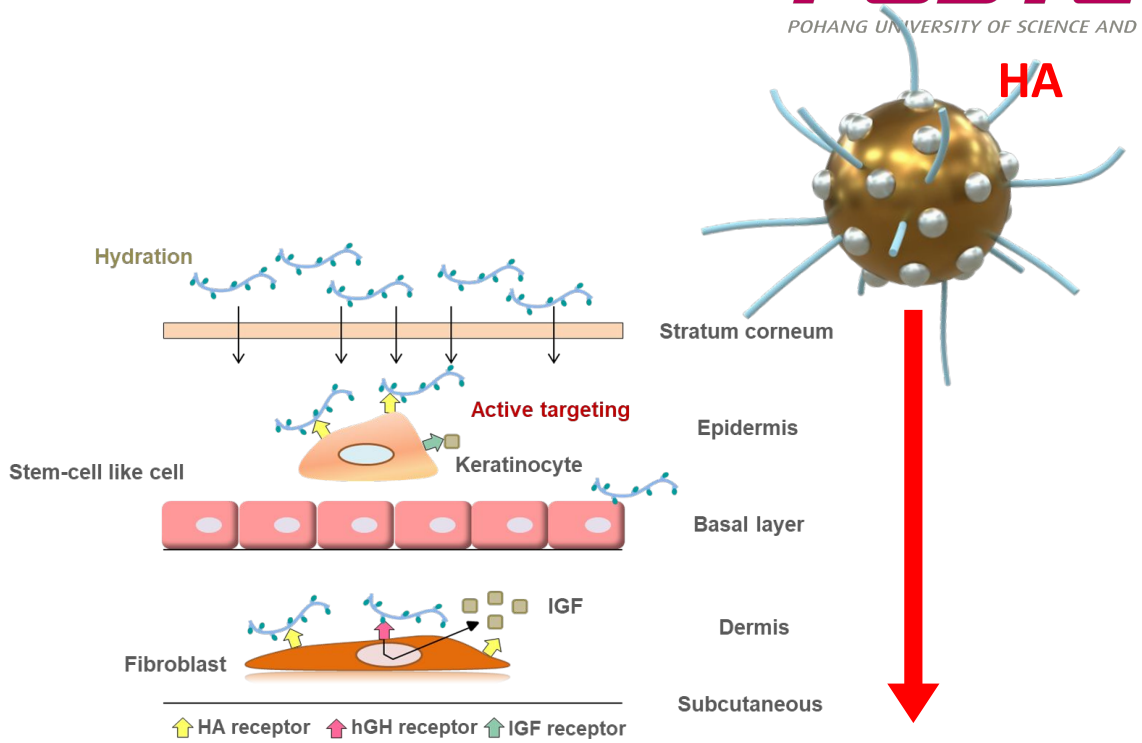


[Source: Polymers, 10, 961, 2018]

Hyaluronate (HA)



[Source: Biomaterials, 123, 155-171, 2017]

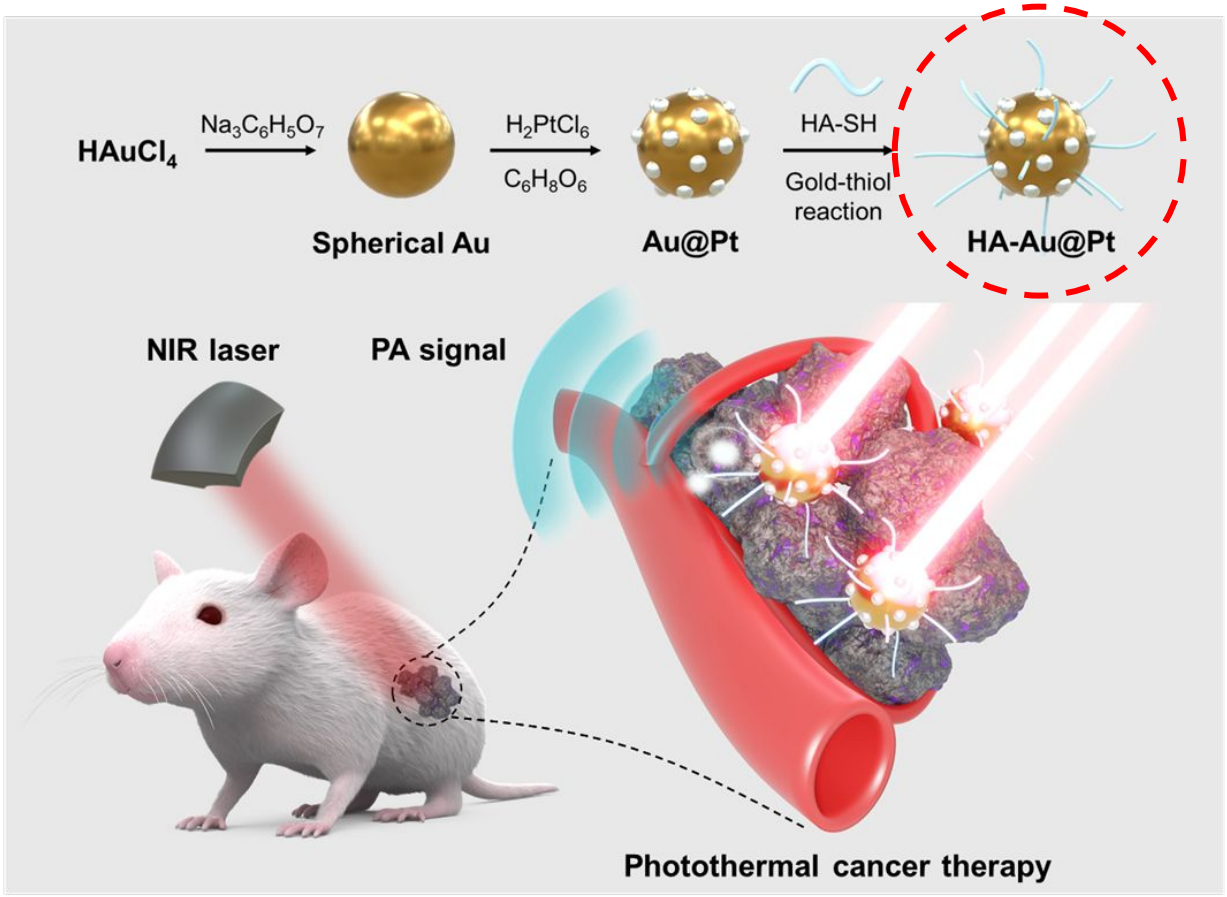


[Source: Biomaterials, 33, 5947, 2012]

- **Hydration** of stratum corneum by HA and loosening of skin tissues
- **Interaction of hydrophobic patches** of HA and lipid layer of skin tissues
- Interaction between HA and its **receptor** expressed on skin cells

HA-Au@Pt

[**Han et al**, *ACS Appl. Mater. Interfaces* 2023, 15]

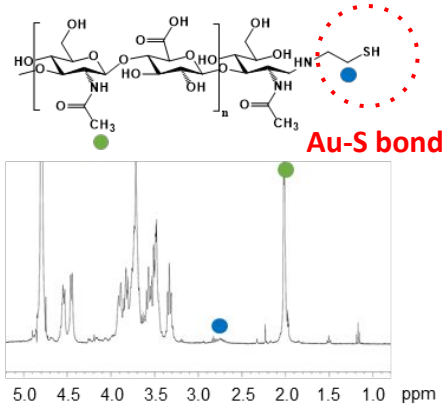


NIR light-induced biophotonic agent

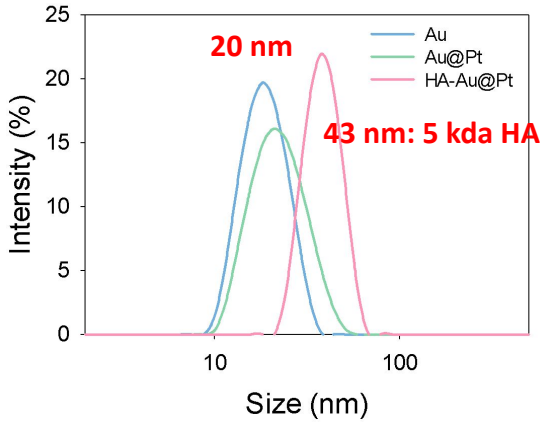
Characterization

[**Han et al**, *ACS Appl. Mater. Interfaces* 2023, 15]

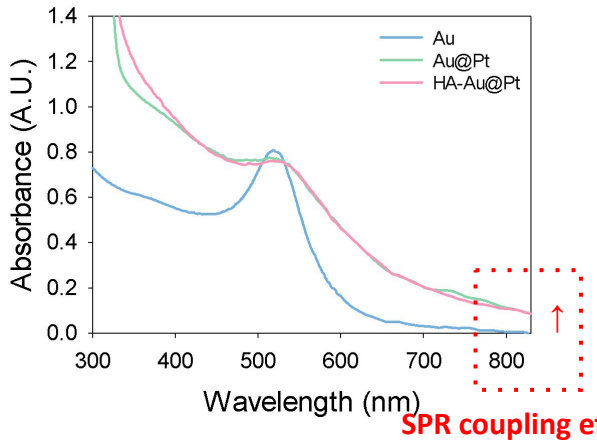
1H-NMR



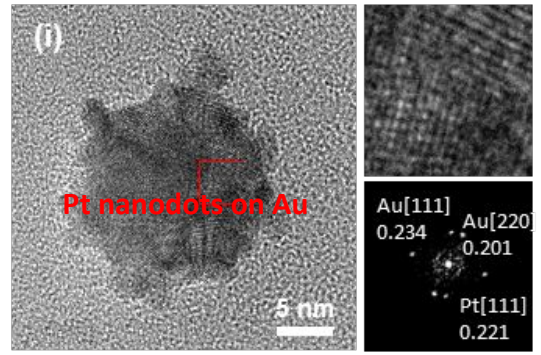
Size



Absorbance



HR-TEM



HA-Au@Pt can be used as NIR light-mediated photonic agent

Photothermal Effect

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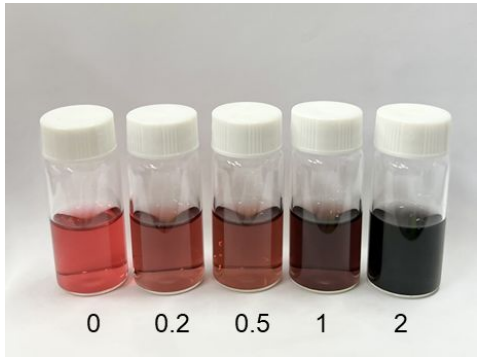
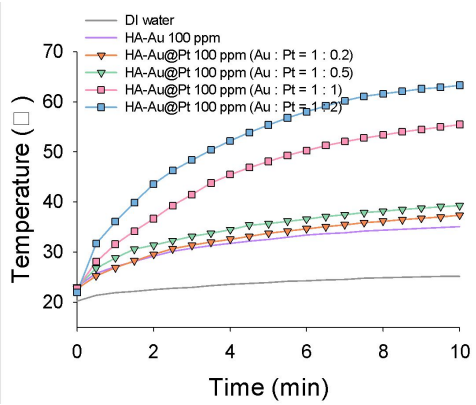
Optimization of Au/Pt ratio

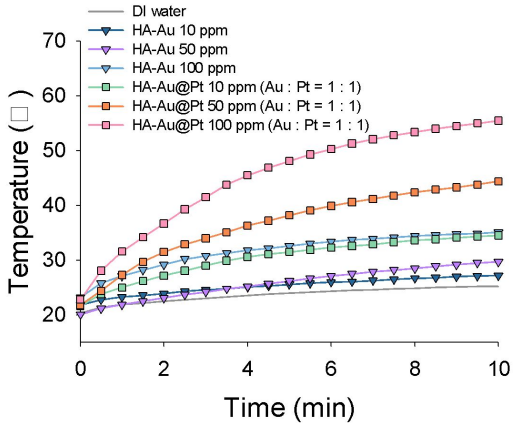


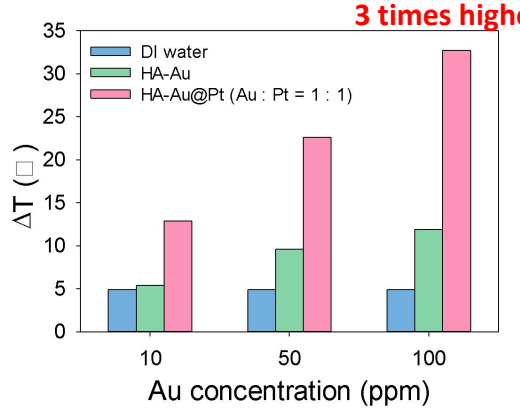


1 : 1 ratio of Au and Pt is most appropriate

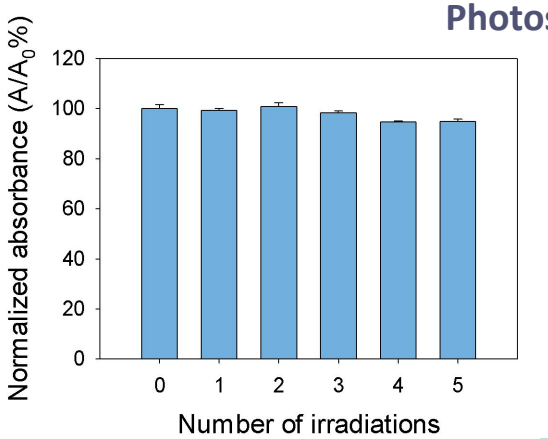
Photothermal conversion effect

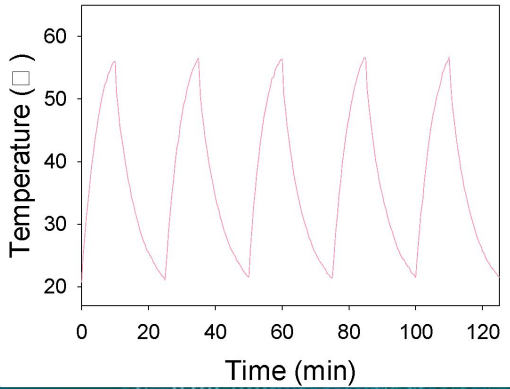
ΔT > 30 °C
3 times higher





Photostability





Targeting Effect

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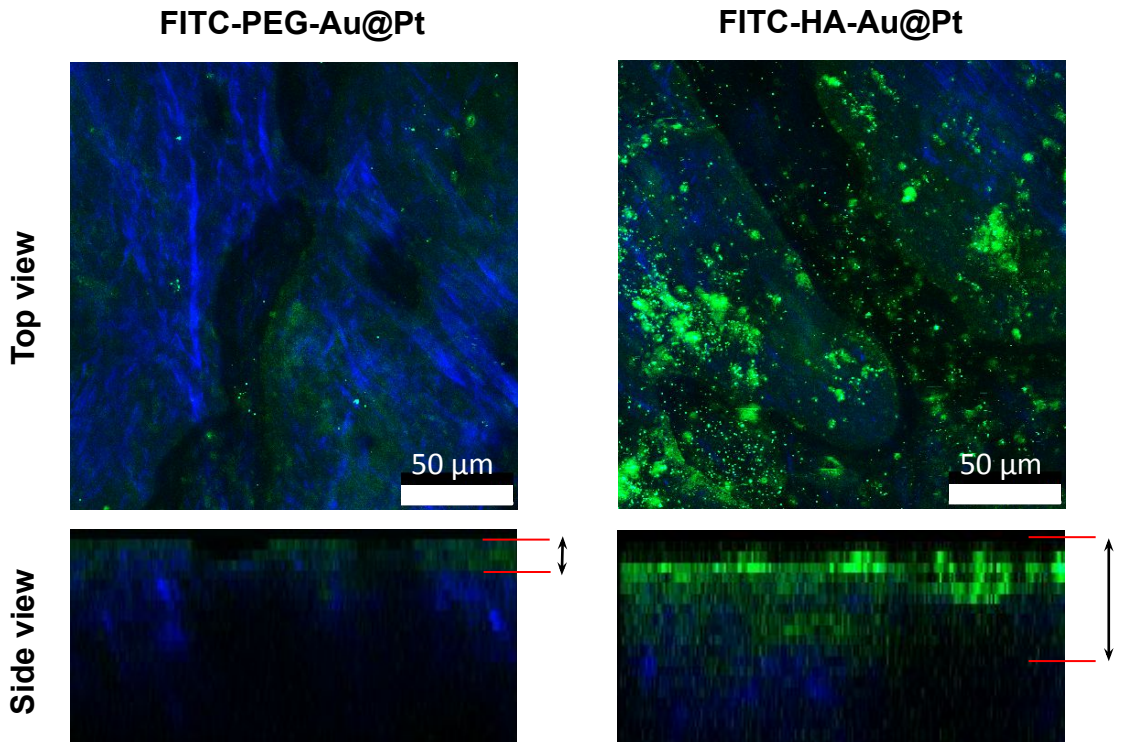
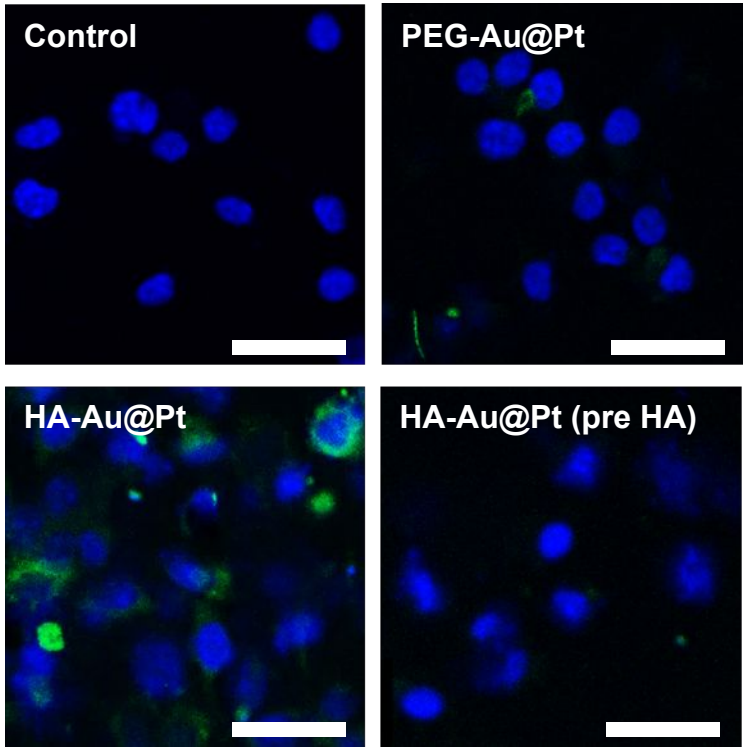
Transdermal delivery into porcine skin



Cellular uptake with B16F10 cells



Transdermal delivery and cellular uptake due to HA receptors

Cell Viability

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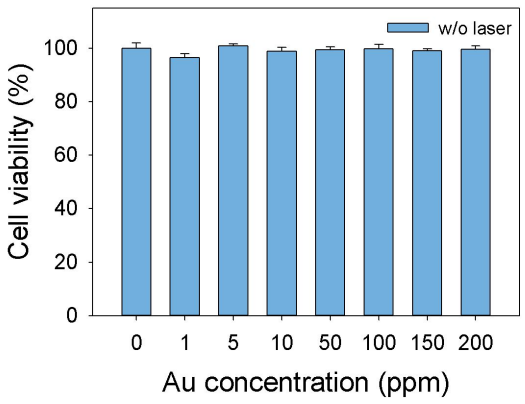
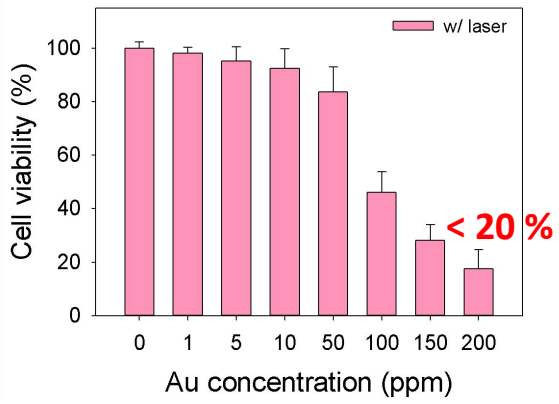
Cell viability with B16F10 cells

w/o 808 nm laser

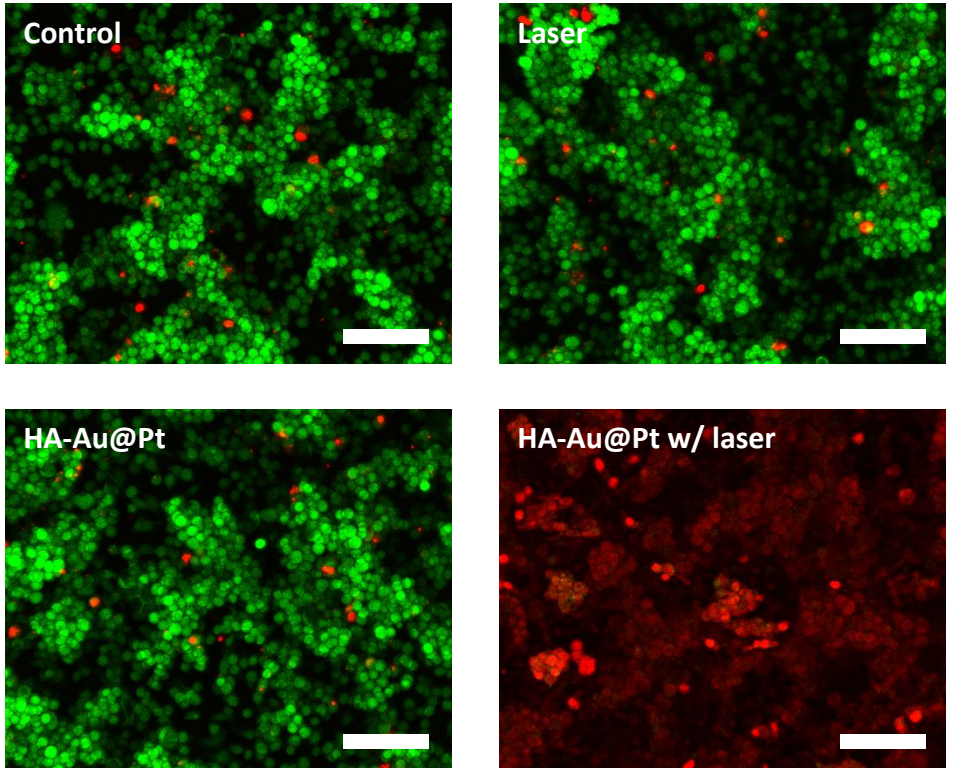


w/ 808 nm laser



NIR light-mediated photothermal ablation agent

Live and dead cell assay with B16F10 cells



Photoacoustic Imaging (PAI)

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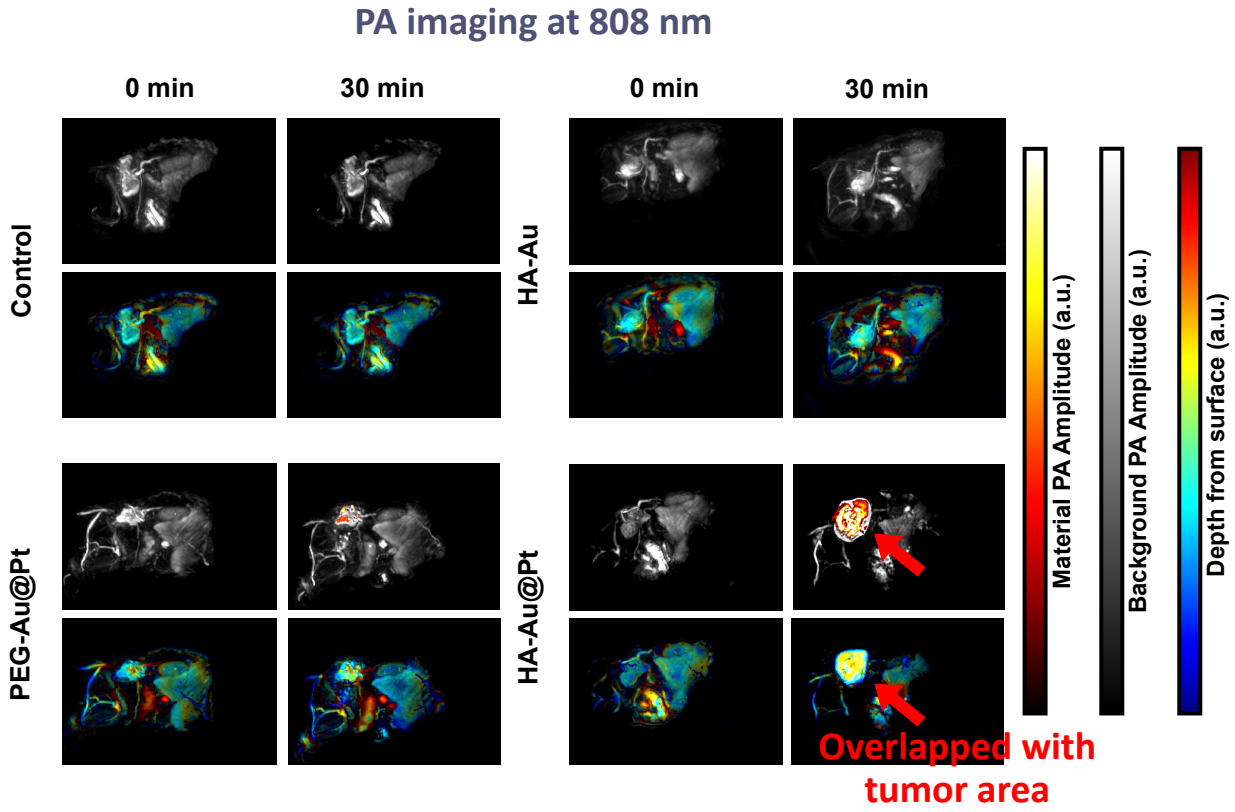

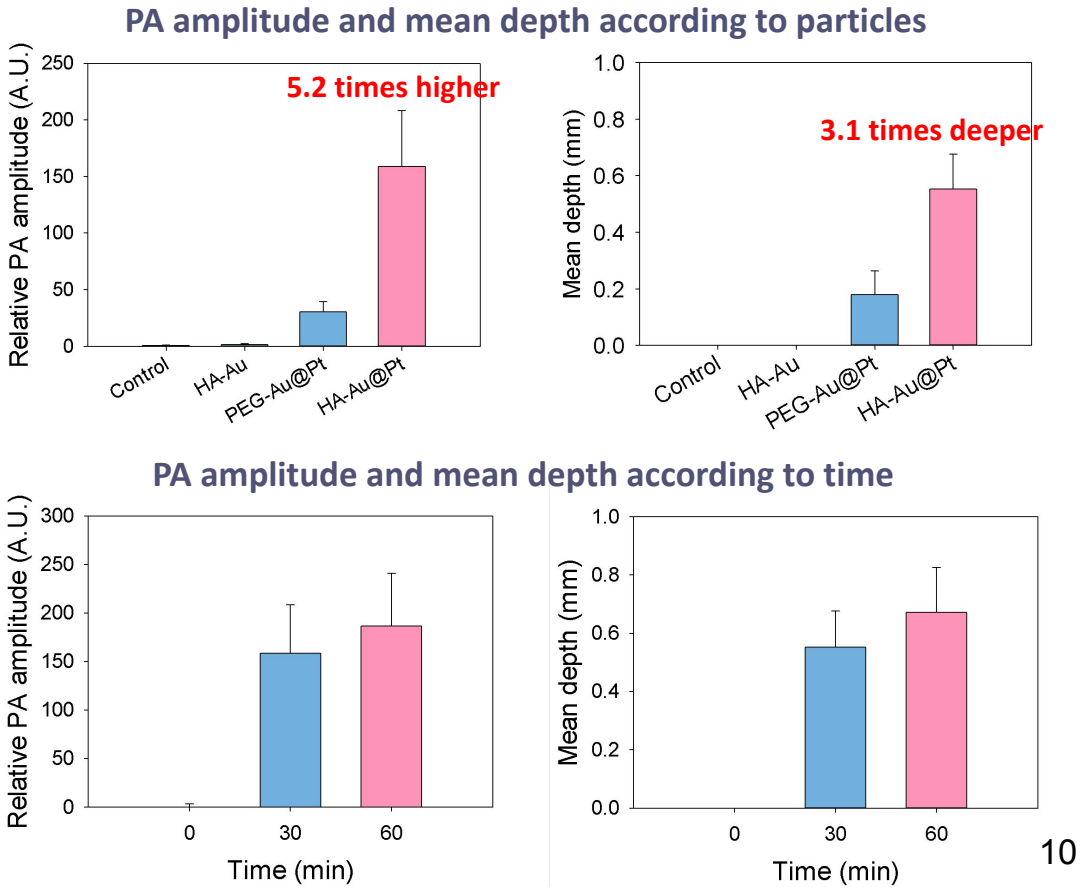

Photothermal Therapy

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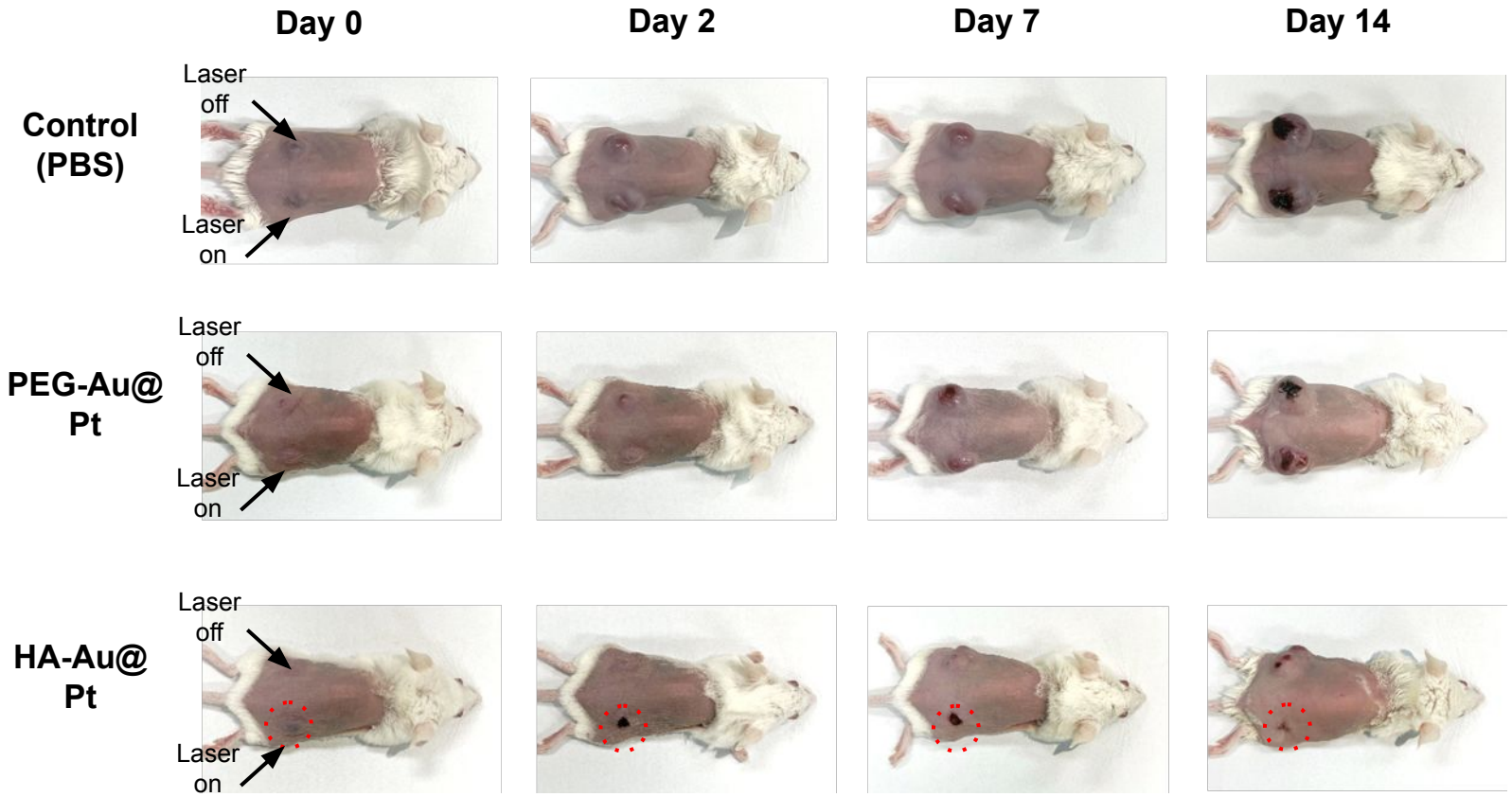
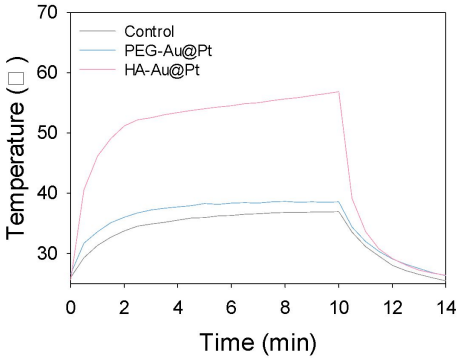
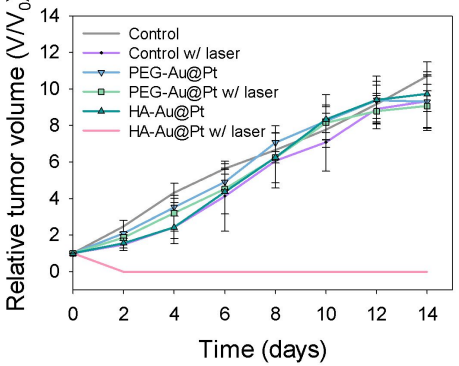


Temperature change



Tumor volume change



Histological Analysis

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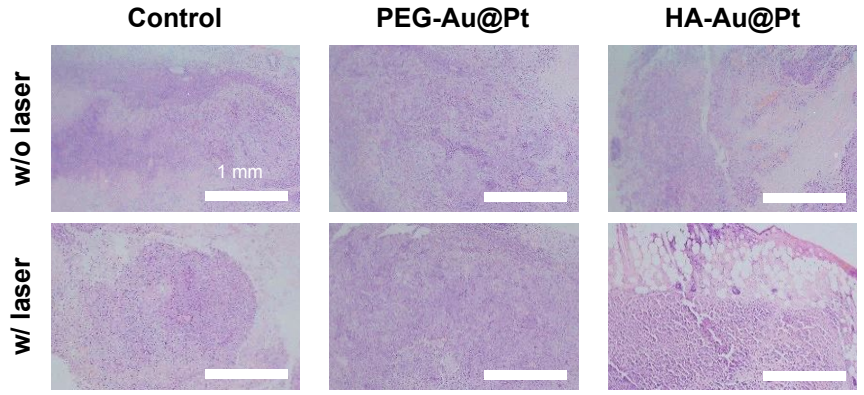
H&E staining



TUNEL assay

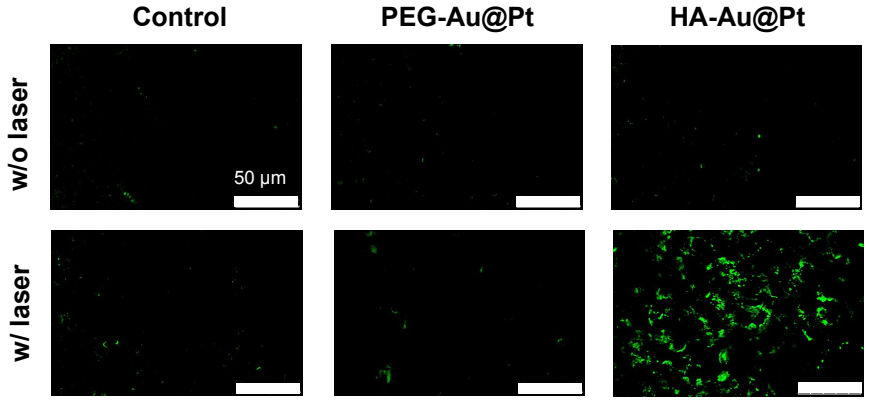
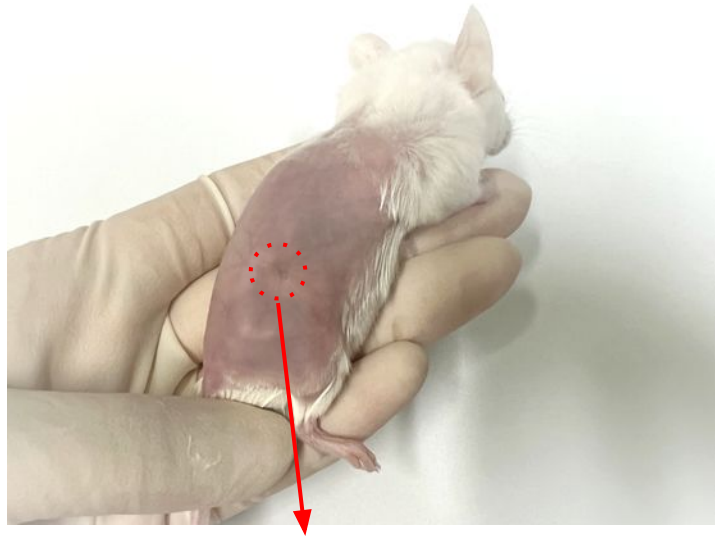


Photo-image after 28 days



Skin was recovered normally

Summary

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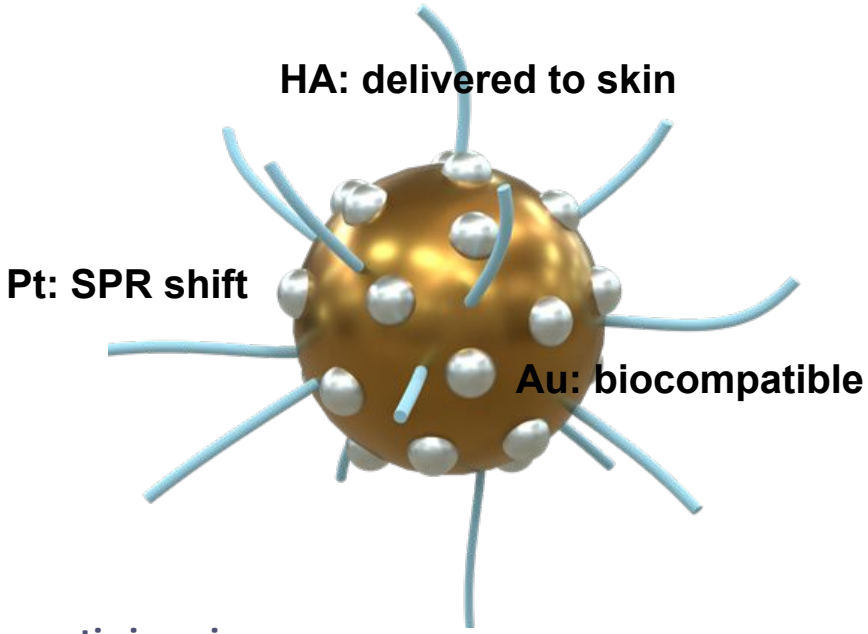
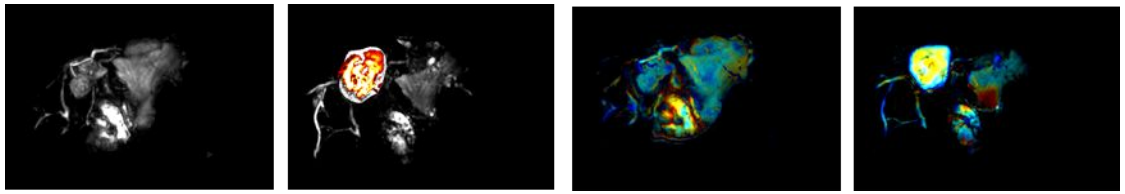
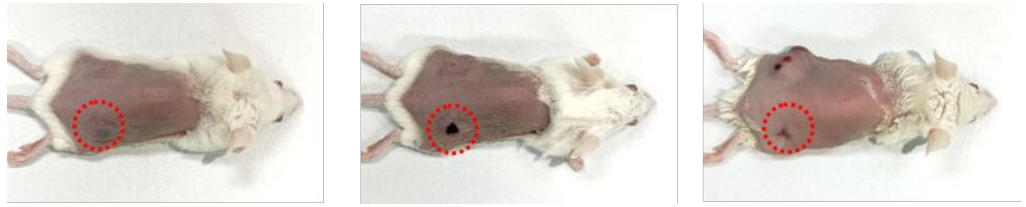


- **Absorbance increase in NIR region**
- **Transdermal and tumor-targeted delivery**
- **Excellent photoacoustic signals**
- **Photothermal effect occurred**

Photoacoustic imaging



Photothermal therapy



Thank You for Your Attention

Presenter: Hye Hyeon Han, Ph.D. candidate

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