

Nanotheranostic Assessments on Three-Dimensional Cell Cultures

Ana Katrina Mapanao

17 October 2019

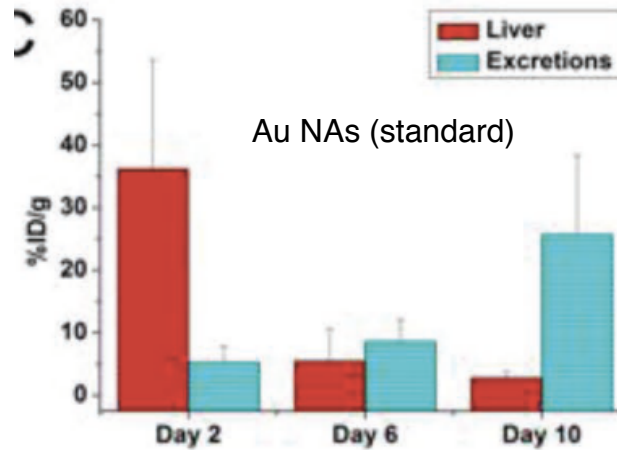
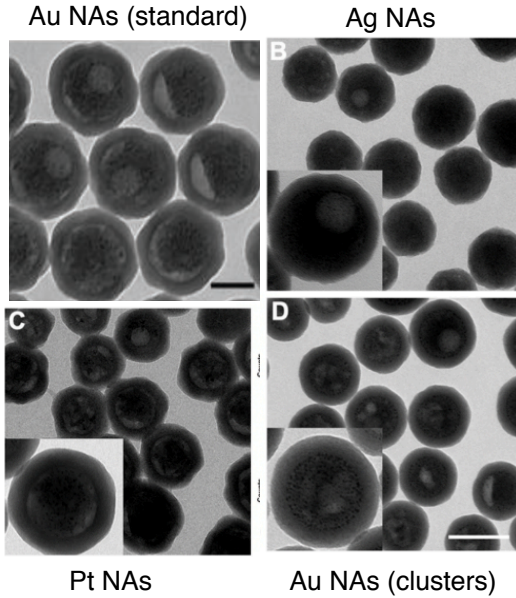
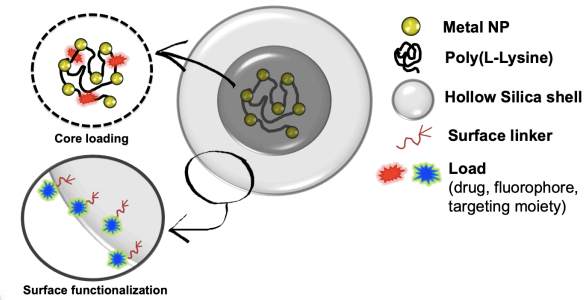
Advisers:

Valerio Voliani, PhD. (IIT)

Stefano Luin, PhD. (SNS-Internal)

Biosafety and biokinetics of noble metal NPs

ULTRASMALL-IN-NANO APPROACH



FULL PAPER
Nanotheranostics

Particle
Particle Systems Characterization
www.particle-journal.com

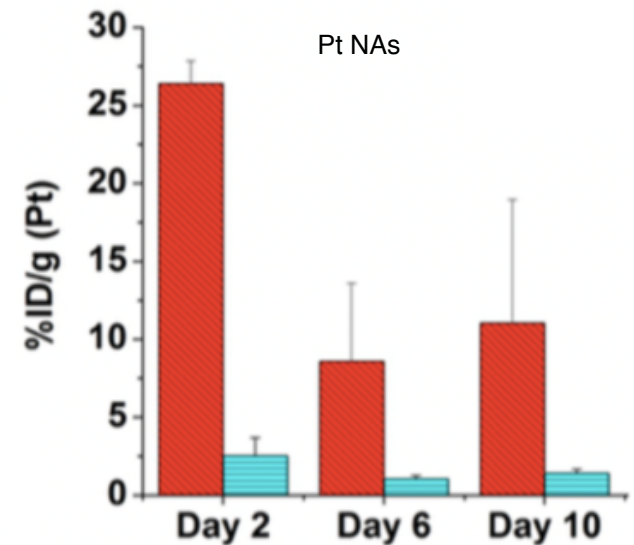
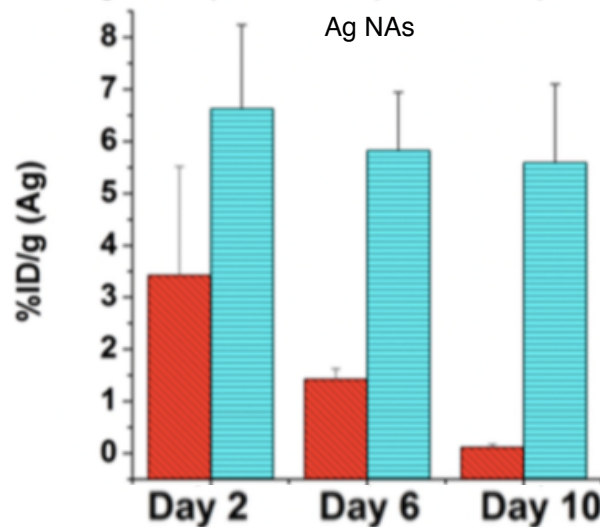
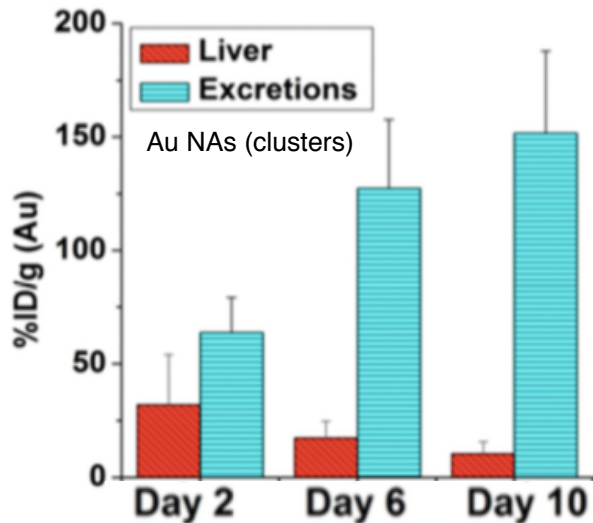
Biodegradable Ultrasmall-in-Nano Gold Architectures: Mid-Period In Vivo Distribution and Excretion Assessment

*Domenico Cassano, Maria Summa, Salvador Pocovi-Martínez, Ana-Katrina Mapanao, Tiziano Catelani, Rosalia Bertorelli, and Valerio Voliani**

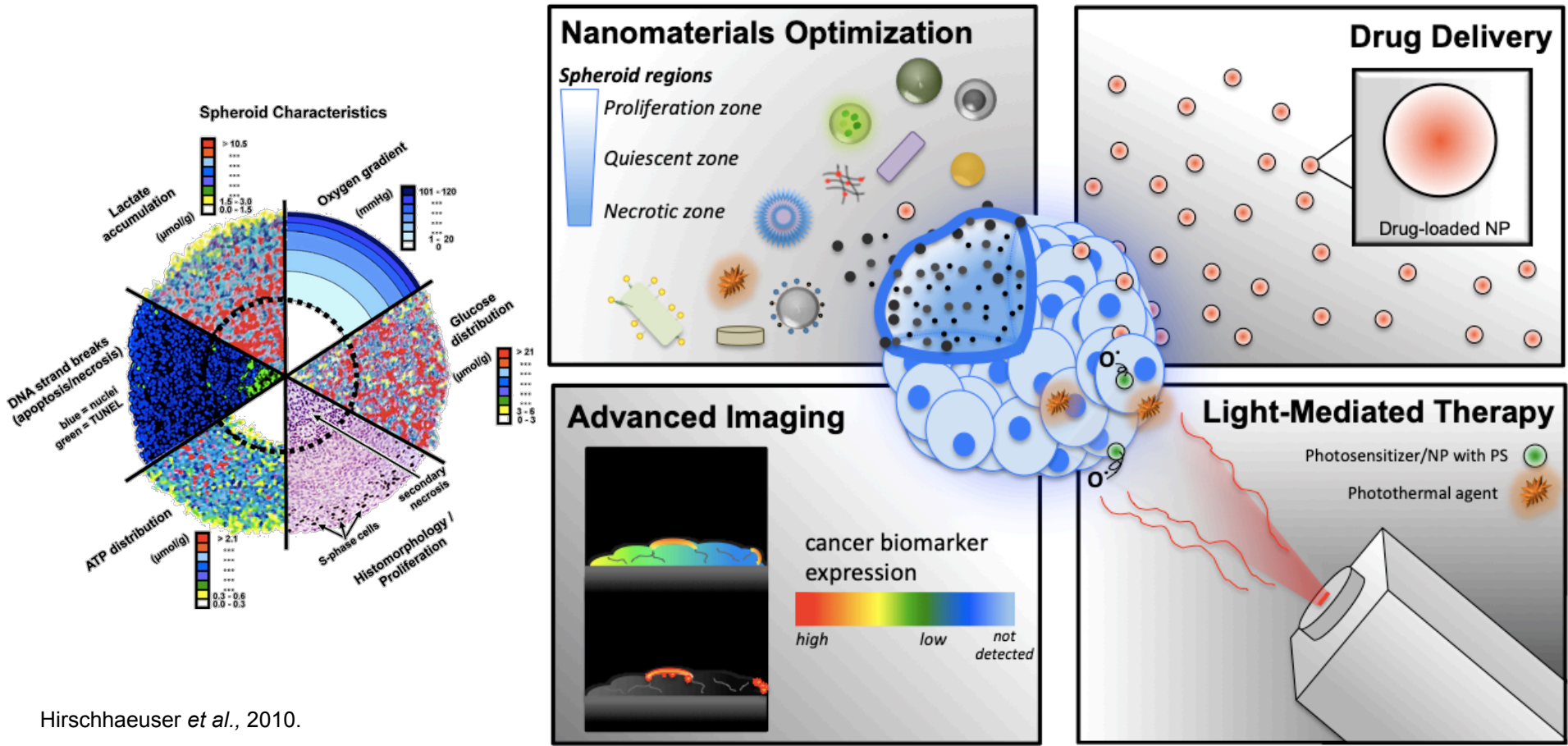
ACS APPLIED BIO MATERIALS Article
Cite This: ACS Appl. Bio Mater. XXXX, XXX, XXX-XXX

Biosafety and Biokinetics of Noble Metals: The Impact of Their Chemical Nature

Domenico Cassano,^{1,II} Ana-Katrina Mapanao,^{1,+,II} Maria Summa,^{8,II} Ylea Vlamidis,⁹ Giulia Giannone,^{1,4} Melissa Santi,¹ Elena Guzzolino,² Letizia Pitto,⁴ Laura Polisenò,^{2,1} Rosalia Bertorelli,⁹ and Valerio Voliani^{1,II}*



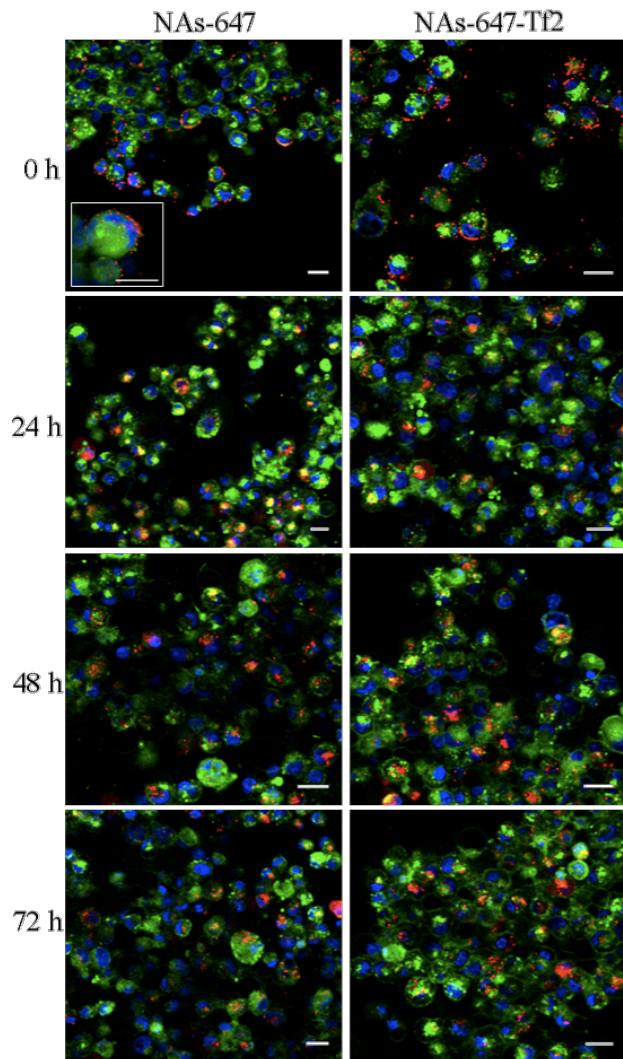
Nanotheranostic assessment on 3D cell cultures



Hirschhaeuser *et al.*, 2010.

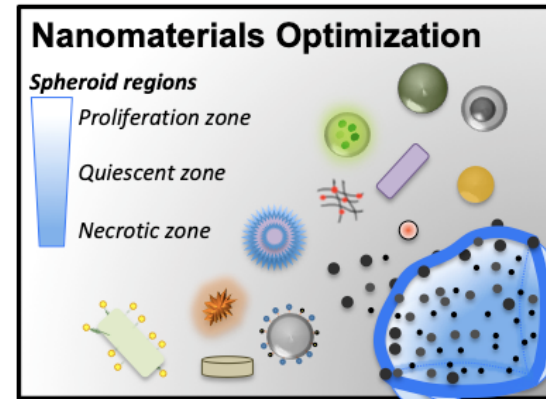
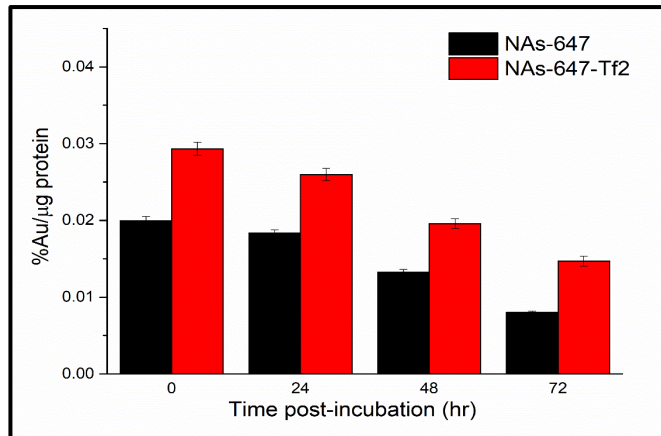
Mapanao, A. K.; Voliani, V. Three Dimensional Tumor Models: Promoting Breakthroughs in Nanotheranostics Translational Research. *Manuscript Submitted*.

(Previous year) Functionalized nanoparticle for improved cell internalization and retention



Scale bars = 20 μm nucleus; cell membrane; NAs-647

Amount of internalized gold



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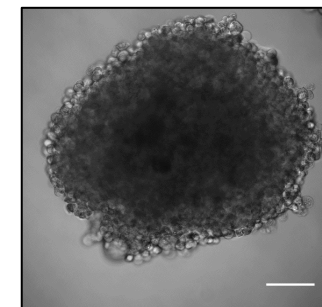


Cite This ACS Omega 2018, 3, 11796-11801

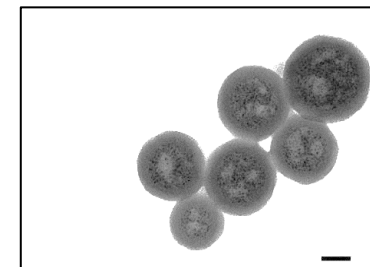
<http://pubs.acs.org/journal/acom>

Endogenously Triggerable Ultrasmall-in-Nano Architectures: Targeting Assessment on 3D Pancreatic Carcinoma Spheroids

Ana Katrina Mapanao,^{1,2} Melissa Santi,¹ Paolo Faraci,² Valentina Cappello,¹ Domenico Cassano,^{1,2} and Valerio Voliani^{1,2*}

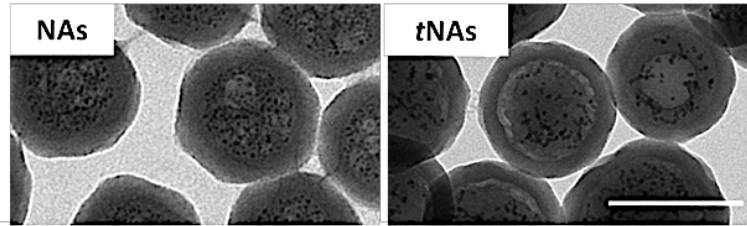
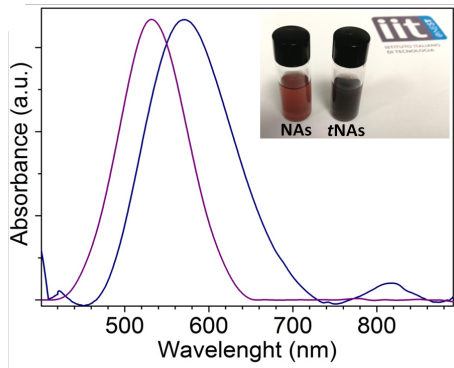
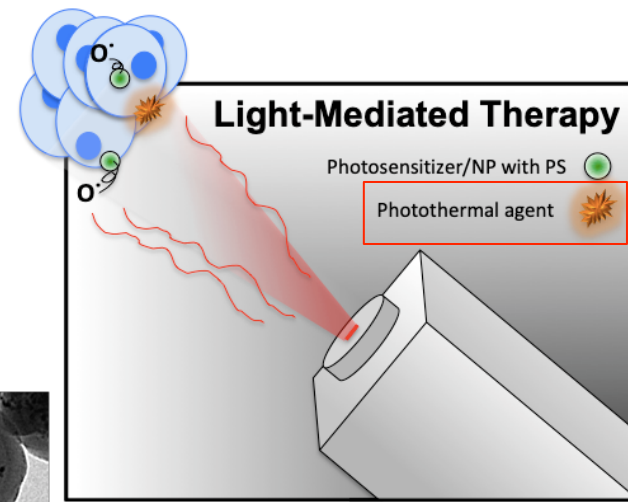


3D MiaPaCa-2 cells



NAs-647-Tf2

Hyperthermia through NIR-stimulation of NAs on pancreatic cancer cells



Materials Horizons

COMMUNICATION



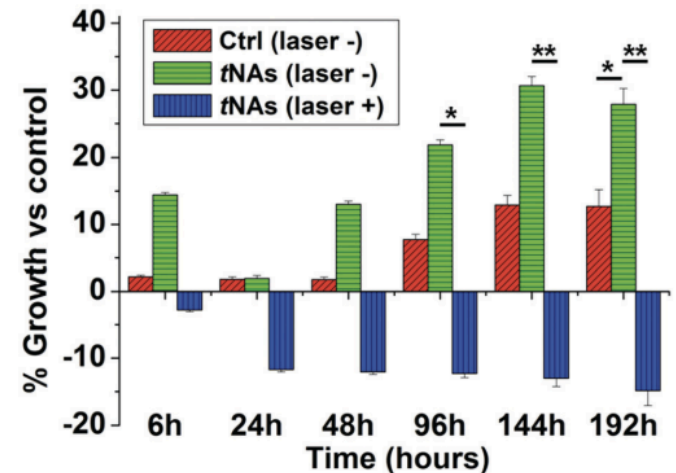
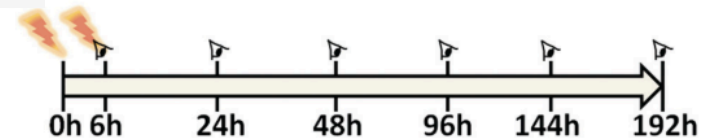
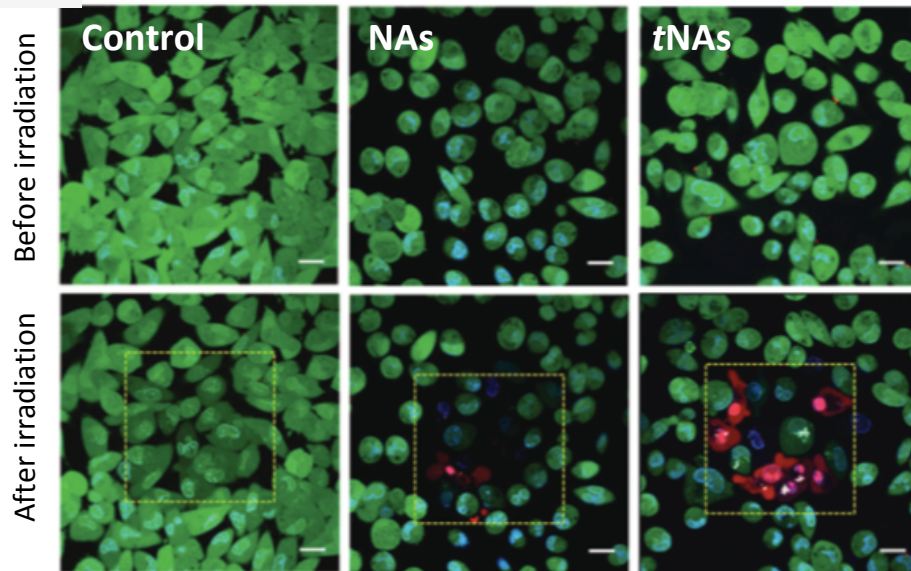
Photothermal effect by NIR-responsive excretable ultrasmall-in-nano architectures†

Cite this: DOI: 10.1039/c9mh00099h

Domenico Cassano,^{1,†} Melissa Santi,^{2,†} Francesca D'Autilia,^{2,†} Ana Katrina Mapanao,^{3,†} Stefano Luhn^{3,†} and Valerio Voliani^{1,†}

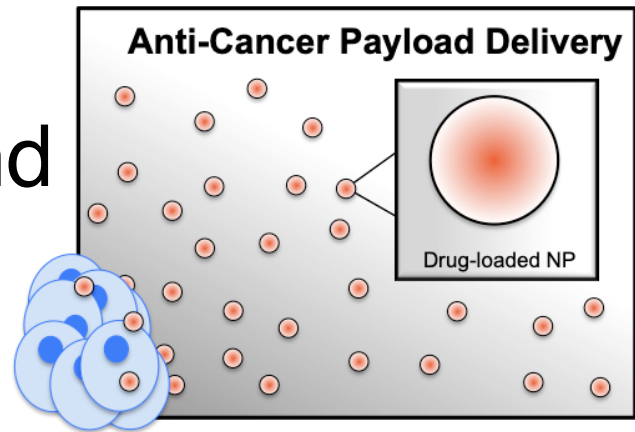
3D cells

2D cells Live; Dead

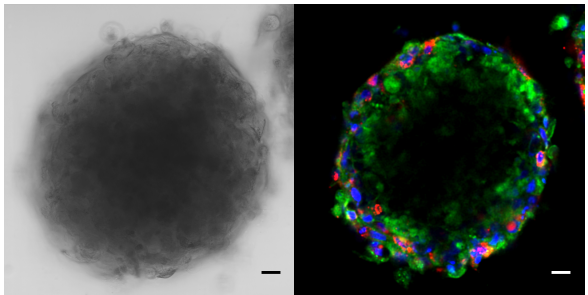


Chemotherapeutic effects of drug-loaded NAs on 3D head and neck squamous cell carcinoma

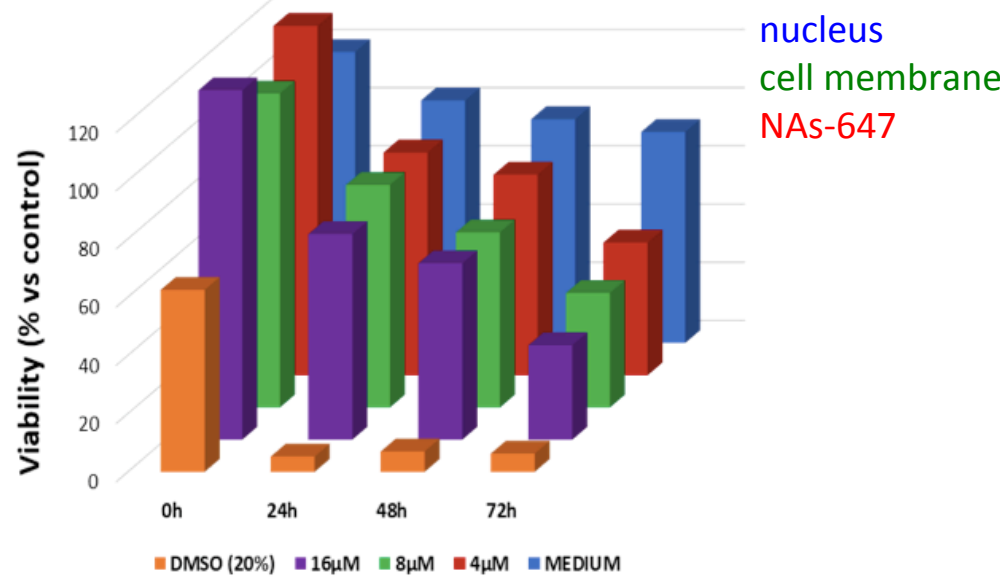
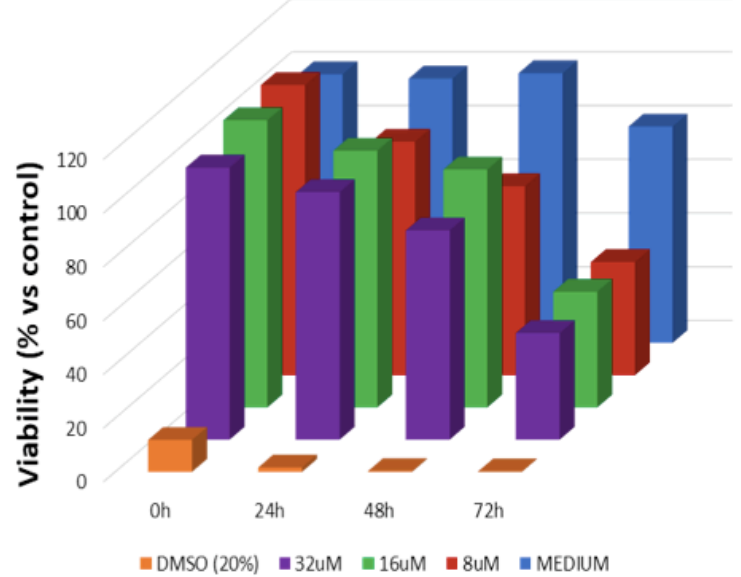
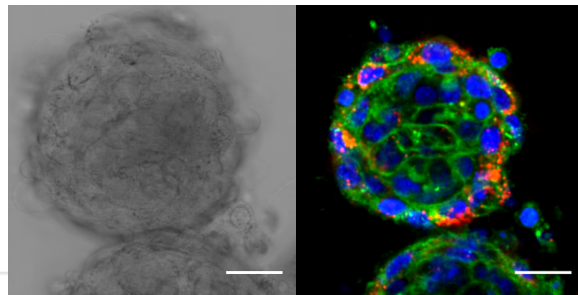
Santi *et al.*, Endogenously-Activated Ultrasmall-In-Nano Theranostic: Assessment On 3D Head and Neck Squamous Cell Carcinomas. *Manuscript Submitted*



SCC-25
(HPV-negative)

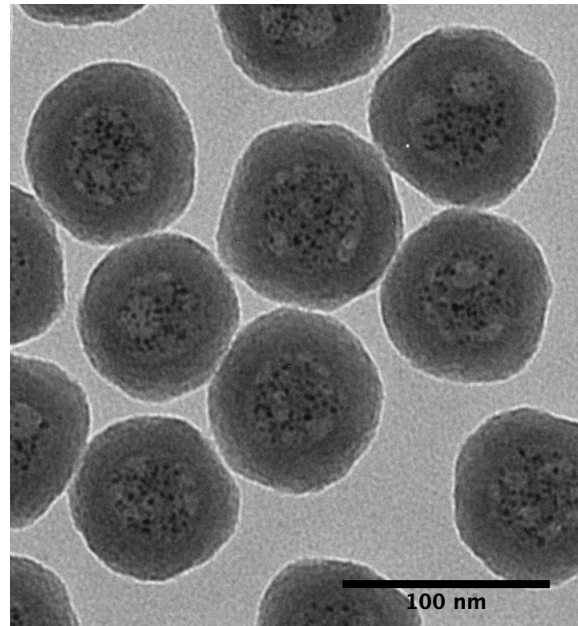
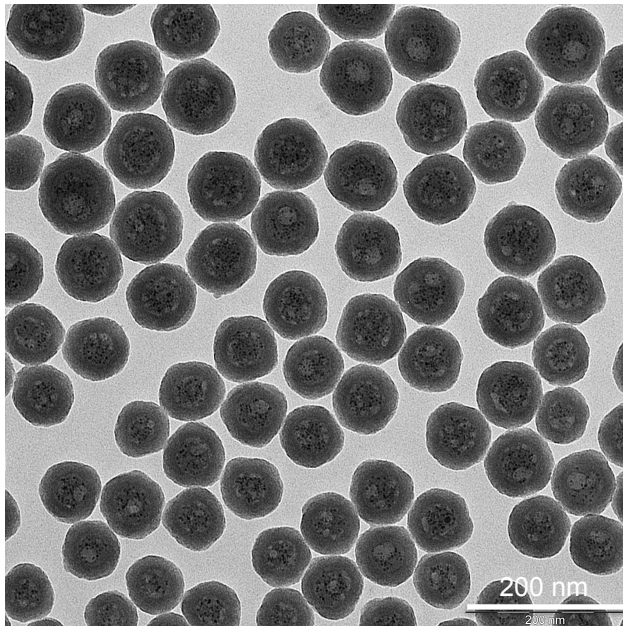
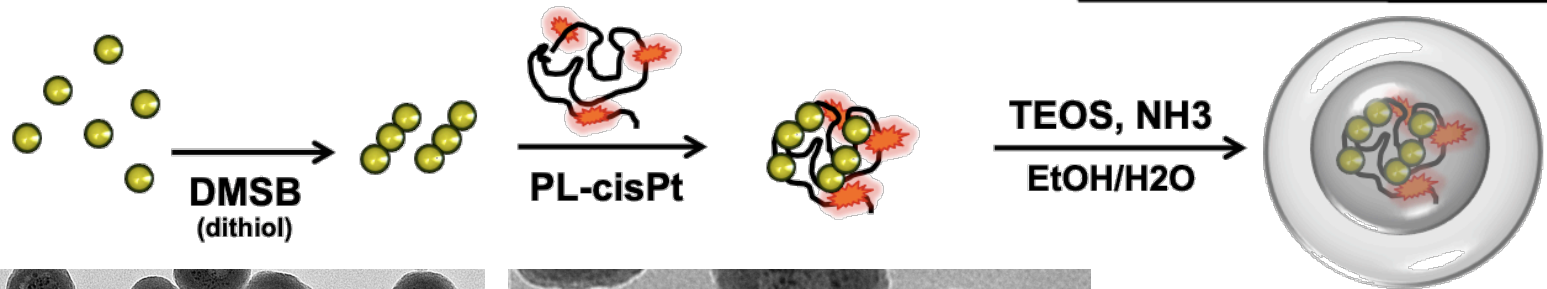
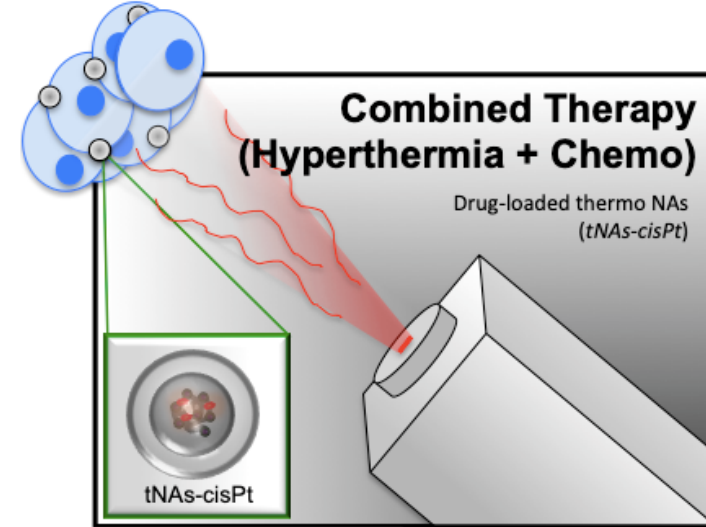


UPCI-SCC-154
(HPV-positive)



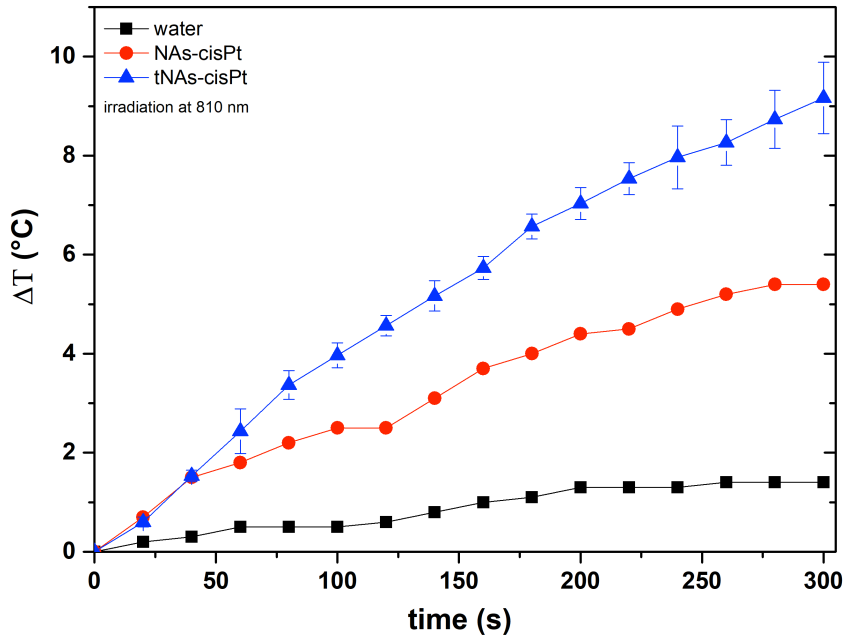
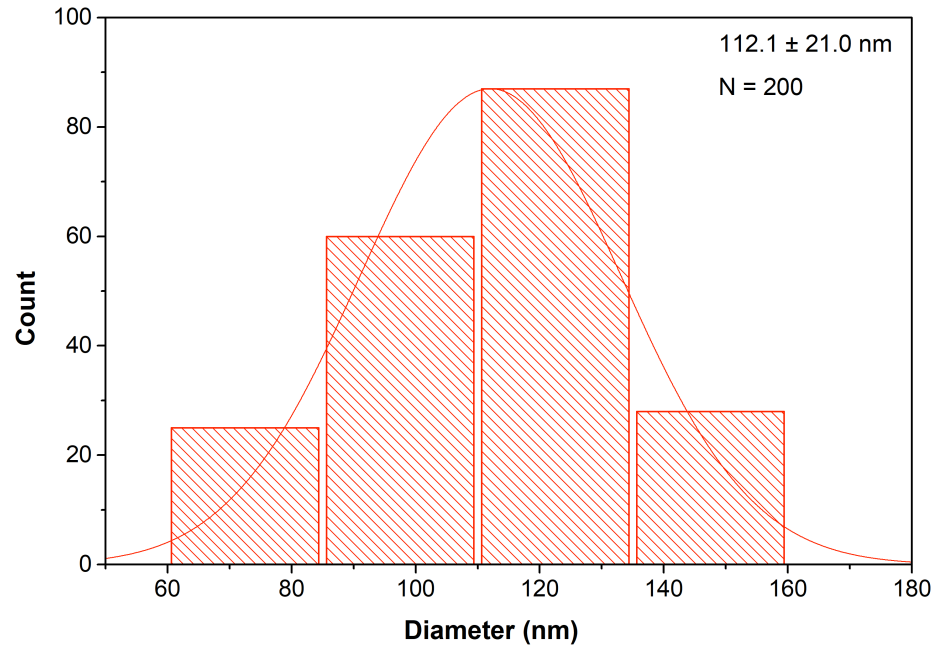
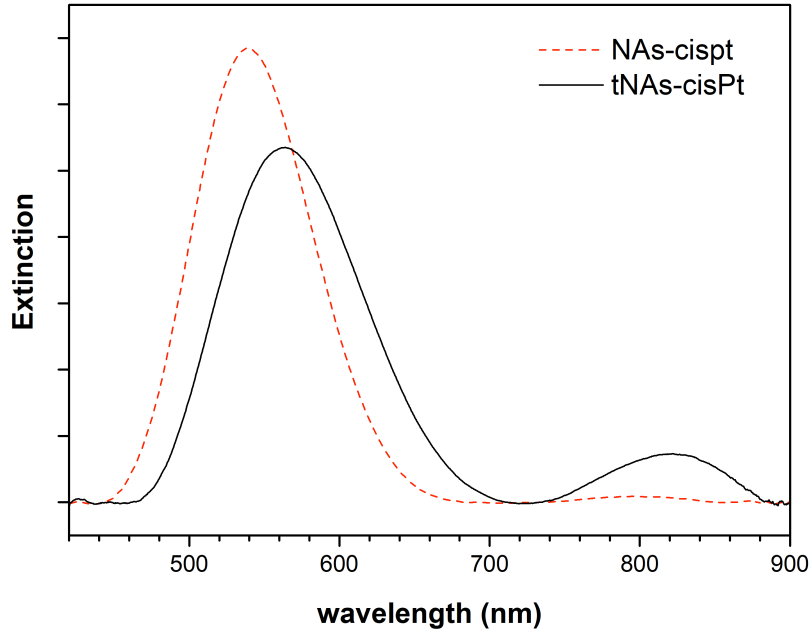
Combined therapy on 3D head and neck squamous cell carcinoma

cisplatin prodrug-loaded photothermal NAs



- tNAs-cisPt
- Gold NP
 - ★ Cisplatin prodrug
 - ⌘ PL: Poly(L-Lysine)
 - Hollow Silica shell

tNAs-cisPt characterization



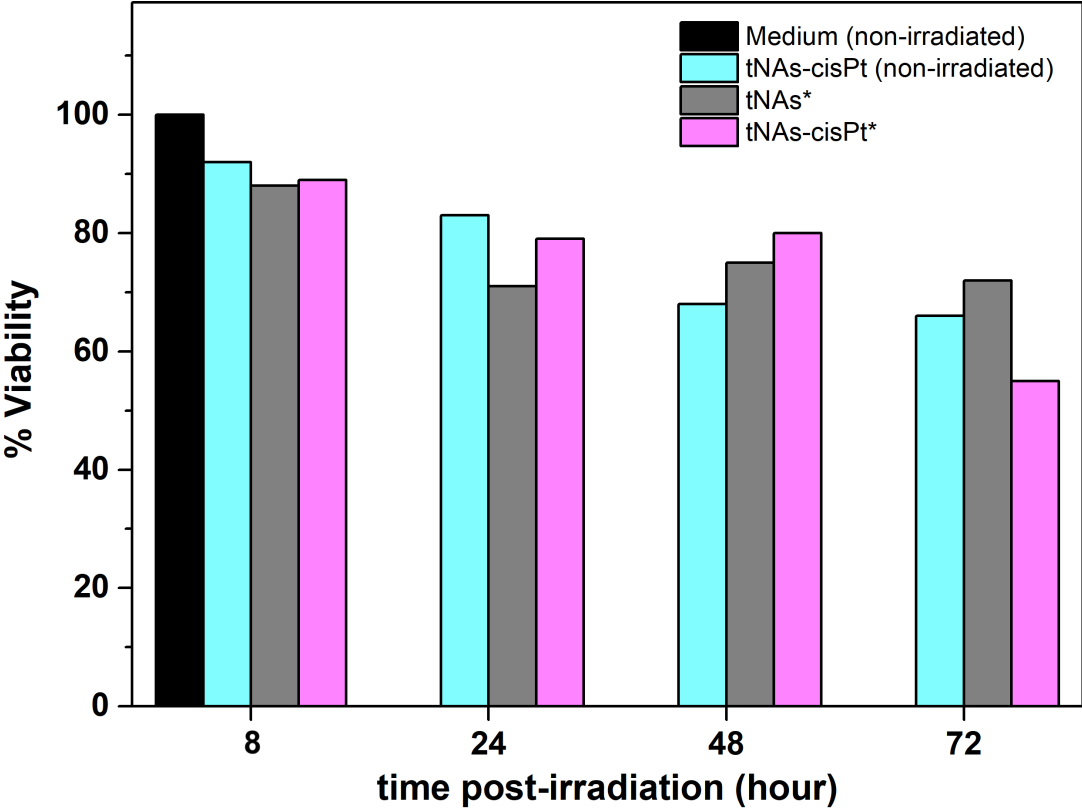
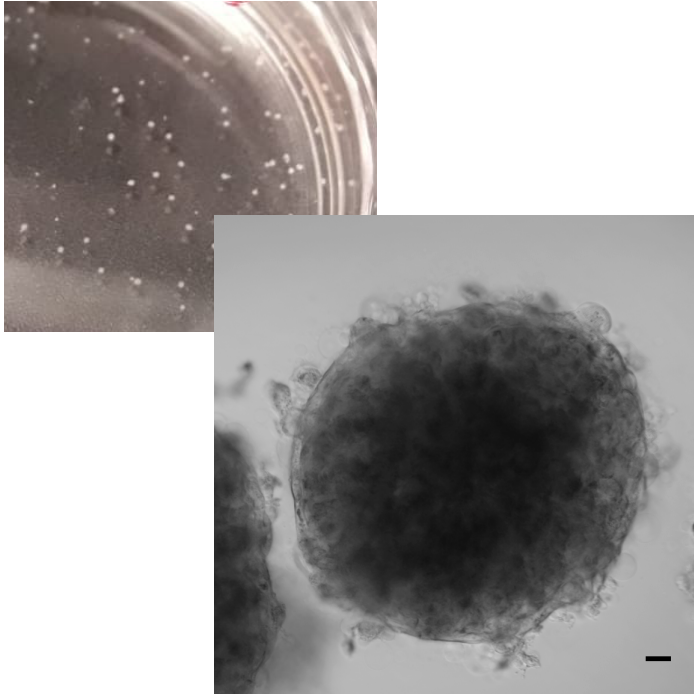
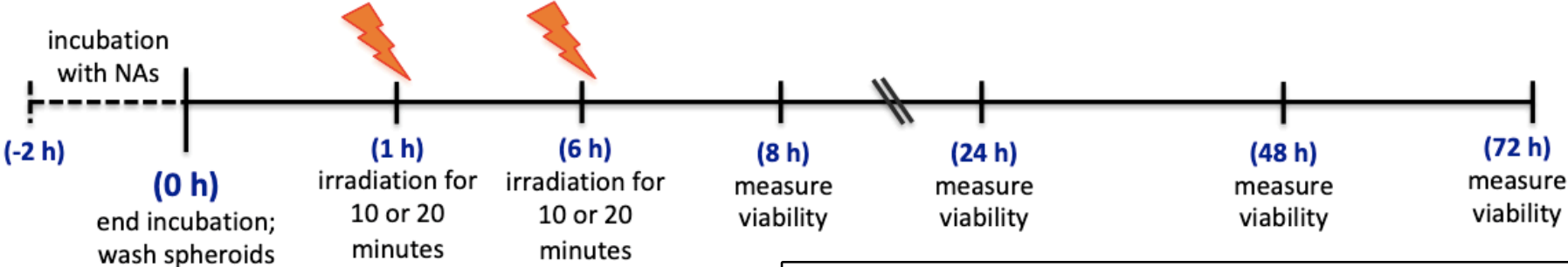
Composition:

79.4 ± 11.3 μg Au (4.8% in total weight)

25.5 ± 5.6 μg Pt (1.6% in total weight)

Combined treatment on 3D SCC-25

SCC-25 Treatment Scheme



*Double irradiation: 810nm laser, 150mW/cm², 20 minutes each

Summary of Research Activities

Finished:

1. Hyperthermia on pancreatic cancer cells
2. Chemotherapy on 3D HNSCC
3. *In vivo* behavior of NAs

On-going:

1. Combined therapy on 3D HNSCC (hyperthermia-chemo)
2. Targeted chemotherapy on HNSCC

Future:

1. Assessment of NAs on chick eggs (short stay at VU Amsterdam)
2. Other NAs-based combined platforms (photodynamic therapy-hyperthermia; PA imaging-hyperthermia)

Chicken egg chorioallantoic membrane (CAM) assay

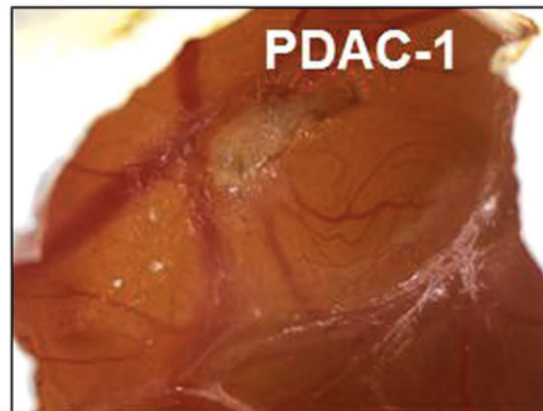


a. View from the top of the egg

b. Localization within the egg

Vargas *et al.*, 2007

Dr. Elisa Giovannetti's lab at VU Medical Center



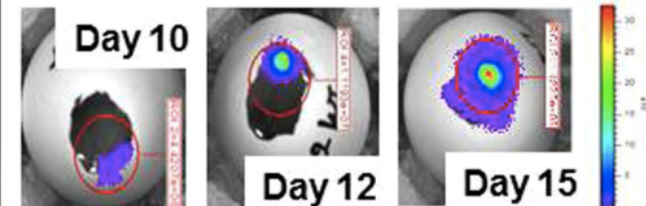
SCIENTIFIC REPORTS

OPEN

Development of bioluminescent chick chorioallantoic membrane (CAM) models for primary pancreatic cancer cells: a platform for drug testing

Received: 15 July 2016
Accepted: 13 February 2017
Published: 17 March 2017

Maria Rovithi^{1,2}, Amir Avan¹, Nicola Funel¹, Leticia G. Leon¹, Valentina E. Gomez¹, Thomas Wurdinger^{1,4,5}, Arjan W. Griffioen¹, Henk M. W. Verheul¹ & Elisa Giovannetti^{1,6*}



Publications:

- Cassano, D., Summa, M., Pocoví-Martínez, S., Mapanao, A., Catelani, T., Bertorelli, R. and Voliani, V. (2018). Biodegradable Ultrasmall-in-Nano Gold Architectures: Mid-Period In Vivo Distribution and Excretion Assessment. *Particle & Particle Systems Characterization*, 36(2), p.1800464.
- Cassano, D., Santi, M., D'Autilia, F., Mapanao, A., Luin, S. and Voliani, V. (2019). Photothermal effect by NIR-responsive excretable ultrasmall-in-nano architectures. *Materials Horizons*, 6(3), pp.531-537.
- Cassano, D., Mapanao, A. K., Summa, M., Vlamidis, Y., Giannone, G., Santi, M., Guzzolino, E., Pitto, L., Polisenò, L., Bertorelli, R., Voliani, V. (2019) Biosafety and Biokinetics of Noble Metals: The Impact of Their Chemical Nature. *ACS Appl. Biomater.* <https://doi.org/10.1021/acsabm.9b00630>.
- Santi, M., Mapanao, A. K., Cassano, D., Vlamidis, Y., Cappello, V., Voliani, V. Endogenously-Activated Ultrasmall-In-Nano Theranostic: Assessment On 3D Head and Neck Squamous Cell Carcinomas. *Manuscript submitted*.
- Mapanao, A. K.; Voliani, V. Three Dimensional Tumor Models: Promoting Breakthroughs in Nanotheranostics Translational Research. *Manuscript submitted*.

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