

Gold and platinum-decorated lithium niobate nanozymes for protection against UV-light induced damage

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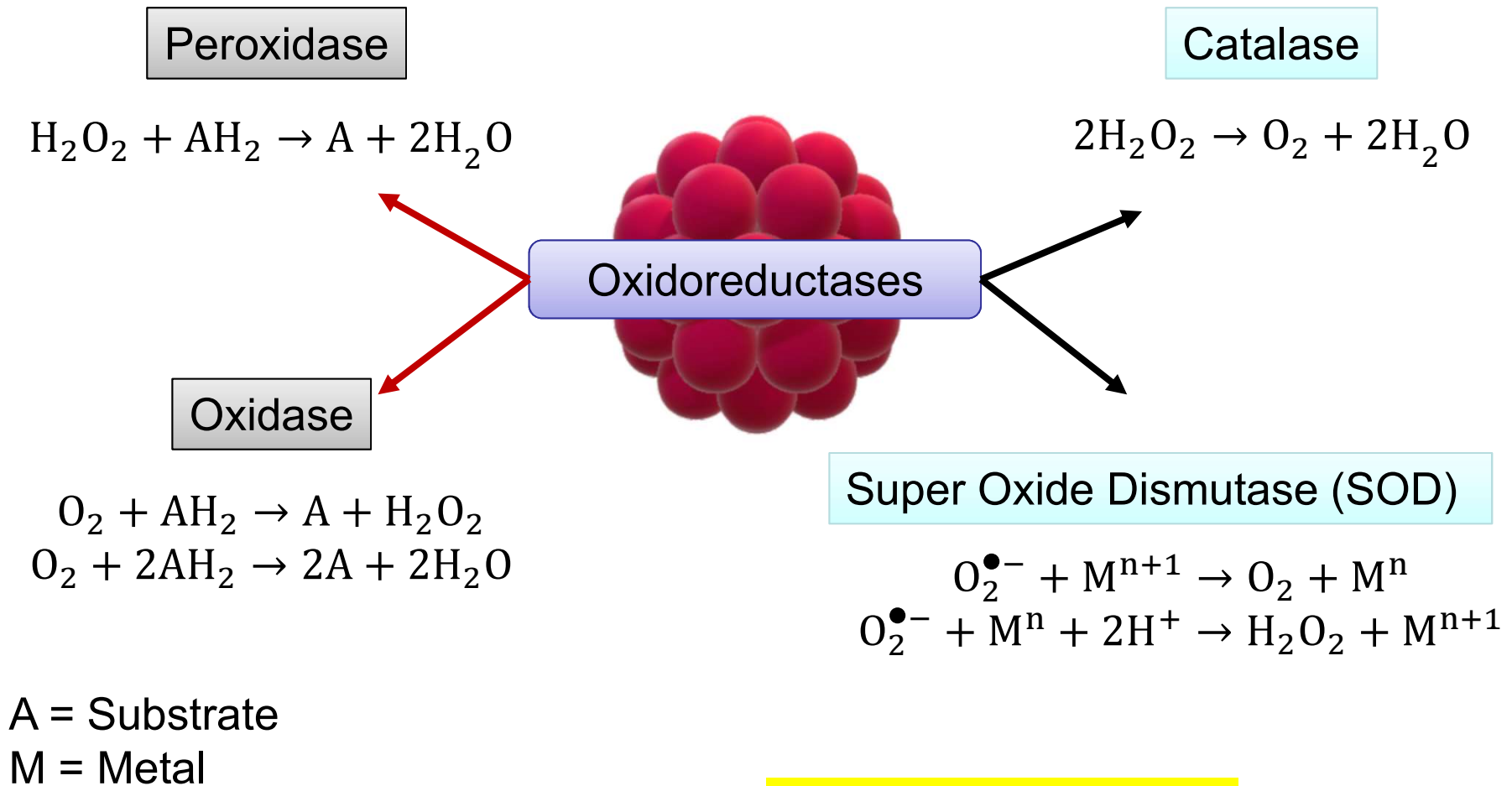
³*Sir Ian Potter NanoBioSensing Facility, RMIT University, Melbourne, Australia*

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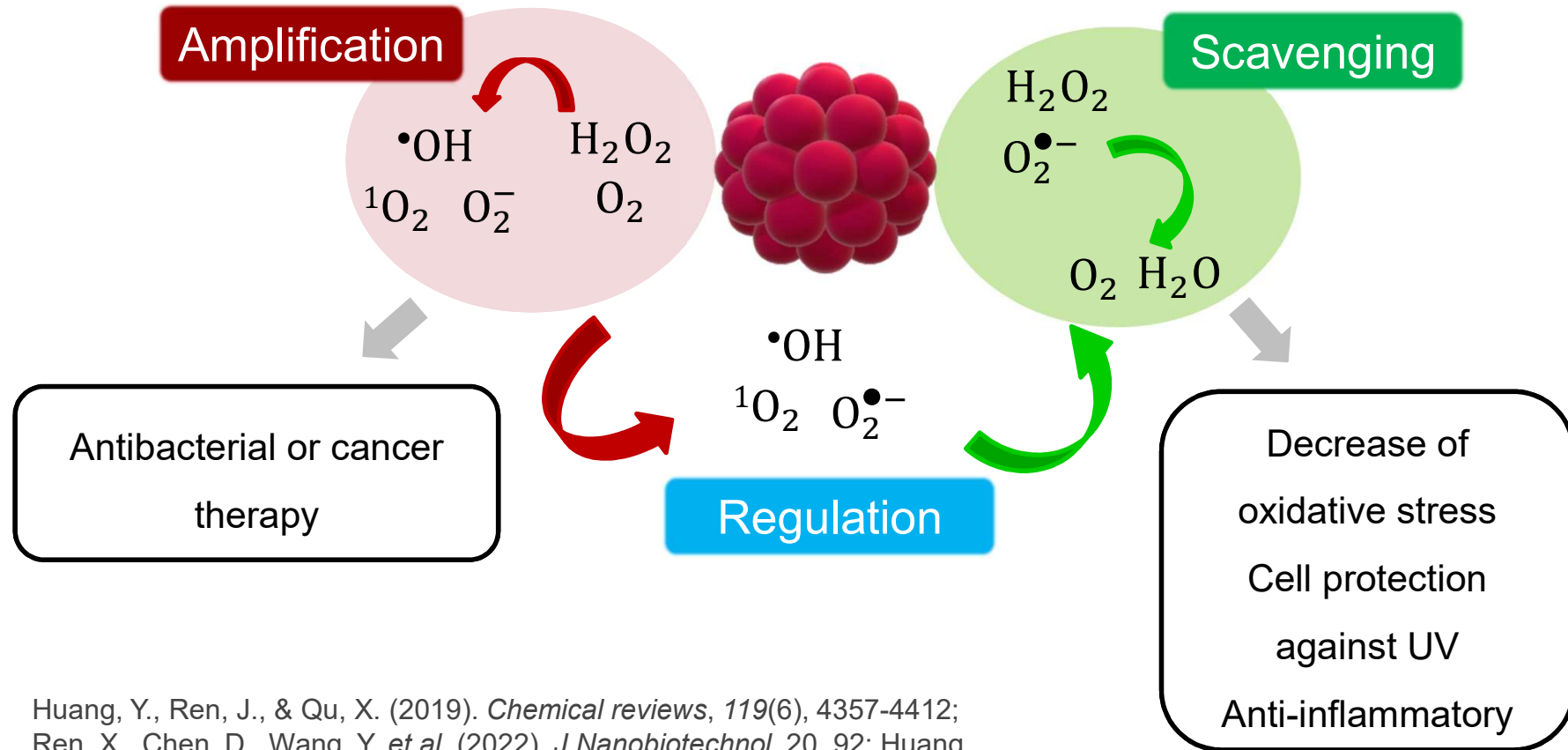
Or Nano Strasbourg – 25-27 oct. 2023

Enzymatic activities of metal nanoparticles



Therapeutic applications through ROS

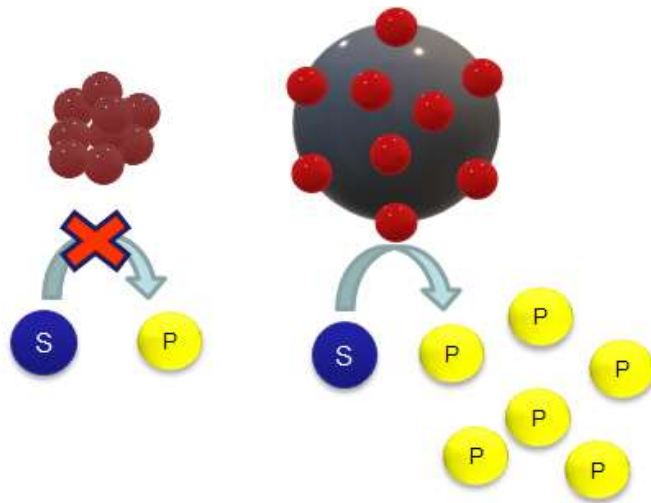
ROS: Reactive Oxygen Species



Huang, Y., Ren, J., & Qu, X. (2019). *Chemical reviews*, 119(6), 4357-4412;
 Ren, X., Chen, D., Wang, Y. *et al.* (2022) *J Nanobiotechnol*, 20, 92; Huang,
 C., *et al.* (2021). *J Nanobiotechnology*, 19, 1-10.

Metal/Metal Oxide combination

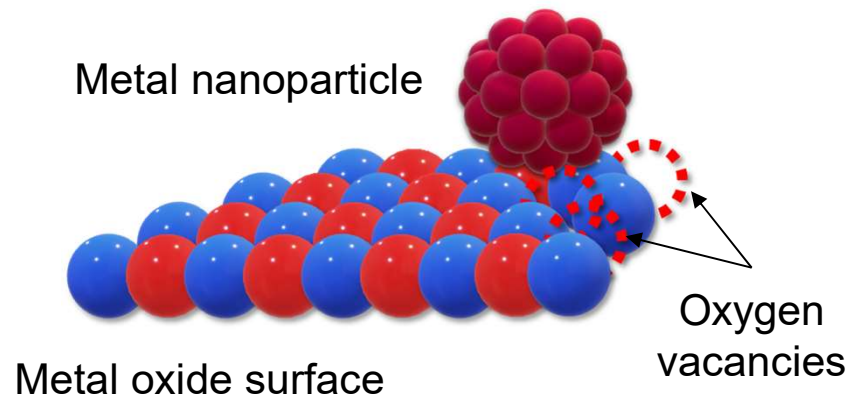
Avoid aggregation



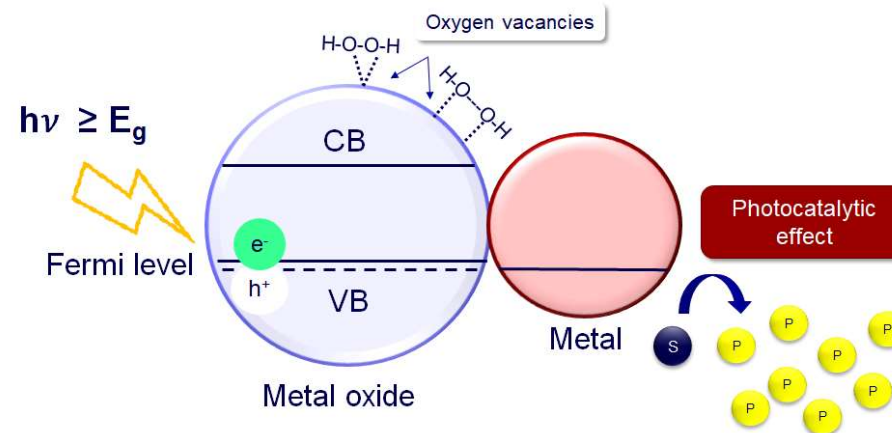
 **Au, Pt,** Pd, Ag

 **LiNbO₃,** TiO₂, SPIO

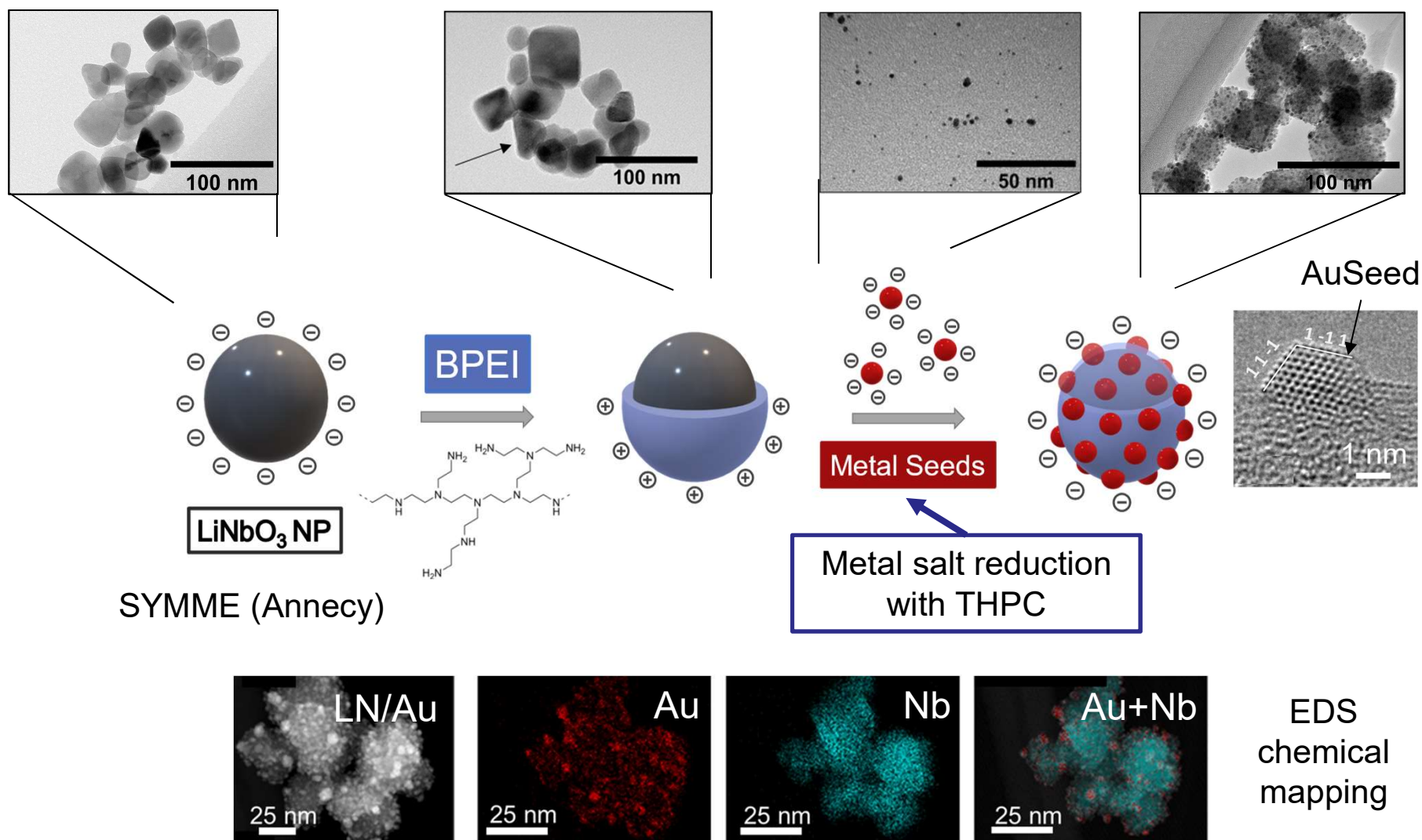
Create oxygen vacancies



Improve charge transfer



LiNbO₃/Au and LiNbO₃/Pt nanoparticles

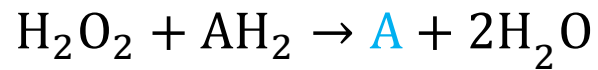


R. Taitt et al (2021). *Nanomaterials*, 11, 950; A. M. Pablo Sainz-Ezquerria et al (2023) *ACS Appl. Nano Mater.*, 6, 13166.

Study of the enzymatic activity

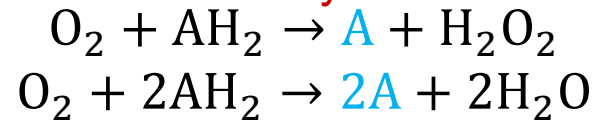
Peroxidase

Nzy



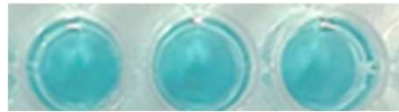
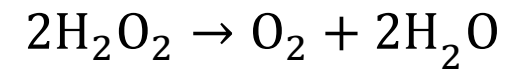
Oxidase

Nzy

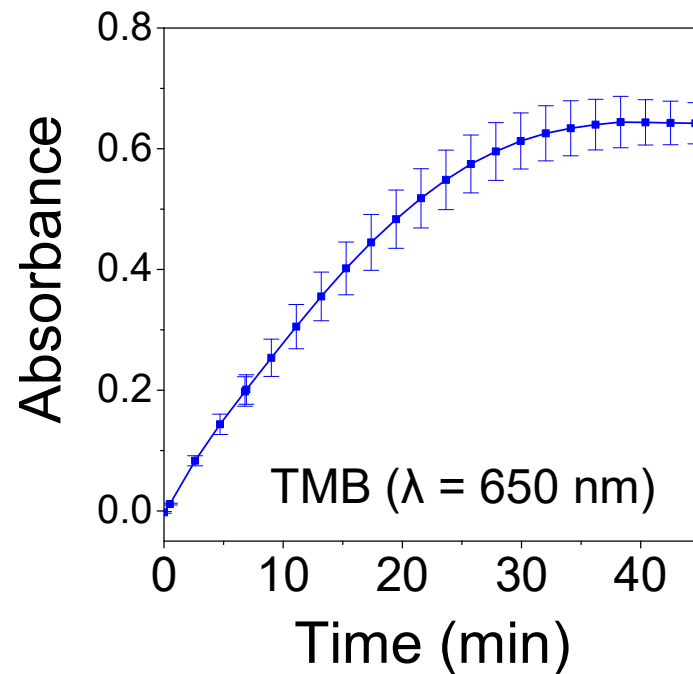


Catalase

Nzy



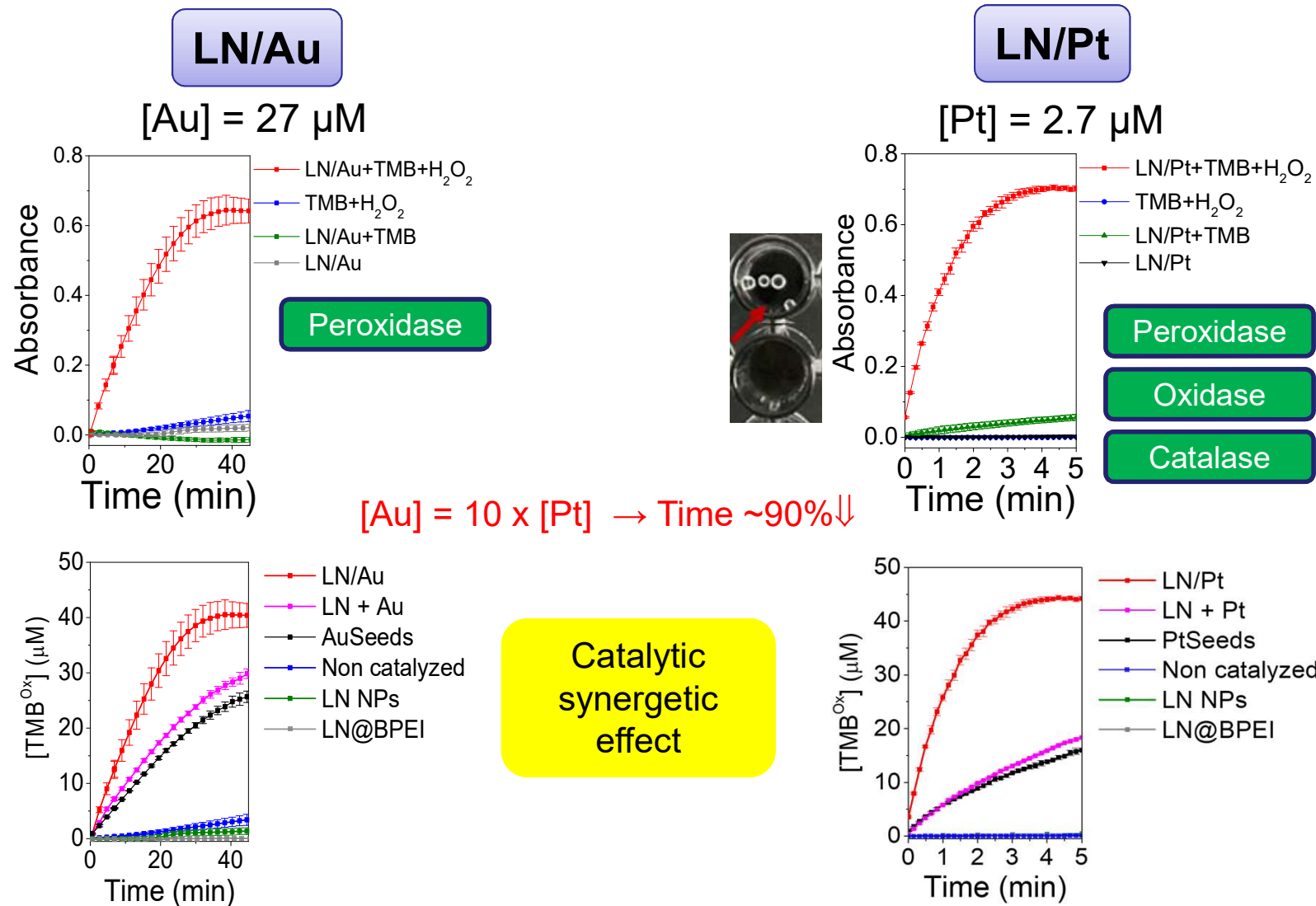
Bubbles generation



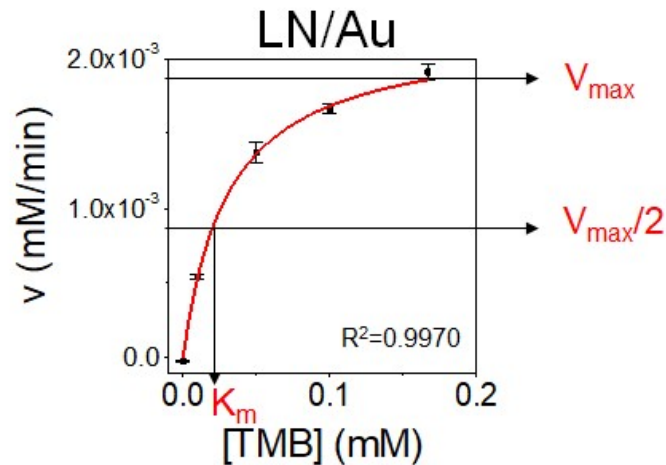
96-well UV-Vis
microplate reader



Enzymatic activity of LN/Au and LN/Pt

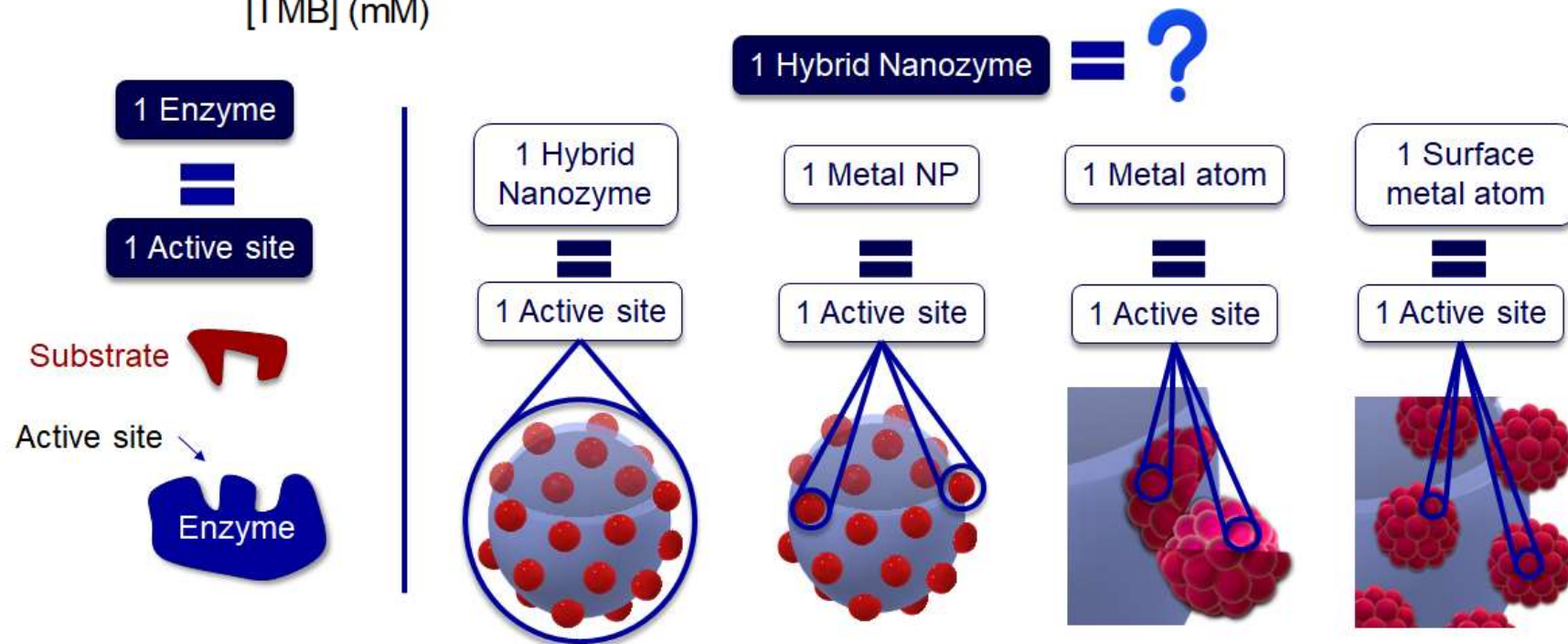


Enzymes vs. Nanozymes



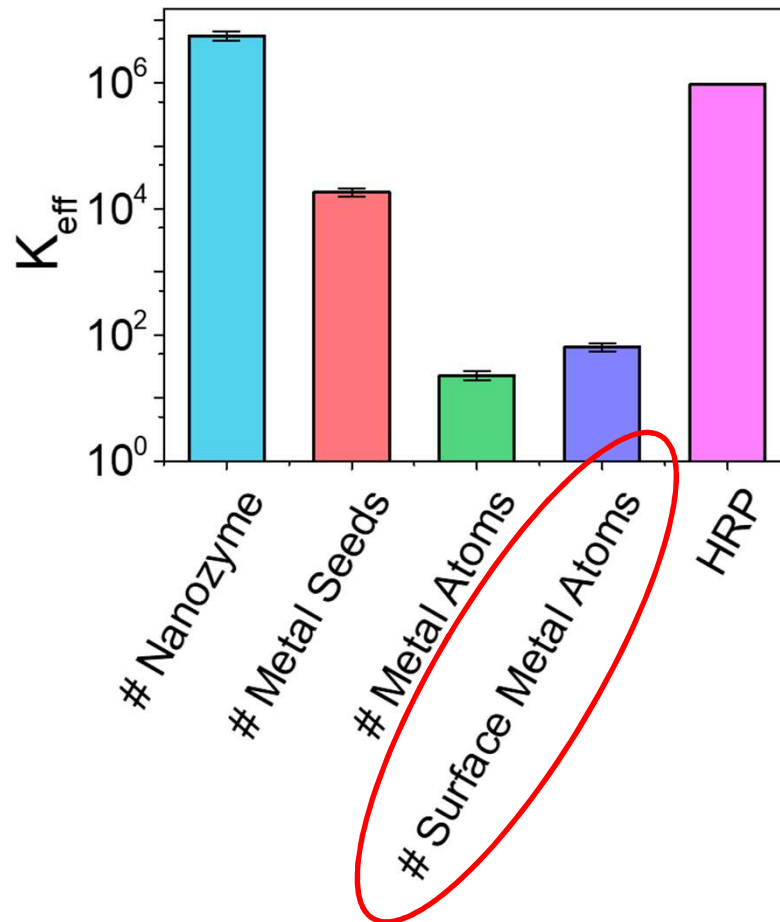
Enzymatic kinetics (Michaelis-Menten)

$$K_{cat} = \frac{V_{max}}{[E]} = \frac{V_{max}}{[act.site]} \Rightarrow K_{eff} = \frac{K_{cat}}{K_m}$$

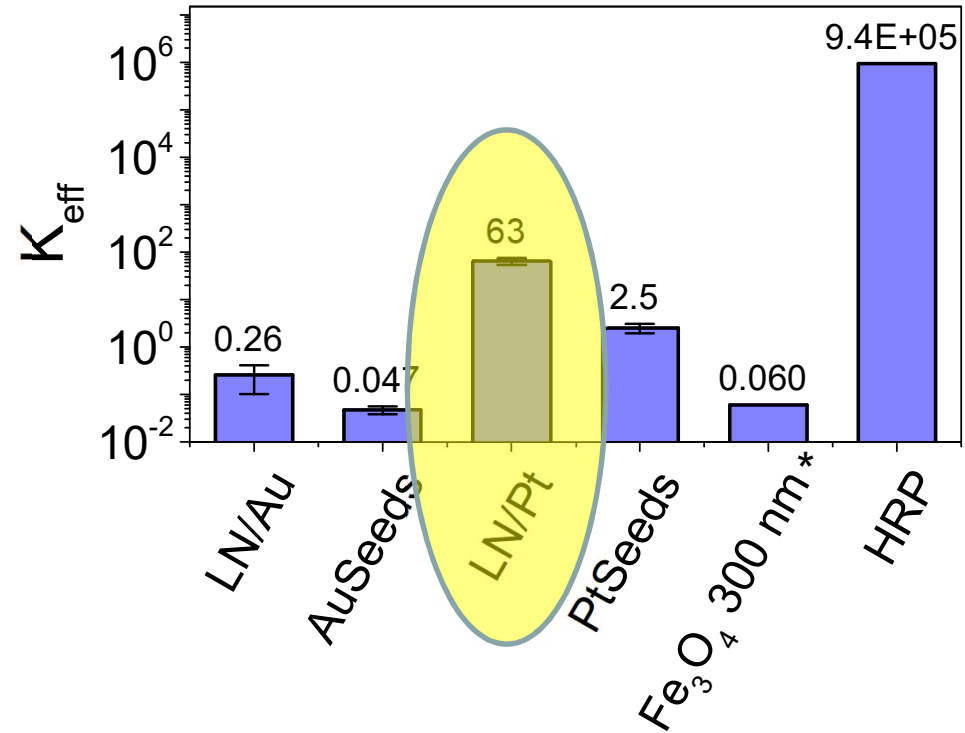


Enzymes vs. Nanozymes

Nanozymes: LN/Pt, Substrate : H_2O_2



Substrate : H_2O_2

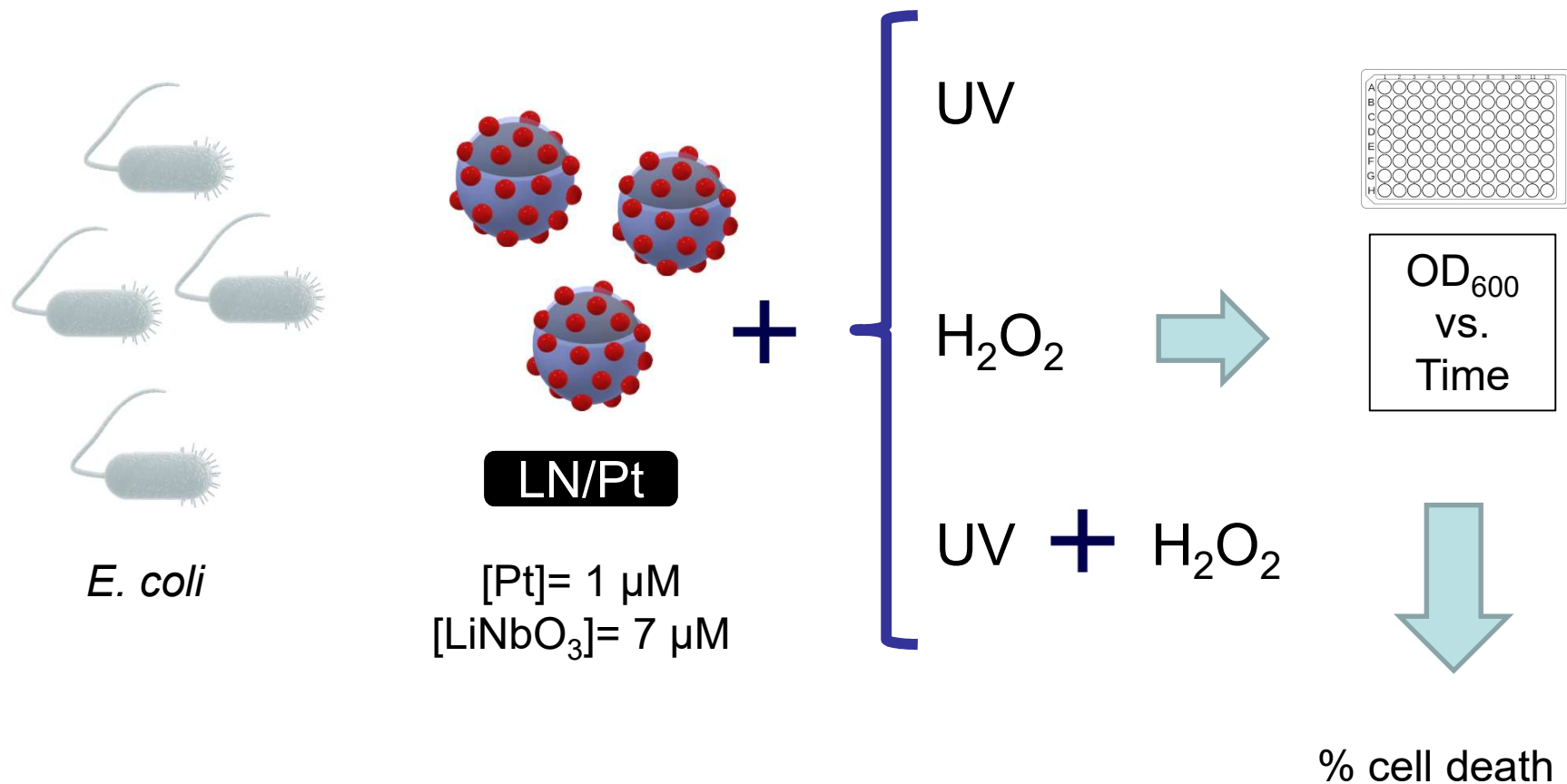


1 active site = 1 surface metal atom

* Zandieh, M., & Liu, J. (2021). *ACS Nano*, 15, 15645-15655.

Bioactivity of LN/Pt nanozymes

Exposure of bacteria to different sources of oxidative stress



Unpublished results

Conclusions and perspectives

- ✓ **LN/Au** and **LN/Pt** are **peroxidase Nanozymes**
- ✓ The enzyme-mimics depends on the metal
- ✓ There is a **synergetic effect** from the combination of materials
- ✓ **Bacterial growth** is affected by Nanozymes and oxidative stress
- ✓ **LN/Pt** might **promote bacterial growth** upon UV irradiation

On-going projects

- Enzyme-mimic study of SPIO/Metal
- Elucidate synergetic effect mechanism
- Biosensing

Acknowledgements

INL – DSE Team

Yann Chevolot

Ana Maria Pablo Sainz-Ezquerro (PhD 2019-2023)

Rachael Taitt (PhD 2017-2021)



SYMME (Annecy)

Ronan Le Dantec

Yannick Mugnier

Mathias Urbain (PhD 2015-2020)

Florian Riporto (PhD 2018-2022)



IRCELYON

Christophe Geantet

Eric Puzenat

Luis Cardenas

Mimoun Aouine



RMIT (Melbourne)

Vipul Bansal

Rajesh Ramanathan

Pyria Rose Divina Mariathomas (PhD 2018-...)

Piyumi Liyanage (PhD 2018-...)



Fundings:

2019-2023: ECLAUsion program from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement no 801512.



Thanks for your attention !