**FWO Research Consortium**

Nanomaterials for drug delivery and in vivo imaging

LECTURE INVITATION

**Enzyme-powered nanobots going *in vivo***

**Prof. Samuel Sanchez**

**The lecture will take place on Monday October 3rd 2022 at 11.00 in seminar room -1.4 Friedrich Sertürner**

**Faculty of Pharmaceutical Sciences, Ottergemsesteenweg 460, 9000 Ghent, Belgium.**

*Registration not required.*

**Contact**

Prof. Kevin Braeckmans

**Abstract**

One of the dreams in nanotechnology is to engineer small vehicles and machines, called here nanobots, which can eventually be applied *in vivo* for medical purposes. Yet, reaching that fascinating goal is not a trivial thing and several challenges need to be addressed. First, researchers need to incorporate efficient but also bio-friendly propulsion mechanisms into the nanobots. Our strategy comprises the use of biocatalysts such enzymes for converting biologically available fuels into a propulsive force. Secondly, nanoparticles’ chassis should be generally recognized as safe (GRAS) material, biocompatible and/or biodegradable.

In my talk, I will present how we bioengineer hybrid nanobots combining the best from the two worlds: biology (enzymes) and (nano)technology (nano- micro-particles) providing swimming capabilities, biocompatibility, imaging, multifunctionality and actuation. Besides the understanding of fundamental aspects (1), and controlling the performance of micro-nanobots (2) I will present some of the proof-of-concept applications of biocompatible nanobots such as the efficient transport of drugs into cancer cells (3) and 3D spheroids (4), sensing capabilities (5), antibactericidal applications (6) and the use of molecular imaging techniques like PET-CT (7) or Photoacoustic (8) for the tracking and localization of swarms of nanobots both *in vitro* and *in vivo* in confined spaces like mice bladder.

**References**

(1) Arqué et al. *Nat. Commun*. 2019. 10, (1) 1-12.; Patino et al. *Acc. Chem. Res*. 2018, 51, (11) 2662-2671

(2) Patino et al. *J. Am. Chem.Soc.* 2018, 140 (25) 7896-7903

(3) Hortelao et al. *Adv. Funct. Mat* 2018, 28, 1705086

(4) Hortelao et al. *ACS Nano* 2019, 13, (1), 429-439

(5) Patino et al. *NanoLett.* 2019, 19, (6), 3440-3447

(6) Arqué et al. *ACS Nano* 2022, 16, 5, 7547–7558

(7) Hortelao et al. *Sci. Robotics.* 2021, 6, (52), eabd2823*.*

(8) D. Xu et al. *ACS Nano,* 2021, 15 (7), 11543-11554

**Biography**

Samuel obtained his PhD in Chemistry at Autonomous University of Barcelona in 2008. Currently, he is ICREA Research Professor, Group Leader and Deputy Director at the Institute for Bioengineering of Catalonia. Before that, he worked at the Max Planck Institute for Intelligent Systems Stuttgart, at the Institute for Integrative Nanosciences at IFW Dresden, Germany, and at MANA-NIMS in Japan. He is currently honorary visiting Professor at HIT Harbin in China and Adjunct Professor at POSTECH University in South Korea. Samuel received several awards (among others): The MIT TR35 Top Innovator Under 35 Spain 2014, Guinness World Records in 2010 and 2017, the Princess of Girona Scientific Award 2015 and the National Research Award for Young Talent 2016 by the Catalan Research Foundation, and this year receive the Scientific Excellence award from the Spanish Royal Society of Chemistry and recently the prestigious Bank Sabadell Foundation award for “Basic Science and Engineering award”. He is elected member of the Young Academy of Spain since 2020.He received the prestigious ERC-Starting grant in 2013 and the ERC-Consolidator Grant in 2019, together with two ERC Proof of concept grants. Besides extensive public funding (>8Mi€), he has cooperation agreements with the Private sector and hospitals. He has published >155 papers with h-index of 66 and filed 7 patents one of them to be licensed to the spin off he’s founder of. His group’s main interests span from self-propelled nanoparticles as intelligent vehicles in biomedicine to the 3D Bioengineering of biohybrid robots and actuators.