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## Conferencia:

# Interaction of colloids with cells (in vitro and in vivo)

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Fachbereich Physik, Philipps  
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Spain

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Aula de Seminarios  
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# Interaction of colloids with cells (in vitro and in vivo)

Wolfgang J. Parak

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What happens to inorganic nanoparticles (NPs), such as plasmonic gold or silver, superparamagnetic iron oxide, or fluorescent quantum dot NPs, after they have been administered to an animal or a human being? The review discusses the integrity, biodistribution, and fate of NPs after in vivo administration. First the hybrid nature of the NPs is described, by conceptually dividing them into the inorganic NP core, an engineered surface coating around the core which comprises the ligand shell and optionally also bioconjugation, and into the corona of adsorbed biological molecules. It is shown that in vivo all of these three compounds may degrade individually and that each of them can drastically modify the life-cycle and biodistribution of the whole hetero-structure. The NPs thus may be disintegrated into different parts, of which biodistribution and fate would need to be analyzed individually. Multiple labelling and quantification strategies for such purpose will be discussed. All reviewed data indicate that in vivo NPs no longer should be considered as homogeneous entity, but should be seen as inorganic/organic/biological nano-hybrids with complex and intricately linked degradation pathways.

## **References:**

- M. Chanana, P. Rivera Gil, M. A. Correa-Duarte, L. M. Liz-Marzán, W. J. Parak, "Physicochemical Properties of Protein-Coated Gold Nanoparticles in Biological Fluids and Cells before and after Proteolytic Digestion", *Angewandte Chemie International Edition* 52, 4179–4183 (2013).
- W. G. Kreyling, A. M. Abdelmonem, Z. Ali, F. Alves, M. Geiser, N. Haberl, R. Hartmann, S. Hirn, K. Kantner, D. Jimenez de Aberasturi, G. Khadem-Saba, J.-M. Montenegro, J. Rejman, T. Rojo, I. Ruiz de Larramendi, R. Ufartes, A. Wenk, W. J. Parak, "In vivo integrity of polymer-coated gold nanoparticles", *Nature Nanotechnology* 10, 619–623 (2015).

## **curriculum vitae Wolfgang J. Parak**



Born on 22. 2. 1970 in Dachau, Germany, German citizenship

Parents: Fritz and Edeltraud Parak (nee Unterstaller)

- 1989-1997 General Physics studies at the Technische Universität München, Germany  
finished on 13. 1. 1997 with the final degree "Diplom Physiker"  
(equivalent to masters in physics; grade: 1,4)
- 1995-1997 Diploma thesis ("Diplomarbeit") at the Technische Universität München, Germany, at the Institute for Biophysics in the group of Prof. Dr. Hermann Gaub with the topic "set-up and characterisation of a LAPS-Sensor for non-invasive measurements of membrane potentials"
- 1997-1999 Graduate student at the Ludwig Maximilians Universität München, Germany, at the Institute of Applied Physics (chair: Prof. Dr. Hermann Gaub with the topic "cell-semiconductor-hybrids"; finished on 15.12.1999 with the PhD degree ("Dr. rer. nat") (grade: 0,7; with honours, "Auszeichnung")
- 2000-2002 Postdoc at the Department of Chemistry at the University of California at Berkeley, California, USA, in the group of Prof. Paul Alivisatos, whereby the first year was sponsored by a fellowship of the German Research Foundation (DFG) field of work: biological applications of colloidal nanoparticles
- 2003-2006 Leader of a Junior Research Group (Emmy-Noether fellowship of the German Research Foundation (DFG), equivalent to Assistant Professor), hosted at the Ludwig Maximilians Universität München, Germany, at the Institute for Applied Physics (chair: Prof. Dr. Hermann Gaub) and at the Center for Nanoscience
- 2005 Temporary position as Associate Professor for Physical Chemistry at the Department of Chemistry and Pharmacy at the Ludwig Maximilians Universität München, Germany for the Summer Semester
- since 2007 Full Professor (chair) for Experimental Physics at the Philipps-Universität of Marburg, Germany
- since 2010 Associate Editor for ACS Nano from the American Chemical Society
- since 2013 in addition head of the Biofunctional Nanomaterials Unit at CIC biomaGUNE, San Sebastian, Spain

### Awards/honors:

- 2009 "Nanoscience" - award 2008 from the Association of Nanotechnology-Centres Germany (AGenNT)
- 2011 ranked #59 in Top Materials Scientists of the past decade by Essential Science Indicators (<http://science.thomsonreuters.com/products/esi/>)
- 2012 Awarded Chinese Academy of Sciences Visiting Professorship for Senior International Scientists
- 2014 highly cited in the category materials sciences (<http://highlycited.com/>)
- 2014 listed in "The World's Most Influential Scientific Minds: 2014" (<http://www.sciencewatch.com>)
- 2015 highly cited in the category materials sciences (<http://highlycited.com/>)

2015 listed in “The World’s Most Influential Scientific Minds: 2015”  
(<http://www.sciencewatch.com>)

2016 Awarded Shanghai Thousand-Talent program

2017 Visiting Professor Australian Research Council Centre of Excellence in  
Convergent Bio-Nano Science & Technology (CBNS)

present h-index: 68 WebOfScience; 78 GoogleScholar

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Editorial activity, organization of conference:

Wolfgang Parak is / was Associate Editor of ACS Nano (2010-), and Nanotoxicology (2009-2010). He is / was in the advisory board of the following journals: Small Methods (2017-), Chemistry of Materials (2015-), Angewandte Chemie (2014-), Theragnostics (2014-), Nanomaterials (2014-), ChemNanoMat (2014-), Colloids and Interface Science Communications (2014-), Particle & Particle Systems Characterization (2013-), Journal of Nanobiotechnology (2011-), Nanotoxicology (2010-), Journal of Colloid and Interface Science (2009-), The All Results Journal (2008-), Recent Patents on Nanotechnology (2007-2010), Journal of Nanobiosensors in Disease Diagnosis (2011-2013). Wolfgang Parak is / was member of the following steering committees: National Research Programme NRP 64 "Opportunities and Risks of Nanomaterials" of the Swiss National Foundation (2010-, Switzerland), Andalucian Initiative for Advanced Therapies (IATA, 2012-, Spain), Institute for medical / pharmaceutical exams (IMPP, Institut für medizinische und pharmazeutische Prüfungsfrage, 2012-, Germany), Minerva Center for Bio-hybrid Complex Systems at the Hebrew University Jerusalem (Chairperson of the Center's Beirat, 2013-, Israel), CIBER-BBN (2013-, Spain), committee of external evaluators of the Italian Institute of Technology (IIT, 2013-, Italy). Wolfgang Parak is co-organizer of the following conference series: "Colloidal Nanoparticles for Biomedical Applications" of the SPIE Photonics West meeting (2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016), NANAX (2003, 2008, 2012, 2016), American Chemical Society ACS Spring / Fall meeting (s2014, s2015, f2015, s2016, f2016, s2017, f2017).

Since 2016 Wolfgang Parak is also co-owner of the start up company Medcomtech Oncosystems