



HR EXCELLENCE IN RESEARCH



*The **CREA**tion of the Department of Physical Chemistry of Biological Sys**TE**ms [CREATE]*

666295 — CREATE — H2020-WIDESPREAD-2014-2015/H2020-WIDESPREAD-2014-2

Report on the visit of prof. Wilhelm Huck
[WP3]

Level of dissemination: PUBLIC

Warsaw, December 2017



This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 666295

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INTRODUCTION

The visit of Prof. Wilhelm Huck at the Institute of Physical Chemistry of the Polish Academy of Sciences (IPC) was held under a series of cyclical lectures on interdisciplinary emerging research.

For this reason Prof. Wilhelm Huck was invited to IPC to:

- deliver seminar lectures on his studies;
- participate in meetings with synergetic teams to support mentoring activity of the ERA Chair holder;
- take part in the consultations on possible changes in IPC and give their recommendations for the Institute.



Prof. Wilhelm T. S. Huck is Professor of Physical Organic Chemistry at the Institute for Molecules and Materials, Radboud University. He received his PhD in 1997 from the University of Twente. After postdoctoral research with Prof. Whitesides at Harvard University, he took up a position in the Department of Chemistry at the University of Cambridge, where he was promoted to Reader (2003) and Full Professor of Macromolecular Chemistry (2007). He became Director of the Melville Laboratory for Polymer Synthesis in 2004 and in January 2010 he moved to the Radboud University Nijmegen. His research focuses on the physical biology of the cell and aims to elucidate, using model systems and living cells, the influence of the special nature of the cellular environment on complex reaction networks in cells. Prof. Wilhelm Huck received various awards

and important research grants such as an ERC Advanced Grant in 2010 and a VICI grant in 2011. In 2012 he was appointed Fellow of the Royal Society of Chemistry, and a member of the Royal Netherlands Academy of Arts and Sciences. In 2016 he was appointed Investigator at the Simons Foundation. He is cofounder of Cytofind Diagnostics and Sphere Fluidics in the UK .

THE COURSE OF THE VISIT

The visit of prof. Wilhelm Huck took place on the 20th – 21st, December, 2017 [see [annex 1 for agenda](#)].

On the first day of the visit, prof. Wilhelm Huck delivered a seminar entitled "Building a Synthetic Cell". The seminar was held in the assembly hall of IPC. All researchers and PhD students employed at IPC were invited to participate in this seminar.

See [annex 2 for full abstract](#) of the seminar.



The seminar of prof. Wilhelm Huck, assembly hall, the 20th December, 2017.

After the seminar, professor met with a few students who had previously expressed such need. The aim of this meetings was to consult students' research projects and discuss the possible development directions. As part of these consultations, prof. Wilhelm Huck met with the following students:

Students' name	Scope of consultation
Ying Zhou	Ying Zhou talked with Prof. Huck about her research on protein oligomerization in living cells. Prof. Huck suggested Ying to investigate the relationship between physical influences (cell size, structure, and et.) and protein oligomerization.
Łukasz Kozoń	Łukasz Kozoń presented his recent project - a microfluidic device for multiplex screening of antibiotic susceptibility. Prof. Huck gave him an experimental advice and mentioned potential problems with its commercialization. They also discussed Łukasz's Career Development Plan.
Kinga Matuła	Kinga Matuła discussed with prof. Huck a project plan on embryo development in 3D microniches. Together with prof. Wojtkowski, they talked about the possibility of using optical coherence tomography (OCT) for detection of circulating tumor cells in microfluidic devices. Kinga is planning to investigate this topic in collaboration with prof. Wojtkowski group and prof. Huck group.



Discussion between prof. Wilhelm Huck and Łukasz Kozoń.

The second day of the professor's visit was devoted to the 2nd meeting of the ERA Chair Advisory Board – prof. Wilhelm Huck is a member of this Advisory Board.



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ANNEX 1.

Agenda of the visit of prof. Wilhelm Huck



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AGENDA of the visit of prof. Wilhelm Huck

(CREATE project)

Institute of Physical Chemistry, Polish Academy of Sciences, 20-21 December, 2017

20 December

- 12.00** pick up from the airport
- 13.00-13.45** lunch
- 14.00-15.00** **prof. Wilhelm Huck** – „Building a Synthetic Cell”
- 15.00-15.45** meeting with Łukasz Kozoń, PhD student supervised by prof. Piotr Garstecki
- 15.45-16.30** meetings with Ying Zhou and Kinga Matuła,
PhD students supervised by prof. Robert Hołyst
- 18.00** **Dinner** - WARSZAWA WSCHODNIA, MIŃSKA 25

21 December

- 9.00-13.00** 2nd meeting of the ERA Chair Advisory Board
- 13.00** lunch
- 14.30** transfer to the airport



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ANNEX 2.

Full abstract of the seminar



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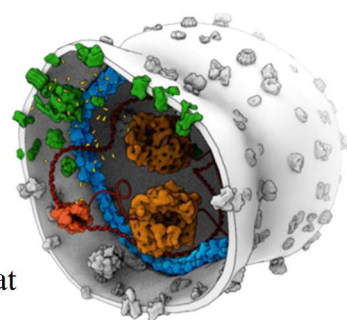
Building a Synthetic Cell

Wilhelm T. S. Huck

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A cell is the common unit structure shared by all living organisms, but even ‘simple’ prokaryotic cells are extremely complex chemical reactors.

One of the grand fundamental challenges of modern science is to reveal the basic operating principles of life. While we have extensive knowledge about the molecular building blocks that form the basis of modern life, we *do not understand* how these building blocks collectively operate to define life as we know it. Cellular life, which provides the fundament of all organisms, appears to be the result of a collection of highly controlled, energy consuming, dynamic self-assembly and self-organization processes that lead to autonomous entities that can reproduce, transfer information, interact, and evolve.



Understanding the physical-chemical principles of these collective processes poses a formidable challenge, which needs to be overcome if we want to be able to understand life itself, and influence biological processes in a rational way in the future. Truly understanding life from the bottom-up will bring huge intellectual, scientific, and technological rewards. At the same time it will raise fascinating philosophical and ethical questions about how society may cope with new opportunities that result from this fundamental insight.

In our research, we use microfluidic techniques to create cell-like environments that allow us to probe the impact of the physical aspects of the cell on key biochemical processes such as transcription and translation. I will also give an overview of our current attempts to reconstruct a living cell.

Recent publications:

1. M.M.K. Hansen, L.H.H. Meijer, E. Spruijt, R.J.M. Maas, M. Ventosa Rosquelles, J. Groen, H.A. Heus and W.T.S. Huck, *Macromolecular crowding creates heterogeneous environments of gene expression in picolitre droplets*, **Nature Nanotechnology** (2016), 11, 191-197.
2. N.-N. Deng, M. Yelleswarapu and W.T.S. Huck *Monodisperse uni- and multi-compartment liposomes*, **J. Am. Chem. Soc.** (2016), 138, 7584-7591
3. S.N. Semenov, A.S.Y. Wong, R.M. van der Made, S.G.J. Postma, J. Groen, H.W.H. van Roekel, T.F.A. de Greef and W.T.S. Huck, *Rational design of functional and tunable oscillating enzymatic networks*, **Nature Chem.** (2015), 7, 160-165.
4. E. Spruijt, E. Sokolova and W.T.S. Huck, *Complexity of molecular crowding in cell-free enzymatic reaction networks*, **Nature Nanotechnology**, (2014), 9, 406-407.
5. E. Sokolova, E. Spruijt, M.M.K. Hansen, E. Dubuc, J. Groen, V. Chokkalingam, A. Piruska, H.A. Heus and W.T.S. Huck, *Enhanced transcription rates in membrane-free protocells formed by coacervation of cell lysate*, **Proc. Nat. Acad. Sci. USA** (2013), 110, 11692-11697.



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