



*The CREAtion of the Department of Physical Chemistry of Biological SysTEms [CREATE]*

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

**Report on the visit of Prof. Gabor Forgacs  
[WP3]**

**Level of dissemination: PUBLIC**

**Warsaw, May 2019**



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## INTRODUCTION

Professor Gabor Forgacs visited the Institute of Physical Chemistry of the Polish Academy of Sciences (IPC PAS) under a series of cyclical lectures on interdisciplinary emerging research.

The main goals of this visit were:

- deliver a scientific seminar and participate in meetings with synergetic teams, to support mentoring activity of the ERA Chair holder,
- take part in the consultations on required changes at IPC to improve our performance,
- discuss the idea of joint grant application with ERA Chair holder.

**Prof. Gabor Forgacs** is a theoretical physicist turned bioengineer turned innovator and entrepreneur. He is the George H. Vineyard Professor of Biological Physics at the University of Missouri-Columbia, the Executive and Scientific Director of the Shipley Center for Innovation at Clarkson University and scientific founder of Organovo, Inc. and Modern Meadow, Inc. He was trained as a theoretical physicist at the Roland Eotvos University, Budapest, Hungary and the Landau Institute of Theoretical Physics, Moscow, USSR. He also has a degree in biology. His research interests span from topics in theoretical physics to physical mechanisms in early embryonic development. He is the co-author of the celebrated text in the field, “Biological Physics of the Developing Embryo” (Cambridge University Press, 2005)



that discusses the fundamental morphogenetic mechanisms evident in early development. These mechanisms are being applied to building living structures of prescribed shape and functionality using bioprinting, a novel tissue engineering technology he pioneered. He is the author of over 160 peer-reviewed scientific articles and 5 books. He has been recognized by numerous awards and citations. In particular, he was named as one of the “100 most innovative people in business in 2010” by FastCompany.

## COURSE OF THE VISIT

The visit took place on 7<sup>th</sup>-8<sup>th</sup> May 2019 [see [annex 1 for agenda](#)] and included planned seminar lecture and several meetings.

As a main event of the first day of his visit, Prof. Forgacs delivered a seminar titled **“Bioprinting In The Life Sciences And Beyond”**. The seminar was held in the assembly hall of the IPC PAS. All

researchers and PhD students employed in the IPC PAS were invited to participate in this seminar - the seminar was attended by approx. 80 people.



**The seminar of Prof. Gabor Forgacs, assembly hall, 7 May 2019**

### Abstract of the seminar

Engineering of tissues and organs has seen spectacular progress in recent years. The associated technologies such as 3D printing and organ-on-the chip have provided invaluable tools for numerous applications. The technologies have also matured from academic research into commercialization. In basic research these structures are used as models to study early developmental processes, cellular interactions and disease in near-physiological conditions. In pharmaceutical applications today the engineered constructs are used in drug toxicity essays in preclinical studies. Tomorrow, animal trials that today precede human clinical trials will be replaced by model organisms representing combinations of bioprinted tissues. We will discuss applications of these technologies, either already on the market notably in pharmaceuticals or soon to arrive there such as in therapeutics. Importantly, we present applications beyond the customary fields of regenerative medicine and drug development, examples of a novel paradigm, the biofabrication of animal products, such as leather and meat without the need to slaughter animal. We conclude with an attempt to provide a free-of-hype, realistic outlook on the future of the discussed technologies. 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.

The seminar was followed by several meetings with selected research groups from Institute of Physical Chemistry PAS. The aim of these laboratory visits was to familiarize Prof. Forgacs with IPC PAS, establish contacts with synergic groups supporting the ERA Chair holder team and discuss the possibility for future cooperation:

*Physical Optics and Biophotonics Group - Prof. Maciej Wojtkowski*

Dr. Piotr Cięćka presented a custom-built autofluorescence scanning light ophthalmoscope used for investigations of the macular pigment. Also, a spatial light modulator was presented with a show of images created by Fourier transform action of the lens on holograms displayed on the LCD.

*Soft Granular Matter and Tissue Engineering Group – Dr. Jan Guzowski*

Dr. Jan Guzowski and his group met with Prof. Forgacs to discuss new 3D culture and tissue engineering tools developed in the group, including hydrogel particles and porous scaffolds fabricated using microfluidics. The meeting followed a lab tour, including presentation of group scientific activities. Lively discussions took nearly 2 hours.

*Group of Microfluidics and Complex Fluids – Prof. Piotr Garstecki*

Dr. Laci Derzsi presented Prof. Forgacs the microfluidic laboratory including microfabrication facilities, confocal microscope and experimental setups. Current projects realized by the Group were discussed including Bacteromic project aiming at developing a microfluidic platform for screening of microbial antibiotic resistance.



**Meeting with Dr Ladislav Derzsi at microfluidic laboratory, 7 May 2019**

Soft Condensed Matter Group – *Prof. Robert Hołyst*

Dr. Grzegorz Bubak showed Prof. Forgacs cell culture laboratory and the customized confocal microscope adapted to intracellular imaging, e.g., via fluorescence correlation spectroscopy.

Visit of Prof. Forgacs included as well a meeting with ERA Chair project coordinator Prof. Robert Hołyst and ERA Chair holder Prof. Maciej Wojtkowski. Meeting was dedicated for an exchange of best practices in research and business in the USA, Hungary and in Poland.



**Meeting with ERA Chair holder, 7 May 2019**



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## **ANNEX 1.**

### **Full agenda of the visit**



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### CREATE lectures

The Institute of Physical Chemistry of the Polish Academy of Sciences

#### Agenda

#### 7 May 2019

- 9:30 – 10:00 am Lab visit - Jan Guzowski, PhD  
*Soft Granular Matter and Tissue Engineering Group*
- 10:00 – 10:30 am Lab visit – Piotr Ciąčka, PhD  
*Physical Optics and Biophotonics Group*
- 11:00 – 12:00 pm Seminar – Prof. Gabor Forgacs:  
“Biofabrication in the Life Sciences and Beyond”
- 12:15 – 1:30 pm Lunch time
- 1:30 – 2:15 pm Lab visit - Ladislav Derzsi, PhD  
*Microfluidics and Complex Fluids Group*
- 2:15 – 3:00 pm Lab visit - Grzegorz Bubak, PhD  
*Soft Condensed Matter Group*
- 3:00 pm Meeting with ERA Chair Project Coordinator and ERA Chair holder  
Short discussion, summary of the visit and recommendations for IPC PAS
- 3:30 – 4:30 pm Working visit – Jan Guzowski group
- 7:00 pm Dinner

#### 8 May 2019

- 10:00 – 12:00 pm Meeting with Prof. Świążkowski at Warsaw University of Technology
- 12:00 – 2:00 pm Lunch time



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