*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

1st report on enhancement of IPC research quality

[Deliverable D.3.5]

Level of dissemination: Public

Warsaw, May 2017

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I. OVERVIEW:

This document contains **description of the courses and effects of events intended for the whole IPC society, and – in particular – the synergetic groups** (i.e. research groups selected by the ERA Chair holder for collaboration and development of the research goals adopted by the ERA Chair holder), i.e.:

- Department of photochemistry and spectroscopy - Laser Centre
- Soft Condensed Matter Group
- Surface Nanoengineering for chemo- and bio-sensors Group.
- Charge transfer processes in hydrodynamic systems Group
- Photochemistry and Spectroscopy Department
- Microfluidics and Complex Fluids Group.

It includes mentoring and tutoring actions which took place between M11 – M20.

Tutoring and mentoring activities of ERA Chair holder towards his/her employees are not within the scope of this deliverable, and will be reported separately under a deliverable: "*Report on tutoring and mentoring activity of ERA Chair holder towards his/her employees*" (M30).

In total, under the given period, the following no. of actions aimed at development of the research IPC staff (excluding members of the new department – i.e. the Department of Physical Chemistry of Biological Systems) were organized:

- **3 lectures**
- **5 person/conferences and/or seminars**
- **11 visits (incl. lab & study visits), i.e. 148 study visit/days[1].**

[1] *Including travel days.*

II. ENHANCEMENT OF SKILLS & KNOWLEDGE OF IPC SOCIETY:

- **Scientific lectures (1):**

On the 20 – 21 Oct., 2016 **Professor Pavel Jungwirth** from the **Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences** came to IPC. On the first day Professor Jungwirth delivered an open for all IPC researchers (incl. PhD students) lecture: "*Exploring Hydrated Electrons in Non-Conventional and Conventional Ways: From Alkali Metal Explosions to Non-Explosive Ways*". The lecture was aimed at stimulating creativity and curiosity of the IPC society as regards to selected research topics and drawing inspiration for research from everyday life. Subsequently, Professor Jungwirth visited selected laboratories and research groups (incl. department of the ERA Chair holder – i.e. Professor Wojtkowski) which was aimed establishing contacts between an internationally recognized scientist, such as Professor Jungwirth and members of the research groups of the Institute.

On the second day of the visit Professor Jungwirth gave a seminar on Czech experience in educational and organizational reforms that were launched in the Czech Academy of Sciences ("*People first, machines and buildings later"*). The seminar on this successful reform of Czech research institutes was followed by a discussion on required changes in Polish science, and IPC – in particular. Both events – the lecture and the seminar were open to all researchers and PhD students, and met with great interest among IPC employees. The IPC Board of Directors also took an active part in the discussion. The visit

ended with a discussion on specific changes to be introduced in IPC, its research programme, and the International Doctoral Studies held at IPC.

The detailed course of the event is described in **an appendix 1)**.

- **"Innovation source" lectures (2):**

Name:	Sarai Kemp
Position:	CEO of Israeli company – Trendlines, offering commercialization services at the field of life science
Date:	26/10/2016

Main aim of the visit was delivering a lecture ***"The Israeli start-ups' eco-system - How to commercialize technologies from the Academia"***. The whole society of IPC, incl. all the IPC researchers, and doctoral students were invited. Sarai Kemp began her presentation by pointing out three major reasons for start-ups failure, namely:

- running out of money
- no market need
- not the right team.

Among the abovementioned reasons, the "No Market Need" has the biggest share. Within two years after 1st financing round most of all start-ups fail. To overcome this stage the Israeli government established a unique program. Under this programme, 22 incubators were founded. The incubators are supported and licensed by the government but they are privately owned and operated. The incubators provide a favourable environment for company development. Companies can interact with other similar start-ups and focus on their technological development, while the incubator takes care of the rest: accounting, administration, mentoring, guidance, and networking.

Sarai gave a brief start-ups statistics. She showed the number of start-ups in Israel and Poland in relation with the number of residents and the money spent on R&D. Referring to the Israeli start-up ecosystem, Sarai listed the greatest challenges (i.e. identify the opportunity, start thinking business, initial funding, market penetration) which should be address in order to successfully commercialize research results.

The interactive way of conducting the lecture allowed for an active discussion.

After the seminar Sarai Kemp visited several laboratories and research groups of the Institute, as well as two spin-off operating on the premises of IPC. These meetings enabled individual researchers to consult problems they face at various stages of commercialization of their research results.

Name:	Vincent Laban
Position:	CFO of VSParticle - a Dutch startup company from Delft University of Technology specialised in the development of nanoparticle generators
Date:	28/03/2017

The main goal of the visit was to deliver a lecture "***VSParticle: spin-off company of the Technical University Delft – Production of nanoparticle***". The whole society of IPC, with IPC researchers and doctoral students, was invited.

Mr. Laban presented the history behind the establishment of the spin-off, indicating some of the biggest challenges the founders (scientists and young entrepreneurs at the same time) had to overcome in the beginning of their business activity, namely securing the funds. After the initial introduction, the method of particle production was explained to the public, given the specific interests of some of the research groups at IPC.

Vincent gave also a clear indication of the areas where the start-up would like to grow in the future, explicitly:

- Catalysis (industrial production of chemicals),
- Printed electronics,
- Life sciences (nanomedicine and sensors).

At the end of the presentation, several of the PhD students asked questions, to verify the possibility of application of the proposed solution into their particular research environment. Vincent addressed all the questions, explaining some of the specific set-ups and possible configurations of the VSParticle products.

The seminar gave an opportunity for active discussion about possible application of the new material solutions developed by VSParticle into the research conducted at IPC.

The detailed course of the abovementioned events is described in **appendices 2) and 3)**.

- **Others:**

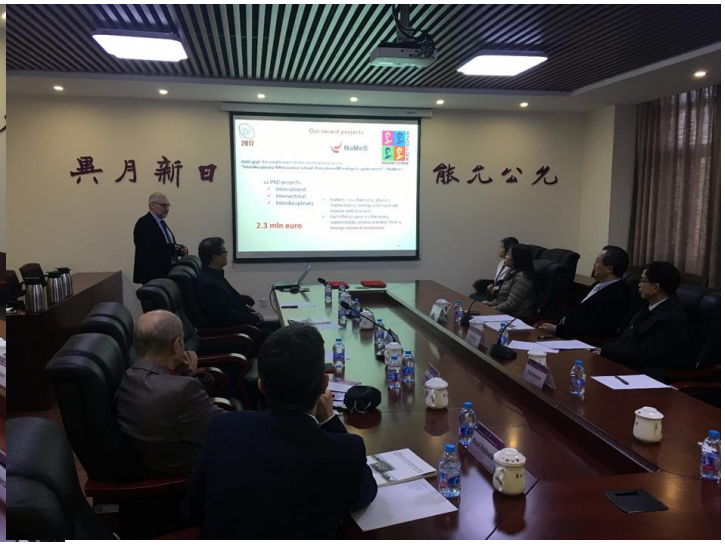
Professor Maciej Wojtkowski (the ERA Chair holder, the Head of the Department of Physical Chemistry of Biological Systems) accompanied by the:

- Director of the Institute of Physical Chemistry PAS - professor Marcin Opallo,
- President of the Scientific Council of IPC - professor Aleksander Jablonski
- Project Coordinator - professor Robert Holyst, and
- former postdoc at Professor Holyst Group – Associate Professor Hou Sen, linking person with Nankai University,

visited Nankai University in Tianjin, China (the 6 – 8th March, 2017). The main aim of this event was to visit laboratories, which required presentation of current research of IPC, looking for joint research

topics, and to sign a cooperation agreement between the **Institute of Physical Chemistry PAS** and **State Key Laboratory of Medicinal Chemical Biology Nankai University**.

The Nankai University, as one of the strongest scientific units, hosts two prestigious and well-funded State Key Laboratories: one of Medicinal Chemical Biology and the second - of Elemento-Organic Chemistry. The National Key Laboratories are private-public laboratories, currently receiving funding and administrative support from the central government of the People's Republic of China. **The State Key Laboratory of Medicinal Chemical Biology has an interdisciplinary character, and as such is a valuable partner for the IPC in the face of strong biological attributions of the ERA Chair project.**



The detailed course of the visit of the Polish delegation to the Nankai University events is described in **appendix 4)**.

Additionally, to increase visibility and foster international cooperation, **on the 12-13th Dec., 2016 the Project Coordinator paid a visit to the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences** (IOCB) as continuation of settlements of Professor Wojtkowski, Professor Holyst and visiting guest – Professor Pavel Jungwirth. Starting from 2017, **IOCB will cooperate with IPC on organization of "Dream Chemistry Award"**. This contest offers an individual prize for a scientist and his/her scientific dreams related to a problem which should be solved. The prize is awarded to a young scientist for the idea of a scientific project in the field of chemistry or combination of chemistry and physics, biology, medicine or materials engineering. The event creates an opportunity to meet emerging promising scientists and strengthen international collaboration among IPC, IOCB and research units represented by the laureates.

The agreement concluded between IPC and IOCB contains **appendix 5)**.

III. ACTIONS AIMED AT ENHANCEMENT OF IPC PhD STUDENTS & JUNIOR RESEARCH STAFF:

Among recommendations of Professor Wojtkowski was **internationalization of PhD programme and an increase visibility of IPC PhD students at internationally significant conferences, and other events.** As a result, starting from 2016, **a new programme was initialized** - "***Mobility of young researchers of IPC***". Under this programme (financed by IPC) young researchers (incl. PhD students) are sent for 1-month secondments to cooperating international research units. PhD students and young doctors are selected based on submitted proposals. Till now 8 young researchers (1 doctor and 7 PhD students) were selected for secondments, out of which 4 – already paid a visit. Description of the visits is presented below:

Name and unit: Kinga Matuła, Soft Matter Group

Place: Radboud University, Nijmegen (Netherlands) **Date:** 16/10 – 19/11/2016

Kinga Matuła (from Soft Matter Group) works at the interface of biology, chemistry, physics and nanotechnology. Under 1-month internship she visited group of Professor Wilhelm Huck in Nijmegen (Holland) at the Radbound University. She **expanded her knowledge in the field of microfluidics and single cell analysis in droplets**. She was working on method of detection of circulating tumor cells (lymphoma) in droplet-based microfluidics. As a result of the visit King Matuła aimes at adaption of acquired knowledge to her project related to sequencing of genome (DNA-seq) of bacteria that acquired mechanical resistance after exposure to sharp nanoparticles.

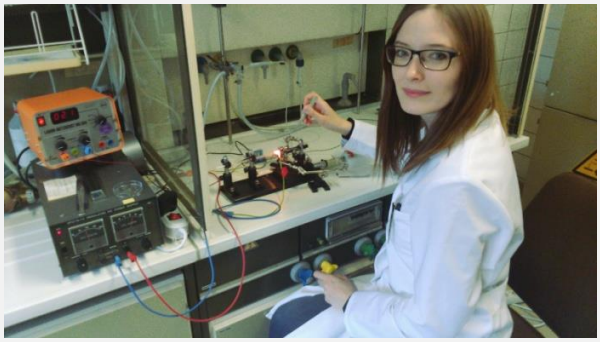
Name and unit : Łukasz Richter, Soft Matter Group

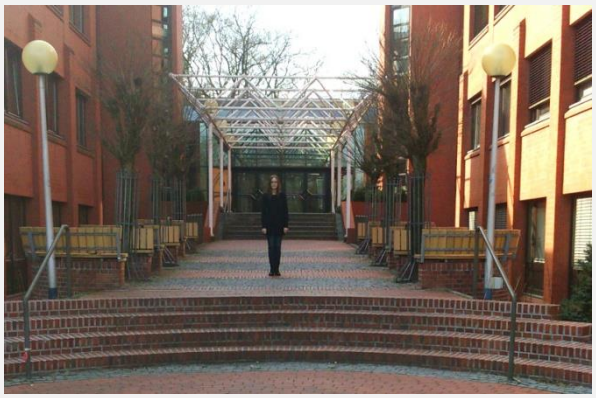
Place: Centre de Recherche Paul Pascal at the University of Bordeaux (France) **Date:** 2/02 – 23/03/2017

Łukasz Richter did an internship at Professor Carlos Drummond group at *Centre de Recherche Paul Pascal* at the University of Bordeaux (France). Main goal of his stay was **to learn the technique called Surface Forces Apparatus (SFA) and to use this method to analyze behavior of ions with different electrophoretic mobilities in the external alternating electric field**. During the internship he conducted a series of experiments. Analyzed parameters were voltage, frequency, geometry of the system, concentration and type of ions and time. Obtained results will allow not only to understand better the nature of behavior of ions in such conditions but will also shed some light on other phenomena, such as deactivation of bacteriophages in the electric field. The latter is one of the topics in his PhD thesis. Established connections and ideas will result in future cooperation. Currently, Łukasz Richter **works on publication** based on the experiments conducted during his internship.

Name and unit : Magdalena Michalak, Department VII, Team 23

Place: Carl von Ossietzky University, Oldenburg (Germany) **Date:** 4/03 – 1/04/2017





The mobility took place at the Carl von Ossietzky University of Oldenburg in the Institute of Chemistry, Faculty V – Mathematics and Science – at prof. Gunther Wittstock's group. The main objective of the mobility was to **create modified carbon pH nanosensor with integrated SICM probe which allows simultaneous examination of the sample topography**. Sensor was prepared by using a theta quartz capillary and a laser puller. One chamber of the theta capillary served as a carbon nanoelectrode (SECM part) and the second one as a SICM probe. Due to the dual nature of SECM-SICM nanoprobe tip, the pH and the topography maps of the examined sample will be obtained simultaneously.

During her stay Magdalena Michalak delivered a presentation entitled „*Electrocatalytic processes on metallic nano-structures obtained by localized electrorefining. Nanoscale pH mapping*".

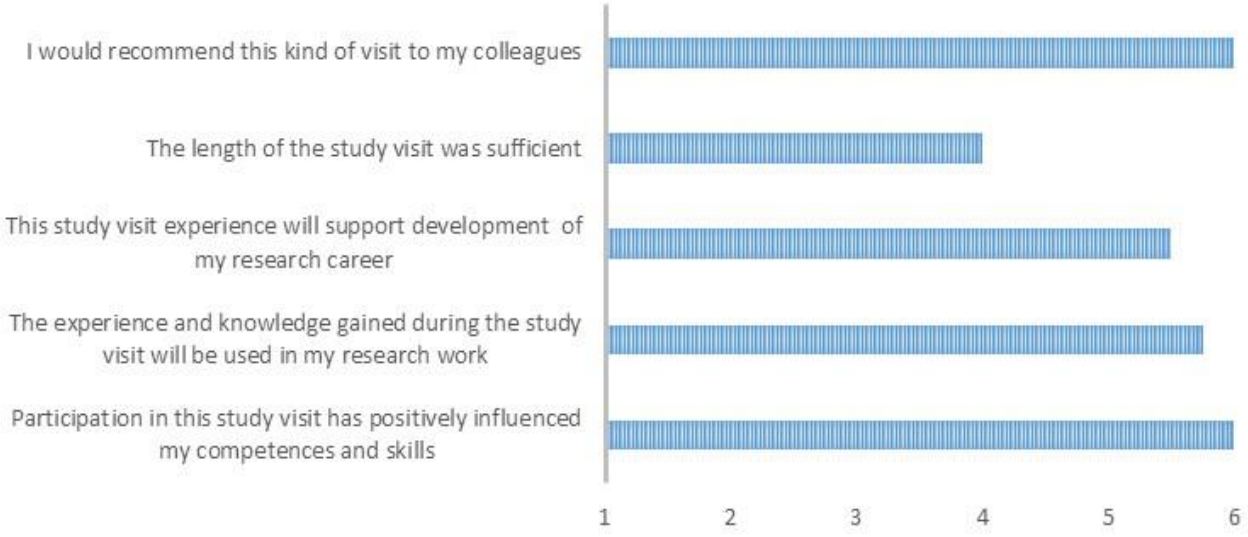
Name and unit : Tomasz Kalwarczyk

Place: Twente University, Enschede, Netherlands **Date:** 5/02 – 4/03/2017

During the internship Tomasz Kalwarczyk conducted research at the University of Twente in the group of prof. Claessens and the group prof. Cornelissen. The main research topic was interactions between α-synuclein (αS, the protein playing the main role in the apoptosis of neuronal cells in the course of Parkinson disease) and the capsid proteins, CP, of the plant CCMV virus. In his research the following techniques were used: Förster resonance energy transfer (FRET), dynamic light scattering (DLS), and total internal reflection fluorescence microscopy (TIRF). Measurements were conducted in solutions that differ in pH and ionic strength. On that basis the equilibrium rate constants for αS-CP complex formation were elbaborated. Additionally the influence of the CP on the fibrillization of the α-synuclein. During his stay Tomasz Kalwarczyk delivered a presentation entitled: „On the motion of nanoscopic probes in complex liquids, from synthetic to living systems". From the gathered results the manuscript for publication is prepared. Moreover, prof. Claessens and prof. Cornelissen expressed their willingness for future cooperation.

After return, the participants of the abovementioned study visits evaluated the lab visits in form of a questionnaire. The joint results of the evaluation are given below:

To what extend do you agree with the following statements referring to your study visit:
[scale: 1-6; 1 – I totally disagree, 6 – I totally agree]



Generally, the lab visits were evaluated positively. Only the length of the visit was assumed to be a bit too short, what will be taken in to account while planning next events of this kind. Overall, the lab visits participants agreed that knowledge gained during secondments is useful, and will be applied by them in future research. Moreover, experience gained during the lab visits is considered as a factor favouring research career development.

Besides the lab visits, to accelerate internationalization of PhD programme, under the CREATE project PhD students were encouraged to take part in different events and lectures delivered by foreign researchers and other professionals. Till now the PhD students took part in **2 "*Innovation source*" lectures (delivered by Sarai Kemp and Vincent Laban) and 1 interdisciplinary lecture (delivered by Professor Pavel Jungwirth)**.

To support internationalization of PhD Studies held at IPC and allow for an inflow of foreign students at IPC (which was a recommendation of the ERA Chair holder), Agnieszka Tadrzak, the Project Manager at the CREATE project joined Marie Sklodowska-Curie Alumni Association (MCAA) took part in:

- **a kick-off meeting of the Polish Chapter of MCAA** (Warsaw, Poland, the 6th March, 2017), and
- **2017 MCAA Conference and General Assembly** (Salamanca, Spain, the 24-25th March, 2017).

Name and unit : Agnieszka Tadrzak, the CREATE Project Manager
Place: University of Warsaw Biological and Chemical Research Centre **Date:** 6/03/2017
Place: University of Salamanca **Date:** 24-25/03/2017

The first event was devoted to **creating a vision for the MCAA Polish Chapter, and deciding the future activities of the Polish Chapter aimed at supporting foreign researchers residing in Poland**. The programme of the conference covered the main aspects of research career in the ERA (i.e. protecting freedom in science, objectivity in research, research career in business and/or academia, pensions for mobile researchers), development of skills essential for contemporary researchers (e.g. business communication skills, merging science and business, pitching experience), and institutional determinants facilitating researchers development (e.g. help to displaced researcher, international cooperation and mobility of scientists, role of mentoring). Participants were encouraged

to be active contributors in poster presentations, short pitches and plenary talk. Lecturers also gave insight into support programmes offered by MCAA to its members.

The conference was a good occasion to talk to excellent scientists, grounds of their decision to move/stay at a specific country; promote CREATE project, and gain knowledge essential to set conditions favouring development of researchers and encouraging them to move and locate in Poland. The conference also was very helpful in perspective of further implementation of the provisions underlying “HR Excellence in Research” logo and prepared reform of IPC International Doctoral Studies under the supervision of the ERA Chair holder as a part of the CREATE project.

The MCAA Conference and General Assembly also enabled discovering obstacles which foreign researchers may face in countries others than their countries of origin. In particular, it refers to handling everyday problems in contacts with authorities. As a result of experience and information gathered while participating in abovementioned events **a position of a coordinator of foreign researchers was established at IPC**. **Aleksandra Kapuścińska-Bernatek was appointed for this position.** She is responsible for providing necessary help and support to researchers in proceedings in front of tax authorities/ Marshall Office / Border Guard, but also at banks and other institutions where lack of knowledge of Polish language, legal provisions or local customs may be a barrier in settling own matters.

IV. FOSTERING DEVELOPMENT OF SYNERGETIC TEAMS:

After commencing a review, Professor Wojtkowski decided to develop at his department the following research fields on the boarder of biology/medicine, chemistry, and physics at the IPC:

- **Physical Optics:** Spatio-Temporal Optical Coherence manipulation /Phototermal imaging
- **Application of photonics to biology:** Dynamics of intracellural organnells in vivo /Noninvasive brain imaging
- **Application of optics to medicine:** Microscopy and biosensing in microfluidic devices /In vivo cellular imaging.

The selection process of synergetic groups (i.e. research groups selected by the ERA Chair holder for collaboration and development of the research goals adopted by the ERA Chair holder) hasn't still been completed. However, the following research groups have already been appointed to develop collaboration:

- **Department of photochemistry and spectroscopy - Laser Centre**
- **Soft Condensed Matter Group**
- **Surface Nanoengineering for chemo- and bio-sensors Group.**
- **Charge transfer processes in hydrodynamic systems Group**
- **Photochemistry and Spectroscopy Department**
- **Microfluidics and Complex Fluids Group.**

Needs in terms of education and development of members of abovementioned research groups is particularly addressed under the project. Within the given time period members of the synergetic groups participated in the following events supported under the ERA Chair project:

- **Department of photochemistry and spectroscopy - Laser Centre:**

The department will be developing with prof. Wojtkowski new laser sources of light which are compact and stable (new lasers aimed at replacing currently used free space lasers, in particular fiber lasers with 30fs pulses and fiber laser for microperimetry device with 200fs pulses), and well predictable scattering structures in optical components.

Name: dr habil Yuri Stepanenko

Place: CLEO Laser Science to Photonic Application conference, the laboratory of Biological Imaging of prof. Mark J. Schnitzer in Howard Hughes Medical Institute, Stanford University, San Jose /USA

Type of event: conference and lab visit **Date: 13-22/05/2017**

The presentation entitled "Ultrafast laser mode-locked using Nonlinear Polarization Evolution in Polarization Maintaining fibers" was presented during the attendance to the CLEO Laser Science to Photonic Application conference. Along with conference participation we visited the laboratory of Biological Imaging of prof. Mark J. Schnitzer in Howard Hughes Medical Institute, **Stanford University**. During our visit at Nevada Terawatt Facility, University of Nevada Reno we tested the stability of the parameters of our newly developed femtosecond oscillator in the Z-pinch laboratory.

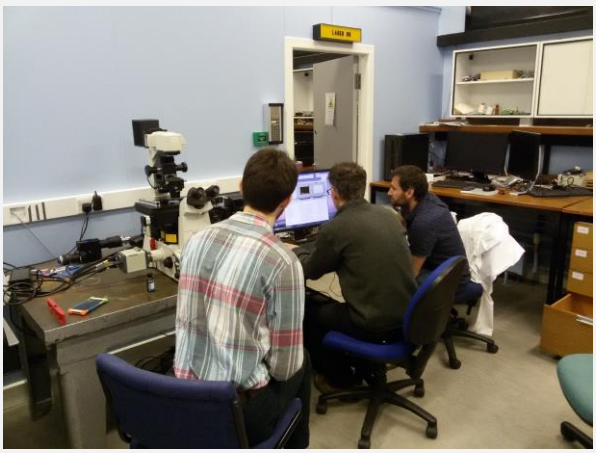
A detailed programme of the conference is **here**.

- **Soft Condensed Matter Group:**

The work of Holyst group researches biochemical processes in living cells using various optical techniques. The group collaborates with Wojtkowski group on further development of these optical techniques for processing of images and also for detection of single photons. A long term goal is to obtain quantitative information about chemical processes in cells from the motion of compounds and cell constituents.

Name: Karina Kwapiszewska
Krzysztof Szczepański
Place: School of Physics and Astronomy, University of Edinburgh **Date: 24-28/04/2017**
Type of event: lab visit

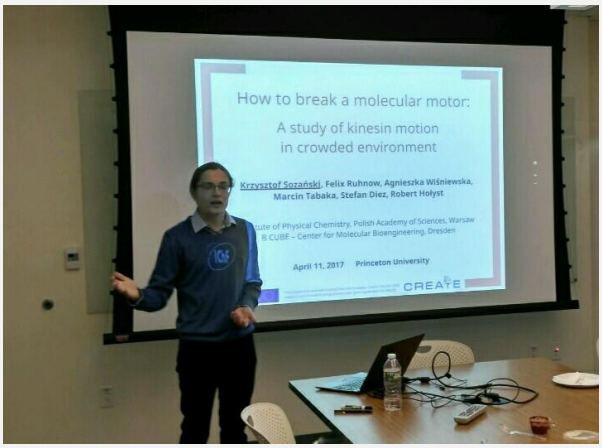
The goal of the visit was to perform experiments on human cells using novel microscopic technique: differential dynamic microscopy (DDM). The plan of the experiments contained quantification of movement of subcellular components in native HeLa cells and observation of changes of mobility during programmed cell death (apoptosis). Overall conclusion of the performed experiments is that limits of DDM method were reached. Single values that could have been obtained were consistent with those measured by fluorescence correlation spectroscopy (FCS) in IPC. However, repeatability was much worse and no additional information could have been obtained. The possible solution for those problems would be work using brighter (more dye molecules) and more stable (different dye) or bigger probes (nanoparticles). This needs more work concerning optimization of probe introduction to cell interior.



Name: dr Krzysztof Sozański

Place: Princeton University

Type of event: lab visits **Date: 10-13/04/2017**



The purpose of the travel was to assess the perspectives for future collaboration with the Soft Living Matter Group run by prof. Clifford Brangwynne at the Princeton University. The group conducts cutting-edge research in the field of physicochemistry of soft matter in living systems. The group possesses a wide background and know-how concerning biophysical studies on model biological systems at all complexity levels (single cells, tissues and organisms). It is applied there, i.e., to studies of phase transitions in living systems and intrinsically disordered proteins, which play a key role in the pathogenesis of neurodegenerative diseases.

These topics are directly related to the research conducted currently at the Department of Physical Chemistry of Biological Systems and Department of Soft Condensed Matter at IPC as well as planned future projects of these departments. During his stay, Krzysztof Sozański gave a talk entitled: "*How to break a molecular motor: A study of kinesin motion in crowded environment*", which was met by a lively reception and sparked a compelling discussion. Krzysztof Sozański held meetings with the PI (prof. Brangwynne) and majority of the group members, talking about their current projects, experimental capabilities of the labs and areas where our scientific interests overlap, as well as the possibilities of the future collaboration with the group.

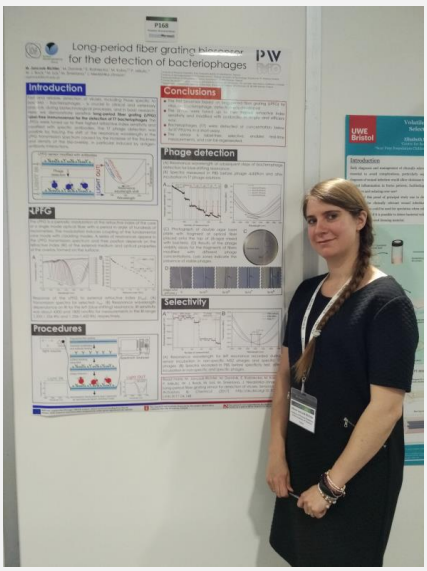
- **Surface Nanoengineering for chemo- and bio-sensors Group.**

The Surface Nanoengineering Group develops strategies for surface modification of long-period fibre gratings for molecular recognition. Therefore, joint research plans of the ERA Chair holder's team and the Surface Nanoengineering Group include using optic devices for biosensing for the purpose of the Department of Physical Chemistry of Biological Systems.

Name: Marta Jańczuk-Richter

Place: 5th International Conference on Bio-Sensing Technology

Type of event: conference **Date: 5-11/05/2017**



The aim of the trip was the participation in 5th International Conference on Bio-Sensing Technology (BITE2017) taking place in Riva del Garda (Italy). This conference is organized every two years and it is prestigious event related to state-of-the-art achievements in the field of bio-detection and bioanalytical chemistry.

Marta Jańczuk-Richter presented a poster entitled "*Long-period fiber grating biosensor for the detection of bacteriophages*". Presented results met with interest of other participants and have become the basis for interesting discussions. During the lecture sessions Marta Jańczuk-Richter got acquainted with research conducted in the best scientific institutions in the world. The level of research presented during oral and poster sessions was very high. The conference allowed her to get acquainted with the most interesting developments in the field of bio-detection and bioanalysis, as well as to gain contacts in foreign research centers, which in the future may

become the basis for international cooperation.

A detailed programme of the conference is **here**.

- **Charge transfer processes in hydrodynamic systems Group**

Similar to prof. Wojtkowski's group - the Charge transfer in hydrodynamic systems Group collaborates with the Nencki Institute for Experimental Biology for detection of neurotransmitters. The groups aims at linking that research to optical analysis systems. The Groups is also focused on building a system for particle image velocimetry where the experience of Professor Wojtkowski will prove invaluable.

Name: dr habil Martin Jönsson-Niedziółka

Place: Comsol House in Cambridge, UK lead by Dr Edmund Dickinson from Comsol Ltd.

Type of event: conference/seminar **Date: 10-11/05/2017**

Dr Martin Jönsson-Niedziolka participated in a course using the software Comsol, for computer simulation of physics and chemistry. The content of the course, under the title "Meshing, solvers, and the finite element method", concerned methods for improving the meshing of calculation models and proper choice of solvers for various problems. The full content is listed as:

- The purpose of meshing
- Setting up an efficient user-defined mesh for your problem
- Working with imported meshes
- Understanding COMSOL solver defaults
- Debugging solver errors
- Understanding the finite element method
- Defining your own equations and boundary conditions in the weak form

The course was arranged at the Comsol House in Cambridge, UK lead by Dr Edmund Dickinson from Comsol Ltd.

A detailed programme of the event is presented **here**.

The selection of the synergetic teams has still been in progress. After completion of selection process (Milestone 6, due month: M25) regular (quarterly) meetings of synergetic teams team leaders with the ERA Chair holder and grant & commercialization staff will be organized. Such meetings will be reported in the next reporting period covering M21 – M40.

APPENDIX 1)

*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. Pavel Jungwirth

[WP3]

Level of dissemination: PUBLIC

Warsaw, October 2016

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

INTRODUCTION

The visit of Prof. Pavel Jungwirth 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. Pavel Jungwirth was invited to IPC to:

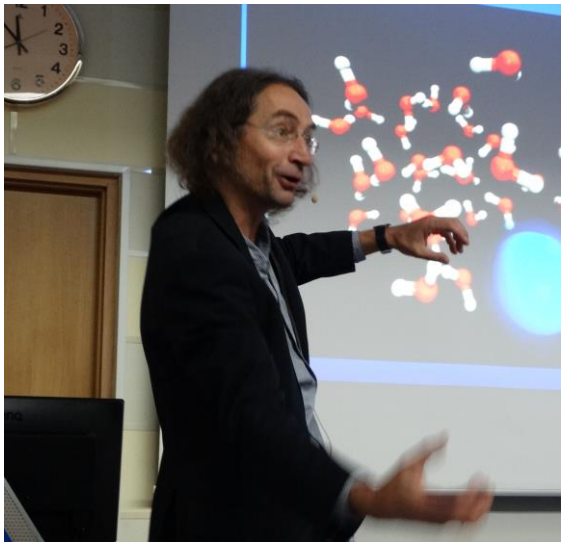
- deliver two lectures:
  - seminar on his studies,
  - seminar on education and organization reform that took place at the Czech Academy of Sciences,
- participate in meetings with synergetic teams to support mentoring activity of the ERA Chair holder,
- take part in the consultations on possible changes in IPC research/doctoral programme.

Professor Pavel Jungwirth is a physical chemist, university lecturer and popularizer of science. He studied physics at the Charles University in Prague, Faculty of Mathematics and Physics. His studies focused on chemical physics. He received his Ph.D. in computational chemistry from J. Heyrovsky Institute of Physical Chemistry, Academy of Sciences of the Czech Republic and Charles University in Prague in 1993 under supervision of Prof Rudolf Zahradník. Currently, he holds a position of the Head of research group at the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences in Prague. His research interests focus on molecular simulations of ions at aqueous interfaces, including interactions of ions with proteins and membranes, chemistry of aqueous aerosols, structure and dynamics of solvated electrons. The scientific profile of Prof. Pavel Jungwirth is included in annex 1**.**

THE COURSE OF THE VISIT

The visit of Prof. Pavel Jungwirth took place on the 20th – 21th, October, 2016 [see annex 2 for agenda].

On the first day of the visit, Prof. Pavel Jungwirth delivered a seminar entitled *"Exploring Hydrated Electrons in Non-Conventional and Conventional Ways: From Alkali Metal Explosions to Non-Explosive Ways"*. 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.




The seminar of Prof. Pavel Jungwirth, assembly hall, the 20th October, 2016.

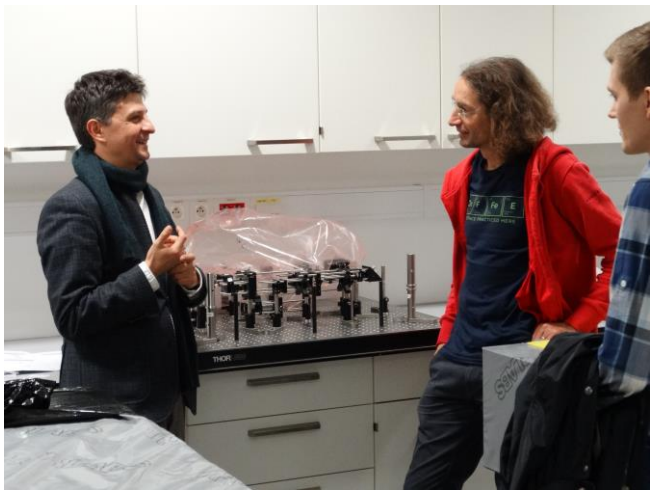
Abstract of the seminar

A dangerous – but among school kids all-time favorite – experiment demonstrating an explosive chemical reaction is throwing a piece of sodium into water. Every high school chemistry teacher knows that the explosion releases electrons from the metal to water which is accompanied by formation of steam and molecular hydrogen, which can ignite during this exoergic process. The very same gases should, however, separate the reacting metal and water and thus quench the reaction. How come that the explosion occurs anyway? Using ultrafast cameras and ab initio as well as force field molecular dynamics simulations Prof. Jungwirth and his team discovered a hitherto unknown primary mechanism of the explosive behavior of alkali metals in water. Namely, after migration of electrons from the metal to water the former acquires a huge positive charge. Thanks to mutual repulsion of these charges the metal undergoes a Coulomb explosion accompanied by ejection of metal spikes into water. This enables effective mixing of reactants, which is a necessary condition for the explosion. They also proved how blue solvate electrons formed during this reaction can be observed with a naked eye despite their sub-millisecond lifetime in water.

The seminar was aimed at encouraging scientists (in particular – junior researchers) to get inspiration for their studies from daily observations, and real life.

After the seminar, Prof. Pavel Jungwirth visited selected laboratories. The aim of this visits was to familiarize with IPC PAS, establish contacts with synergic groups supporting the ERA Chair holder and discuss possibility of future cooperation.

Meetings with the following research groups were organized:



Prof. Maciej Wojtkowski, *ERA Chair Holder, Head of the Department of Physical Chemistry of Biological Systems, Physical Optics and Biophotonics Group*

Prof. Maciej Wojtkowski is a physicist specializing in optics applications to biology and medicine. He designed and constructed the first Fourier Domain Optical Coherence Tomography instrument for in vivo retinal imaging. Currently, he holds the position of ERA Chair holder and is responsible for setting a new Department in IPC PAS.

Dr. Gonzalo Angulo, *Associate Professor, Laser Centre Group*
Dr. Yuriy Stepanenko, *Laser Centre Group*
Dr. Michal Nebauer, *Laser Centre Group*
Dr. Marcin Pastorczak, *Laser Centre Group*

Laser Centre Group is focused on development and exploration of experimental techniques to study ultrafast physical and chemical processes. The members of the Group discussed such projects as:

- chemical reactions under strong light illumination,
- designed and built by themselves a time resolved fluorescence spectrometer able to observe fluorescence emitted by molecules exited by an ultra-short pulse.

Dr. Piotr Zarzycki, *Head of the Charge transfer in biological systems and at the interfaces Group*. He studies molecular geochemistry, in particular, he develops and uses molecular modeling methods to solve geochemically relevant problems (mineral/ water interfaces, electron/ proton transfer in environmentally important settings).

Dr. Patryk Zaleski-Ejgierd, *member of the Group of Charge transfer in biological systems and at the interfaces* . He investigates hypothetic High-Pressure compounds.

Dr Adam Kubas, *member of the Modern Hetero-genous Catalysis Group (MoHCa)*

His scientific interests include:

- theoretical aspects of catalysis,
- hydrogenases and FeS clusters,
- small molecules activation,
- electron transfer kinetics,
- multireference methods for electronic structure calculations.

Prof. Jacek Waluk, *Head of Photochemistry and Spectroscopy Department, head of the Group of Photophysics and spectroscopy of photoactive systems: structure and reactivity of systems with hydrogen bonds.*

His research encompasses various aspects of physical organic chemistry. A subject of particular interest is proton/hydrogen transfer, intra-molecular as well as intermolecular, occurring in the ground and excited electronic states.

Moreover prof. Pavel Jungwirth also visited very talented young researchers, among them were:

- Michał Hamkało (PhD student) who was awarded Gold Medal of Chemistry 2014 – a prestigious prize given by the Institute of Physical Chemistry of the Polish Academy of Sciences for best diploma thesis (in chemistry, physics and biology) in Poland. In October 2016 Michał joined the Department of Physical Chemistry of Biological Systems at IPC led by prof. Wojtkowski, where he works on implementing Optical Coherence Tomography (OCT) for heart imaging, and novel techniques of nanoscale bioimaging with use of ultrafast lasers.
- PhD. Krzysztof Sozański who is the post-doc affiliated with the Soft Condensed Matter Group since the 2nd year of his BSc studies. MSc received in 2013 from the University of Warsaw, Faculty of Chemistry; PhD -- from the IPC PAS in 2015 (with distinctions; at the age of 24). Currently, he deals with motion- and chemical kinetics in crowded systems, and an inclination towards biomimetic and biological systems.

The second day of Prof. Pavel Jungwirth's visit (the 21st October, 2016) was devoted to organizational reforms. In the first part of the day, Prof. Jungwirth delivered a *"Seminar on the successful reform of Czech research institutes followed by discussion on desired changes in Polish science: People first, machines and buildings later"*. 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. During this seminar an open discussion was provided – all participants were encouraged to participate in open discussion on the reforms in education and research institutes.

The seminar of Prof. Pavel Jungwirth, assembly hall, the 21th October, 2016.

After the seminar, the discussion on reforms was continued in a group of:

- **Professor Pavel Jungwirth** – the visiting guest
- **Professor Maciej Wojtkowski** – the ERA Chair holder, head of Department of Physical Chemistry of Biological Systems, IPC PAS
- **Professor Robert Holyst** – Project Coordinator, head of Department of Soft Condensed Matter, IPC PAS
- **Agnieszka Tadrzak –** CREATE Project Manager, Manager for R&D funding at the IPC PAS.

Discussion on educational reforms. From left: Prof. R. Holyst, A. Tadrzak, Prof. M. Wojtkowski, Prof. P. Jungwirth.

The whole discussion lasted about 2 hours. During this meeting the consultations about possible changes at IPC research and doctoral programme were carried out. Prof. Pavel Jungwirth described the changes which were launched in the Czech Academy of Sciences (mainly regarding implementation of transparent procedure for Academy members' recruitment, and resulting from law - a ban on conducting doctoral studies at institutes of the Czech Academy of Sciences). Prof. Maciej Wojtkowski mentioned that some of the changes implemented to the Czech Academy of Sciences were also introduced into IPC (like flat group structure, reduced influence of hierarchical structures, cooperation between IPC groups, putting the stress on changes in the organization and methods of management). Prof. Pavel Jungwirth suggested that it is advisable to improve the image of IPC as well as to strengthen the position of researcher in Polish society. After the meeting the ERA Chair holder made some comments and formed new recommendations aimed at IPC organizational and structural change, *inter alia* referring to:

- The potential of International Advisory Board of IPC is not fully exploited – their engagement in the process of evaluating, recruiting and building the image of IPC should be strengthened.
- It would be advisable to launch a transparent structure of internal granting system in case new funding options occur – the structure adapted to the stage of the researchers' careers as well as to specificity of work (fundamental or application research).
- Strengthening the IPC image – participation at conferences of larger groups of researchers, and in particular - participation of PhD students, and young scientists in significant national and international conferences, participation in major European consortia that enable applying for financial funds.
- Strengthening vertical integration of different research types – different evaluation criteria of leaders and members of the group, introduction of research groups categories, differentiation of team members dependent upon nature of the work performed (e.g. senior researcher, senior engineer, supporting staff etc.).

- Support in initiating and/or participation in existing large European consortia seeking funding – selection of 3-5 group leaders with the best potential and stimulate action towards creating a pan-European organization or research projects, which may as a whole to apply for funds from the European Union.
- Internationalization of the PhD programme incl. an increase of attendance of the PhD students at international significant conferences, and other events.
- Improvement of IPC image and reinforcement of PR activities.

ANNEX 1.

SCIENTIFIC PROFILE OF PROF. PAVEL JUNGWIRTH

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

Prof. Pavel Jungwirth – scientific profile of the researcher

***Academic Training*:**

- PhD. in Computational Chemistry at J. Heyrovsky Institute of Physical Chemistry, Acad. Sci. of the Czech Rep. and Charles University, Prague, Czech Rep., 1993. Thesis title "Ab initio molecular dynamics: Dreams and reality"

***Academic Experience and Previous Positions*:**

- Golda Meir Postdoctoral Fellow at the Hebrew University of Jerusalem, Israel , 1994-5.
- Postdoctoral Fellow at the University of California, Irvine , 1995.
- Research group head at the J. Heyrovsky Institute of Physical Chemistry, Prague, 1995-2003.
- Visiting professor at the University of Southern California, Los Angeles, 2007.
- Visiting professor at the École Normale Superiéure, Paris, 2010.
- Visiting professor at the Rush University, Chicago, 2012.

***Present Positions*:**

- Research group head at the Institute of Organic Chemistry and Biochemistry, Acad. Sci. of the Czech Rep., Prague, Czech Republic (2003 -).
- Professor (External Faculty) at the Charles University in Prague, Faculty of Mathematics and Physics (2011 -).
- Finland Distinguished Professor at the Tampere Institute of Technology – FiDiPro program of the Academy of Finland (2013 - 2017).

***Main Scientific Awards*:**

- Annual Medal of the International Academy of Quantum Molecular Science (2001).
- Spiers Memorial Prize of the Royal Society for Chemistry (2008).
- Elected member of the Learned Society of the Czech Republic (2009).
- Praemium Academie Prize from the Czech Academy of Sciences (2010).
- Jaroslav Heyrovsky Medal of the Czech Academy of Sciences (2015).

Servis to the Scientific Community:

- Senior Editor of Journal of Physical Chemistry of the American Chemical Society (2009 -).
- Member of Editorial Board of Chemical Physics Letters (2007 -).
- Member of Editorial Board of Accounts of Chemical Research (2015 -).
- Popularizer of science – regular articles in Czech newspapers and magazines on science and society. Numerous radio and TV shows on popular science.

***Publications and presentations*:**

Around 300 research and review papers in international journals with more than 10000 citations, H-index 51.

Research funding (only current grants):

- "Beyond the Hofmeister series: From molecular understanding of specific ion effects to their biological function" Czech Science Foundation, 2016-2018, 192,000 EUR.

- ”Interaction of ions with biomolecules in solutions: Computer simulations and experiments.” Praemium Academie of the Acad. Sci. of the Czech Rep., 2010-2016, 1.1 million EUR.
- “Translocation of molecules across cell membranes.“ FiDiPro of the Academy of Finland, 2013-2017, 1.2 million EUR.
- “Controlling structure and function of biomolecules at the molecular scale: Theory meets experiment.“ Czech Science Foundation Centers of Excellence, 2012-2018, 420,000 EUR directly to me as a Team Leader within the Center.

ANNEX 2.

Full agenda of the visit of Prof. Pavel Jungwirth

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

CREATE lectures

The Institute of Physical Chemistry of the Polish Academy of Sciences

Agenda

20th October, 2016

10.30-12.00	**Pavel Jungwirth**
	„Exploring Hydratated Electrons in Non-Conventional and Conventional Ways: From Alkali Metal Explosions to Non-Explosive Ways"
12.00-13.00	**Lunch**
13.00-14.50	**lab visits**
	13.00-13.30 Prof. Maciej Wojtkowski
	13.30-13.50 dr Gonzalo Angulo
	13.50-14.10 dr Yuriy Stepanenko
	14.10-14.30 dr Piotr Zarzycki
	14.30-14.50 dr Patryk Zaleski-Ejgierd

21th October, 2016

9.40-10.10	**lab visits** - Prof. Jacek Waluk
10.30-12.00	**Pavel Jungwirth**
	„Seminar on the successful reform of Czech research institutes followed by discussion on desired changes in Polish science: People first, machines and buildings later" – with open discussion
12.00-13.00	**Lunch**
13.00-15.00	**Discussion on education reforms**
15.30	**Departure to the airport**

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

APPENDIX 2)

*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

Visit Sarai Kemp report

[WP5]

Level of dissemination: PUBLIC

Warsaw, October 2016

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

CREATE lectures ”Innovation source”

The first open lecture under a series of “*Innovation source*” was held on the 26th Oct., 2016 at the Institute of Physical Chemistry PAS (IPC). The purpose of the above series of lectures is to update scientists’ knowledge of current technological trends and innovation in chemistry-related sectors, as well as establishment of relations with business.

At the invitation of the Project Coordinator, **Sarai Kemp, CEO of Israeli company – *Trendlines*, offering commercialization services at the field of life science aimed at establishment of start-up companies**, paid a visit at IPC. Main aim of the visit was delivering a lecture “***The Israeli start-ups’ eco-system* - How to commercialize technologies from the Academia**”. The whole society of IPC, including all the IPC researchers, and doctoral students was invited.

Sarai Kemp began her presentation by pointing out three major reasons for start-ups failure, namely:

- running out of money
- no market need
- not the right team.

Among the abovementioned reasons, the “No Market Need” has the biggest share. Within two years after 1st financing round most of all start-ups fail. To overcome this stage the Israeli government established a unique program. Under this programme, 22 incubators were founded. The incubators are supported and licensed by the government but they are privately owned and operated. The incubators provide a favourable environment for company development. Companies can interact with other similar start-ups and focus on their technological development, while the incubator takes care of the rest: accounting, administration, mentoring, guidance, and networking.

Sarai gave a brief start-ups statistics. She showed the number of start-ups in Israel and Poland in relation with the number of residents and the money spent on R&D.

Referring to the Israeli start-up ecosystem, Sarai listed the greatest challenges (i.e. identify the opportunity, start thinking business, initial funding, market penetration) which should be address in order to successfully commercialize research results.

The interactive way of conducting the lecture allowed for an active discussion.

BUSINESS MEETINGS AND LAB VISITS

After the seminar Sarai Kemp visited several laboratories and research groups of the Institute, as well as two spin-off operating on the premises of IPC. These meetings enabled individual researchers to consult problems they face at various stages of commercialization of their research results.

Marcin Izydorzak Curiosity Diagnostics, President *(on the left)* ***and Sarai Kemp*** *(on the right)*

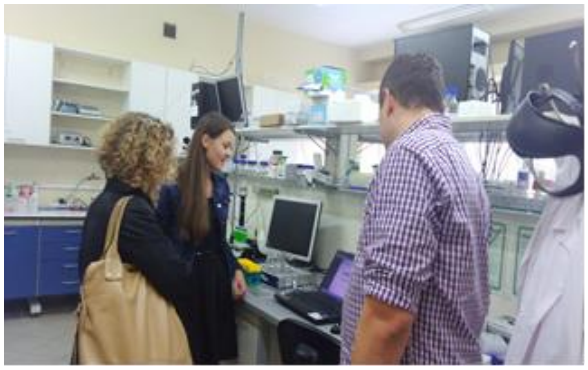
Sarai Kemp visited two innovative companies at IPC:

- **Scope Fluidics** - researching and designing microfluidic devices for medicine and biotechnology;
- **Curiosity Diagnostics** - implementing innovative techniques of molecular diagnostics.

Marcin Izydorzak and Piotr Garstecki, CEOs of the abovementioned companies gave detailed information on both companies, mutual business relationships and ongoing projects. They also gave an overview of presented a very modern laboratory, in which prototypes of chips for blood analysis are created. They also discussed possibility of wider application of this technology.

After that, Sarai Kemp met with representatives of the five research groups at IPC :

- the Microfluidics and Complex Fluids Group
- the Physical Optics and Biophotonics Group (of the ERA Chair holder)
- the Laser Centre
- the Fuel Cells Group
- the Soft Condensed Matter Group.



Prof. Piotr Garstecki, *Head of Microfluidics and Complex Fluids Group, Curiosity Diagnostics, President*

Prof. Garstecki was a Postdoctoral Research Fellow in the group of Prof. George Whitesides at Harvard University. He is co-founder of Scope Fluids and Curiosity Diagnostics.

Prof. Garstecki disscussed his current scientific research and indicated correlation between Scope Fluidics and his Department.

Prof. Maciej Wojtkowski, *ERA Chair holder, Head of Physical Optics and Biophotonics Group*

Prof. Maciej Wojtkowski is a physicist specializing in optics applications for biology and medicine. He constructed the first Fourier Domain Optical Coherence Tomography instrument for in vivo retinal imaging. He also contributed to development and construction of three clinical prototype high speed and high resolution OCT instruments which are in use in ophthalmology clinics: in Collegium Medicum in Bydgoszcz, New England Eye Center in Boston, and UPMC Pittsburgh.

Prof. Wojtkowski presented his plans of building a potential of the new Department of Physical Chemistry of Biological Systems. He talked about his current and planned research projects. He presented his team and presented new laboratory, which is built under the project CREATE.

Dr. Yuriy Stepanenko, *Member of the Laser Centre*

Ph.D. Yuriy Stepanenko works as an Adjunct in Photochemistry and Spectroscopy Department. His research interests especially include development of femtosecond oscillators.

Dr. Yuriy Stepanenko showed round a laser laboratory. He described briefly methods and techniques used in femtosecond spectroscopy. Dr. Stepanienko has recently established a spin-off company. For this reason he asked Sarai some practical questions related to the conduct of the spin-off company.

Dr. Andrzej Borodziński, *Group of Fuel Cells*

Dr. Andrzej Borodziński has a wide experience in selective acetylene - hydrogenation process. Since 1974, he has conducted basic research and cooperated with industry resulting in patents and their application in Polish industry. Dr. Andrzej Borodziński and his team presented his current research. Sarai was surprised that such a small laboratory created so interesting solutions that are used in the automotive industry. They also consulted the problems that appear at different stages of the commercialization of inventions.

Dr. Krzysztof Sozański, *Member of the Soft Condensed Matter Group*

Dr. Krzysztof Sozański is a post-doc affiliated to the Soft Condensed Matter Group since the 2nd year of his BSc studies. He presented the fluorescence correlation spectroscopy and mammalian cell culture laboratories of the Soft Condensed Matter Group. Sarai Kemp was introduced to the techniques and research topics currently realized in the group, especially the length-dependent viscosity studies with application to living cells. The visit evolved into a discussion on how basic understanding of motion in living systems at the molecular scale could be applied in both research methodologies as well as clinical treatments.

ANALYSIS AND RECOMMENDATIONS

Recommendations of the ERA Chair holder, Prof. Maciej Wojtkowski, for IPC arising from the discussion inspired by the visit of Sarai Kemp:

1. Even basic research should be in line with world trend to ensure their applicability: Research confronted directly with the global scientific work will give a realistic perspective of application. This concerns mainly the areas such as life sciences, engineering sciences, chemistry and physics. In other words, it is enough to adapt to world trends and the results of basic research will be usable in practice.
2. Application potential depends on the organization of research - in particular the organization chart of the research group. Therefore it is recommended to:
    - strengthen integration both at the level of a group and at the entire institution. All types of works – i.e. fundamental research, applied research and implementation works – can be simultaneously carried out at the level of the research group and at the level of the whole institute.
    - create groups dedicated to the implementation activities, or conducting development works to balance the number of research of a purely fundamental nature
    - constantly evaluate of research groups
    - maintain an appropriate number of staff with extensive experience
    - acquire and/or maintain Team leaders with a very good sense of the current market needs. They have to go beyond their traditional role of scientists and advisors, understand the needs of the industry (aimed at profit), and optimize the process of technology development and sale of new technologies.
    - open to cooperation with specialists with unique skills who do not have purely scientific ambitions
    - allow for the research groups people who do not to duplicate a one-dimensional academic career model adopted in Poland
    - allow for recruitment of recruit highly qualified specialists at a decent level earnings.

ANNEX 1.

Full agenda of the Sarai Kemp visiting

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

*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

CREATE lectures "Innovation source"

Institute of Physical Chemistry of the Polish Academy of Sciences

26th October, 2016

Agenda

9.30-11.00 **business meetings and lab visits**

9.30-10.00 Marcin Izydorzak
Curiosity Diagnostics, President; Scope Fluidics, CEO

10.00-10.30 Prof. Piotr Garstecki
Head of Microfluidics and Complex Fluids Group

10.30-11.00 Prof. Maciej Wojtkowski
ERA Chair holder, Head of Physical Optics and Biophotonics Group

11.30-13.00 **Sarai Kemp**

„Israeli start-ups eco-system:
How to commercialize technologies from Academia?"

13.00-14.00 **Lunch**

14.00-15.00 **business meetings and lab visits**

14.00-14.20 Ph.D. Yuriy Stepanenko – Laser Centre

14.20-14.40 Ph.D. Andrzej Borodziński – Fuel Cells

14.40-15.00 Ph.D. Krzysztof Sozański - FCS

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

APPENDIX 3)

*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

Visit of Vincent Laban - report

[WP5]

Level of dissemination: PUBLIC

Warsaw, March 2017

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

CREATE lectures ”Innovation source”

The second open lecture under a series of “*Innovation source*” was held on the 28th March, 2017 at the Institute of Physical Chemistry PAS (IPC). The purpose of the above series of lectures is to update scientists’ knowledge of current technological trends and innovation in chemistry-related sectors, as well as establishment of relations with business.

Vincent Laban was invited to the Institute by the CREATE Project Coordinator, professor Robert Holyst. **Vincent Laban** is a **CFO of *VSParticle* - a Dutch startup company from Delft University of Technology specialised in the development of nanoparticle generators**. The main goal of the visit was to deliver a lecture “***VSParticle: spin-off company of the Technical University Delft – Production of nanoparticle***”. The whole society of IPC, with IPC researchers and doctoral students, was invited.

Mr. Laban started with description of his career path – from a researcher, through an employer of a corporation to an entrepreneur and at the same – an employer. He also presented the history behind the establishment of his spin-off company, indicating some of the biggest challenges which founders (scientists and young entrepreneurs at the same time) need to face at the first stage of running own business. In particular, it refers to securing funds. Mr. Laban also defined the timeframes and resources needed to transfer the ideas from one laboratory to the other, and from the laboratory to business unit (more than 20 years). In his case – a lacking resource obstructing his research (lack or hampered access

to particles) was an inspiration to elaborate an apparatus for – firstly – his own purpose, and then – external recipients.

Next, Mr. Laban explained a method of particle production used by his company, which aroused interest of some of the research groups at IPC. He gave also a clear indication of areas where his company is supposed to developed in the future, explicitly:

- Catalysis (industrial production of chemicals),
- Printed electronics,
- Life sciences (nanomedicine and sensors).

At the end of the presentation, several PhD students for some clarification, mainly referring to application of the proposed solution into their particular research environment.

The seminar gave an opportunity for active discussion about possible applications of the new material solutions into the research conducted at IPC.

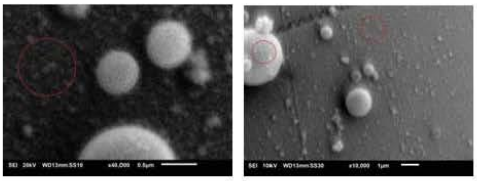
ANNEX 1.

Presentation: Introduction to VSParticle

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

Nanoparticles

What are nanoparticles?



Founders

Who are we?

Aalke van Vugt
Chemical Engineering
CEO

Tobias Pfeiffer PhD.
Chemical Engineering
CTO

+ Andreas Schmidt-ott
Prof. TU Delft

Tobias Coppejans
Chemical Engineering
COO

Vincent Laban
Industrial Design
CFO

Two Problems

What do we need to overcome?

1. **Scientist** spend majority of their time on the synthesis of nanoparticles
2. **Industry** struggles to make the step from research to production

VSParticle Solution

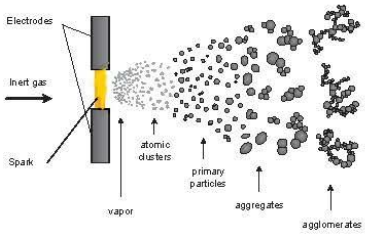
Production of nanoparticles

Automated production

- ✓ On location (24/7)
- ✓ No chemicals
- ✓ Tremendous control on particle size and purity

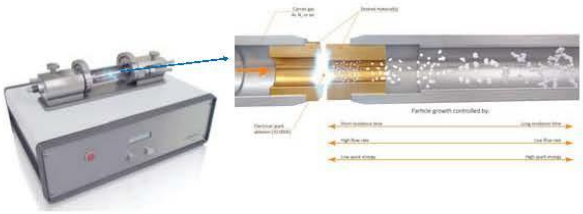
Our method

Detail of particle production



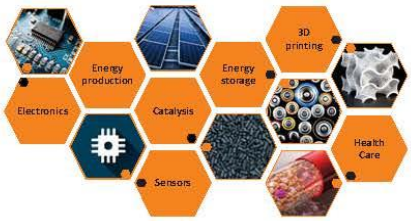
Our method

Detail of particle production



Nanoparticle Application

Markets for nanoparticle technology

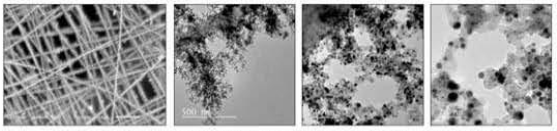


Complete solution

Nanoparticles at the touch of a button

VSParticle results in catalysis

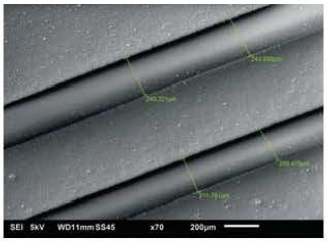
Printing both support and active particles for catalysts



Aluminium oxide fractal nanostructures with Au nanoparticles (SEM & TEM)

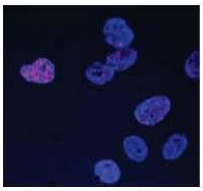
VSParticle results in electronics

Printed conductive lines (pure copper)

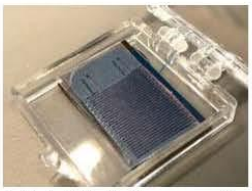


VSParticle results in Life Sciences

Medical treatment and sensory (microfluidics)



Fluorescence microscopy of Cervical cancer cell cores, showing double string DNA fractures (FeO NP)



Coated microfluidics chip with copper nanoparticles to simulate Pt NP and Pd NP deposition for sensor


Thank you!
Questions?
Contact person:
Vincent Laban
v.laban@vsparticle.com
+31(0)6 19 30 1486
VSPARTICLE

APPENDIX 4)

*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

A visit at the State Key Laboratory of Medicinal Chemical Biology, the Nankai University, China

Raport

Level of dissemination: PUBLIC

March 2017

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

INTRODUCTION

Professor Maciej Wojtkowski (the ERA Chair holder, the Head of the Department of Physical Chemistry of Biological Systems) accompanied by the:

- Director of the Institute of Physical Chemistry PAS - professor Marcin Opallo,
- President of the Scientific Council of IPC, - professor Aleksander Jablonski, and
- Project Coordinator - professor Robert Holyst

visited Nankai University in Tianjin, China (the 6 – 8th March, 2017).

AIM OF THE VISIT

The main aim of this event was to visit laboratories, which required presentation of current research of IPC, looking for joint research topics, and to sign a cooperation agreement between the **Institute of Physical Chemistry PAS** and **State Key Laboratory of Medicinal Chemical Biology Nankai University**.

ABOUT NANKAI UNIVERSITY

Nankai University, founded in 1919, belongs to the top 0,5% of the best universities in China. In fact, it is one of the most prestigious Chinese university. Among its alumni are:

- the first Prime Minister of the People's Republic of China - Zhou Enlai,
- a mathematician - Shiing-Shen Chern,
- Nobel Prize laureates: Chen Ning Yang and Tsung-Dao Lee.

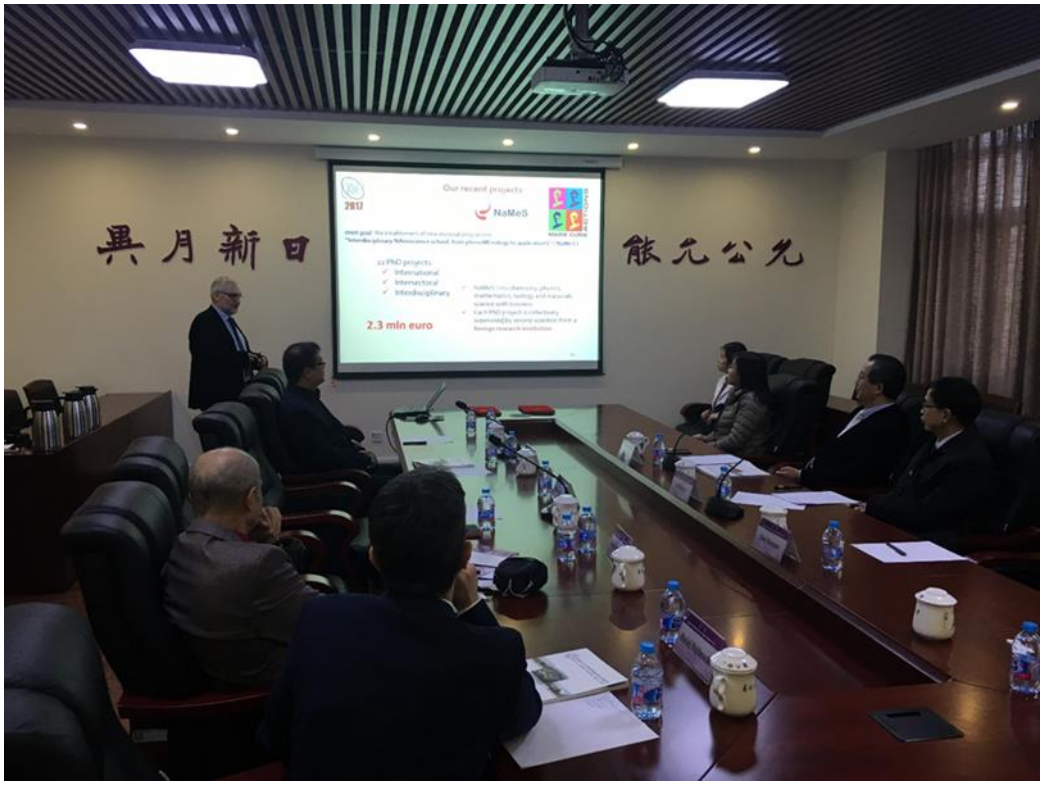
The University hosts two prestigious and well-funded State Key Laboratories: one of Medicinal Chemical Biology and the second - of Elemento-Organic Chemistry (founded in 1957). The National Key Laboratories are private-public laboratories, currently receiving funding and administrative support from the central government of the People's Republic of China. The key labs at the Nankai University are deemed as the most prestigious institutes at the Nankai University. There are two such key labs at Nankai and now IPC cooperates with one of them.

THE COURSE OF THE VISIT

The Polish delegation visited both scientific units: Medicinal Chemical Biology and the Elemento-Organic Chemistry, and the College of Life Sciences and the Department of Chemistry. Chemistry as a research field is the strongest part of the Nankai University, and probably the strongest among all chemistry scientific units in China. Professor Opallo made a presentation about the Institute and all four Polish delegates took part fruitful discussions conducted subsequently in each of visited scientific units of the Nankai University. The direct outcome of these collaboration is the agreement (see appendix for details) between both parties. The State Key Laboratory of Medicinal Chemical Biology has an interdisciplinary character, and as such is a valuable partner for the IPC in the face of strong biological attributions of the ERA Chair project.

Professor Opallo and Professor Li (both sitting) are signing the agreement.

One of the major points of this agreement is the application of synergy/common grants for both parties. The ceremony was recorded by Chinese TV. IPC also prepared a press release informing about the event.



Profesor Opallo makes a presentation about IPC PAS for the authorities of the Nankai University

ANNEX 1.

SIGNED AGREEMENT

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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AGREEMENT ON THE TERMS AND CONDITIONS OF MUTUAL COOPERATION

This agreement on the terms and conditions of mutual cooperation ("**Agreement**") was executed on the day, month and year stated below by and between:

State Key Laboratory of Medicinal Chemical Biology, Nankai University, 94 Weijin Road, Tianjin, China ("**SKLMCB**")

and

Institute of Physical Chemistry- Polish Academy of Sciences
with its headquarters in Warsaw Kasprzaka Str. No. 44/52, 01-224 Warsaw, Poland
("**IChF-PAN**")

(SKLMCB and IChF-PAN are collectively referred to as "**Parties**" and individually also as "**Party**".)

7. **Duration of collaboration**

This Agreement covers an initial period of five (5) years and is renewable should it be deemed necessary by both Parties.

The agreement can be terminated by either party within 6 month notice.

8. **Persons responsible for collaboration**

Professor Luyuan Li from SKLMCB and Professor Robert Holyst from IChF-PAN will coordinate collaboration. Professor Xizeng Feng and Professor Sen Hou will act as contact persons for both parties.

9. **Signature**

This Agreement shall be valid and effective from the date of the signature of all Parties.

Oh behalf of SKLMCB

Date: .....

Name: Prof. Luyuan Li

Position: director

Signature: .....

On behalf of IChF-PAN

Date: .....

Name: Prof. Marcin Opallo

Position: director

Signature: .....

APPENDIX 5)

COOPERATION AGREEMENT

This cooperation agreement ("**Agreement**") is executed by and between:

Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences
(Ústav organické chemie a biochemie AV ČR, v.v.i.)
with its registered office at Flemingovo nám. 2, 166 10 Prague 6, Czech Republic
Business Identification No.: 61388963
(hereinafter referred to as "**IOCB Prague**")

and

Institute of Physical Chemistry – Polish Academy of Sciences
with its registered office at Warsaw Kasprzaka St. no. 44/52, 01-224 Warsaw, Poland
NIP: 525-000-87-55
(hereinafter referred to as "**IChF-PAN**")

with the participation of

IOCB TTO s.r.o.
with its registered office at Flemingovo nám. 2, 166 10 Prague 6, Czech Republic
Business Identification No.: 28934024
(hereinafter referred to as "**IOCB TTO**")

IOCB Prague and IChF-PAN are collectively referred to as "**Parties**" and individually as "**Party**"

Preamble

In order to promote scientific research by enabling young scientists worldwide to solve scientific problems they dream to solve, IChF-PAN set up a "*Dream Chemistry Award Contest*" ("**Contest**") in year 2013 and 2015. Now the Parties wish to cooperate on

organization of the third and following editions of the Contest and awarding a prize to a young scientist for the idea of a scientific project in the field of chemistry, combining chemistry with physics, biology, medicine or materials engineering, using the formula developed by IChF-PAN.

1. Undertakings of the Parties

1.1 Under this Agreement, the Parties will cooperate in organizing the Contest every year, commencing with the third edition in 2017. Each Party undertakes to organize the Contest every two years with support and participation of the other Party, i.e. IOCB Prague will be responsible for organizing the Contest in 2017, 2019, 2021, etc. and will bear all related costs and IChF-PAN will be responsible for organizing the Contest in 2018, 2020, 2022, etc. and will bear all related costs.

1.2 IChF-PAN created a website – www.ichf.edu.pl/DreamChemistryAward, which serves as a website for registration of the scientists for the Contest and where the contact data of these scientists and other relevant information of the Contest are available. The Parties agree to move all the data, which are now available on www.ichf.edu.pl/DreamChemistryAward to a common website of the Parties – www.dreamchemistryaward.org.

2. Financial terms

2.1 IOCB Prague will provide all funding necessary for organizing the Contest by itself in 2017, 2019, 2021, etc., whereas the funding must comply with the conditions stated in the Act No. 341/2005 Coll., On Public Research Institutions.

2.2 IChF-PAN will provide all funding necessary for organizing the Contest by itself in 2018, 2020, 2022, etc.

2.3 Each Party can invite external financial sponsors in order to finance the Contest subject to the other Party's prior written consent.

2.4 IOCB TTO shall arrange for reimbursement of the price for the winner of the Contest in the amount of EUR 10,000 in 2017.

3. Duration of the Agreement, obligations of the Parties

3.1 This Agreement is concluded for an indefinite period of time. The Agreement can be terminated by either Party based on a written notice, which must be delivered to the other Party during first calendar quarter of each year, i.e. in the period from 1 January to 31 March of each year, whereas the notice period is 9 months and begins to run on the first day of the month following after the first calendar quarter (1 April).

3.2 The Party terminating the Agreement by notice undertakes to transfer all ownership rights and hand over free of charge to the other Party all material relating to the Contest and to transfer to the other Party all intellectual property rights (know how) or to provide necessary license to these rights so as the other Party could organize the Contest in the following years itself. The terminating Party is obliged namely to provide to the other Party access and rights of use to the internet pages, through which the Contest is organized and to provide to the other Party the contact data of the scientists participating or having participated in the Contest

3.3 Each Party may withdraw from the Agreement in case the other Party breaches in a substantial way any of its obligations under the Agreement and does not remedy such a breach upon written notice of the other Party. The Agreement terminates by delivery of a written withdrawal to the respective Party.

3.4 In case of withdrawal from the Agreement, the Party who failed to remedy substantial breach of the Agreement, is obliged to transfer all ownership rights and to hand over free of charge to the other Party (terminating the Agreement by withdrawal) all material relating to the Contest and to transfer to such Party all intellectual property rights (know how) or to provide necessary license to these rights so as the other Party could organize the Contest in the following years itself. The terminating Party is obliged namely to provide to the other Party access and rights of use to the internet pages, through which the Contest is organized and to provide to the other Party the contact data of the scientists participating or having participated in the Contest.

4. Persons responsible for cooperation

4.1 Professor Pavel Jungwirth from IOCB Prague and Professor Robert Holyst from

IChF-PAN will act as contact persons for both Parties.

4.2 Any of the Parties is entitled to change the above stated contact person by a notification sent to the other Party by email or by post.

5. Signature, Counterparts, Governing law and Courts

5.1 This Agreement shall be valid and effective from the date of its execution by both Parties and IOCB TTO.

5.2 The Agreement is executed in three counterparts, one for each Party and one for IOCB TTO.

5.3 In case of any dispute hereunder, the Czech general courts shall be competent to solve the dispute.

On behalf of IOCB Prague

Date: March 7/2017

Name: RNDr.PhDr. Zdeněk Hostomský, CSc.

Position: Institute Director

Signature:

On behalf of IOCB TTO

Date: 9/3/2017

Name: Prof. Ing. Martin Fusek, CSc.

Position: Managing Director

Signature:

On behalf of IChF-PAN

Date: 27-02-2017

Name: Prof. Marcin Opallo

Position: Institute Director

Signature:

INSTYTUT CHEMII FIZYCZNEJ
POLSKIEJ AKADEMII NAUK
ul. Kasprzaka 44/52
01-224 Warszawa