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## ***From Master to Doctor – in just a few months***

*In a standard scientific career usually several years pass between being awarded a master's degree and earning a doctorate. Krzysztof Sozański from the Institute of Physical Chemistry of the Polish Academy of Sciences in Warsaw has become a doctor shortly after graduation, at the age of 24 years. Such rapid progression was possible thanks to his early involvement in research work.*

A student who participates in laboratory research right from the beginning of his studies has the opportunity to earn a PhD really rapidly – only several to a dozen or so months after obtaining his master's degree. This is what Krzysztof Sozański from the Institute of Physical Chemistry of the Polish Academy of Sciences (IPC PAS) in Warsaw did. He was in the IPC PAS laboratory since the second year of his bachelor studies, and has become a doctor at the age of 24 years.

“The policy of the Institute has been constant for several years: if we get a student who is interested in science and how it functions, we do not set him any formal obstacles. What is most important is his desire and passion for discovering the world. We are convinced that these constitute the main driving force for the development of truly creative knowledge,” says Prof. Robert Hołyst (IPC PAS), Head of the Department of Soft Condensed Matter, in which Sozański began – and is continuing – his adventure with real scientific research.

“On first crossing the threshold of the Institute of Physical Chemistry of the PAS I was a second-year student of the College of Inter-faculty Individual Studies in Mathematics and Natural Sciences of the University of Warsaw, just the idea of working in such a good institute of such a prestigious organization as the PAS filled me with foreboding. But I knew that I wanted to get involved in laboratory research, the sooner the better. My stress proved to be unnecessary. Fifteen minutes after the start of the interview, I was in the lab,” recalls Sozański, winner of the Ministry of Science and Higher Education's Diamond Grant in 2012.

Working in the laboratory allowed Sozański to almost immediately become involved in the studies being the conducted in the Institute's research teams. This meant that he could soon start building up a portfolio of scientific publications, initially as a contributor and later as first author. At the time of submitting his doctoral dissertation he could boast of 11 scientific publications, among others, in such notable physics and chemistry journals as *Physical Review Letters*, *Soft Matter* and *Chemistry of Materials*; two more publications were at the review stage.

Sozański initially became involved in the research of Dr. Jan Paczesny, related to the application of self-aggregating nanostructures on the surfaces of various materials. Apart from scientific publications, this work has resulted in three patents, of which Sozański is co-author. One of the patents relates to the production of innovative substrates for use in surface-enhanced Raman spectroscopy (SERS) and is of practical importance, in fact SERS is a very promising research technique: signals emitted by single chemical molecules can be amplified hundreds of thousands, or even millions of times.

“But for me, physico-chemical issues of biological importance are the most interesting. Modern biochemistry tells us a lot about the physical structure of the cell and the chemical structure of the molecules and particles that make it up. But all the time very little is known about the kinetics of basic biochemical processes. How do small objects really move in biological systems?” asks Sozański.

In his doctoral dissertation Sozański presents the results of his research on the movement of molecules and particles at the nanoscale. He shows that in the same way as a chemical reaction has an activation energy, we can also talk about a certain activation energy in diffusive motion: in order to move effectively, an object must exceed a certain threshold of energy, depending not only on its own size and shape, but also on its immediate environment. Sozański also presents observations concerning the motion of micro-oscillators in polymer solutions, carried out in collaboration with Prof. Teodor Gotszalk's group at the Wrocław University of Technology. As it turns out, objects vibrating with an appropriately high frequency are capable of pushing out their surroundings to such an extent that they feel a viscosity of up to two orders of magnitude less than the standard. In the last part of his dissertation Sozański analyzes the movement of kinesins, molecules of biological significance, responsible in cells for the transport of large proteins along microtubules. The publication concerning the movement of kinesins, prepared in collaboration with the Technische Universität Dresden, is soon to appear in one of the prestigious physics journals.

“The open-door policy allows us to quickly pick out the most valuable and most creative students. This is an advantage for both parties. The young person gains by having a door opened to a research career, the scientific institution gains by having valuable research carried out by people truly interested in learning about the natural world,” concludes Prof. Hołyst.

Dr. Sozański is the second person at the IPC PAS to have gained the title of doctor so quickly: in 2011 Dr. Marcin Gronowski was awarded a PhD having submitted a dissertation on cyanides in outer space only six months after receiving a master's degree.

The Institute of Physical Chemistry of the Polish Academy of Sciences (<http://www.ichf.edu.pl/>) was established in 1955 as one of the first chemical institutes of the PAS. The Institute's scientific profile is strongly related to the newest global trends in the development of physical chemistry and chemical physics. Scientific research is conducted in nine scientific departments. CHEMIPAN R&D Laboratories, operating as part of the Institute, implement, produce and commercialise specialist chemicals to be used, in particular, in agriculture and pharmaceutical industry. The Institute publishes approximately 200 original research papers annually.

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**LINKS:**

<http://www.ichf.edu.pl/>

The website of the Institute of Physical Chemistry of the Polish Academy of Sciences.

<http://www.ichf.edu.pl/press/>

Press releases of the Institute of Physical Chemistry of the Polish Academy of Sciences.

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Early involvement in laboratory research allowed Krzysztof Sozański from the Institute of Physical Chemistry of the Polish Academy of Sciences in Warsaw, Poland, to submit his doctoral dissertation at the age of 24 years. (Source: IPC PAS, Grzegorz Krzyżewski)