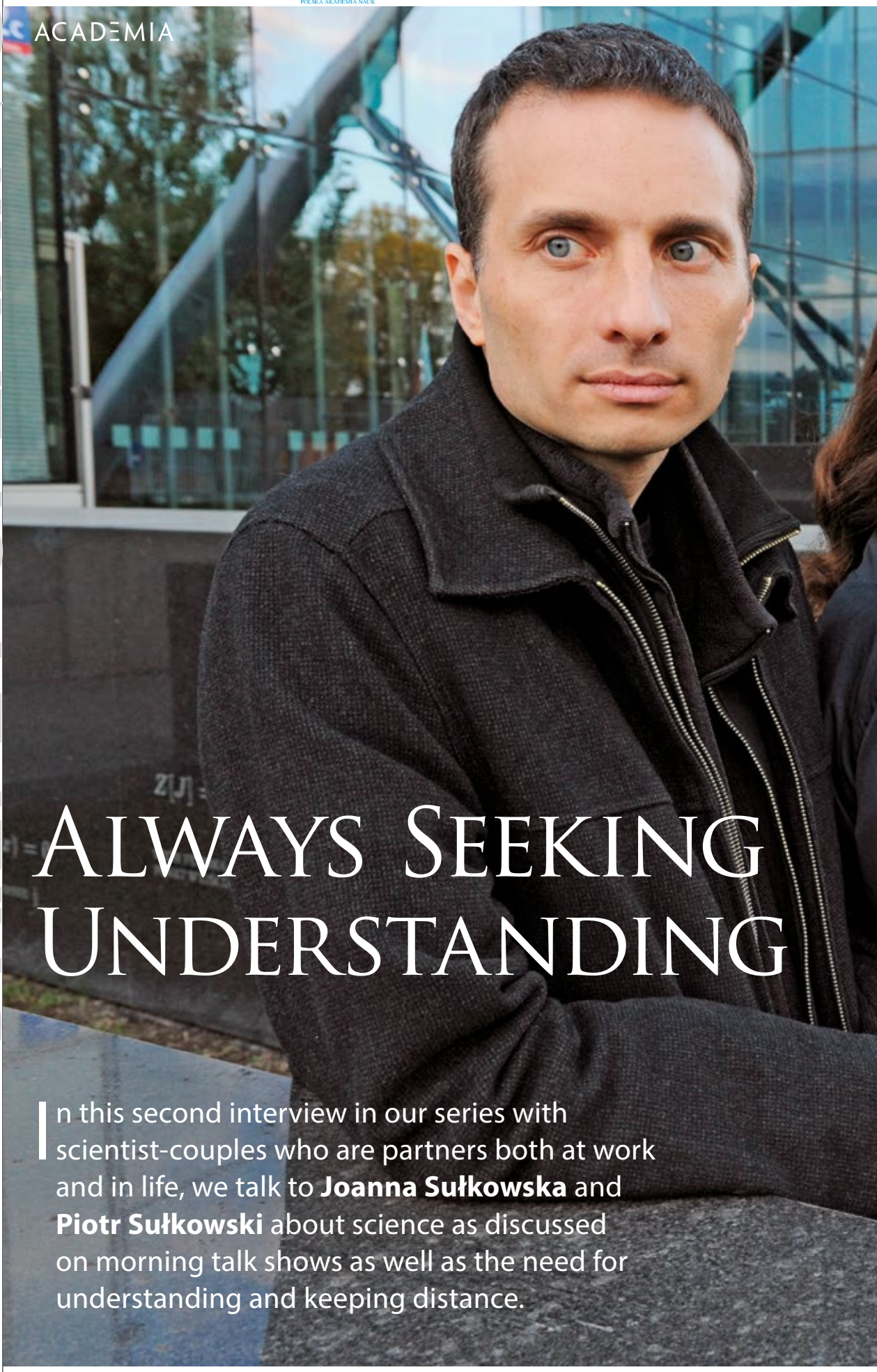

Always Seeking Understanding

In this second interview in our series with scientist-couples who are partners both at work and in life, we talk to **Joanna Sułkowska** and **Piotr Sułkowski** about science as discussed on morning talk shows as well as the need for understanding and keeping distance.


ASYMPTOTYCZNA SW
MODELU STANDARDOWEGO

ACADEMIA: "That's all a bit complicated." Such a comment was written by one of the viewers of a morning show on which you talked about your research. Do you often hear such opinions?

JOANNA SUŁKOWSKA: Quite often, even if I don't try to explain my research in detail. When I say I'm a physicist, many people react in this way. You can often hear such opinions when it comes to the exact sciences.

PIOTR SUŁKOWSKI: What you can hear in the voice of the people you talk to is on the one hand appreciation, and on the other one a certain lack of confidence in their own ability to understand scientific topics.

> Even if people don't understand everything, listening to what scientists think about, the projects they are working on, is always a certain form of education, a way to broaden their horizons.

Ok, we started on a somewhat humorous note, but the topic of this conversation is quite serious. Does other people's failure to understand what you do hinder you in your work, or does it pose a certain challenge?

P.S.: It generally doesn't affect our research work in any quick or direct way. Indirectly, however, it carries significance in a much broader and more serious context. After all, society's level of education determines which politicians get elected and what decisions they make. These also include funding of science and the assessment and dissemination of what scientists do. If we didn't have to be having discussions about vaccines and climate change at an absolutely elementary level – a point we really should be long past – then we could be talking about more advanced problems.

J.S.: On the other hand, such opinions give us another purpose, namely to help those who don't understand to finally understand.

I see such comments as the aforementioned text message from a viewer as constructive criticism. I later wonder if I should have spoken more clearly, in a way that would have been easier to understand.

So can modern-day scholars afford to stay in isolation and devote themselves exclusively to research work, or do they have to engage in science popularization as well?

J.S.: They really have to. I believe it's my duty as a citizen to do so. But that's not an easy task.

Exactly. On a morning show, let's say, there's a gentleman who is cutting carrots into different shapes and a celebrity who is talking about her wedding. Suddenly, a female professor appears and starts talking about proteins. It might seem preposterous. Maybe that's not the right place to talk about physics, chemistry, or biology?

J.S.: On the one hand, that's a problematic situation. Such shows require things to be presented simply and there's very little time, so what you get are maybe not complete absurdities but at least serious distortions. It's hard to choose your words in a way that allows you to communicate quickly everything you want to communicate in a way that is understandable to viewers.

P.S.: But there are probably many people who would never hear anything about the topic, if they had not heard it on a morning show. Why not? I run the website "Ask a Physicist" (https://zapytajfizyka.fuw.edu.pl/), where we regularly answer questions about physics sent in by Internet users. Also, we organize lectures by well-known scientists.

J.S.: These two things could be combined: if someone hears something on television and wants to learn a little more, they have a chance to write to "Ask a Physicist" and find out more or to attend a lecture.

P.S.: Such lectures are increasingly popular. We're about to organize the 30th. They are always attended by several hundred people. We record them and post them on our channel on YouTube, where they already have a total of over 500,000 views. There may be people who don't understand everything, but when they listen to what scientists think about and what projects they are working on, that's always a certain form of education, a way to broaden their horizons.

J.S.: And this also shows that science is for everyone. That's where we get back to morning shows – cutting carrots can also make you think. About the fact

that someone had to invent steel or why what we eat matters, why carrots are good and for what reasons. Physics as a branch of science is certainly part of that.
P.S.: Science popularization, even in this form, is hugely important. First of all, because there are growing problems posed by "post-truth," or quite simply the dissemination of lies, for example about vaccines. So maybe when some people listen to a scientist, they may finally realize that logical arguments and logical reasoning are more important than emotions. Secondly, people are becoming distanced from the things they can touch and understand.

What do you mean by that?
P.S.: Some twenty or thirty years ago, people could do a lot of things by themselves. When a car broke down, they would look under the hood and do some tinkering, and the problem was solved. The same holds true for computers – you used to go and buy parts and put them together, and you had a computer that worked.
J.S.: In my opinion, phones are the best example. They used to have cables, and it was a lot easier to understand how they worked. Now, everyone has a cell phone and no idea why the screen works or how it is connected. In a word, there's more and more electronics in everything, and that doesn't help us understand the world better.

Does it cause greater fear?
J.S.: Not necessarily. It seems to me that people are less afraid, they learn how to use various things much faster. I'd rather say that this is about natural acceptance and slight ignorance – I use something, but I don't have to think about how it works or why. More and more people only state that the devices around us work based on some sort of magic. And this later affects their lives, their ability to make decisions concerning other spheres in life, such as candidates in parliamentary or presidential elections. I wonder which of these two things occurs more frequently: elections are fair and rational, based on knowledge and an analysis of facts, or voters just jump into a driving train, because essentially they don't know in what direction it is headed or why.

What else should scientists be, apart from scientists? Also managers, financers, accountants?
J.S.: People. We do all those things, but they are technical issues. We must not forget that when we explain physics, we can't get too far away from the reality, or from the phenomenon we're talking about. Similarly, we can't pursue science in isolation from other people. Most of the things that I'm currently working on require the efforts of several people, from various fields at that. This can only go well if I know how to talk to other people, explain to them what my goals are in specific projects, take into account all suggestions of the members of the team, and understand that someone may sometimes fail. Science is something we do out of passion. This passion is often put to a test – you have a thousand ideas, and sometimes only one proves successful. Those who pursue masters or doctoral programs must see the light at the end of the tunnel so that they could come to terms with the fact that they may be working on a project that may likely not bring about the expected results, but it's worth taking up the challenge nonetheless, because people also learn from mistakes. Consequently, in addition to all those things that we have to do, we must be able to explain things and comfort others.

> Of course, it is impossible for everything to always work. You need to be able to accept that some of your ideas will fall through, will prove impossible to measure, or a theory will prove wrong.

P.S.: It would be a good idea to introduce incentives for various aspects of our activity. As for science popularization, it should be more formally recognized in the accomplishments of scientists, instead of being treated as an additional hobby. It would be good if scientists didn't have to organize everything by themselves and if they had institutional support. There is little popularization activity not because scientists are too lazy but because there's no systemic approach. As for other duties of scientists, there's no need to perform them all at once. You need to be a manager if you

lead your research group or hold a post in an institution. Other scientists have fewer administrative duties, and not everyone has to be proficient in this respect. In turn, many scientists are also academic teachers, they hold lectures, and of course they should have teaching skills. There are many things that scientists should know how to do, but it would be good if all of that depended…

J.S.: … on what their calling is. It would be good if scientists didn't have to do all these things, because they waste their strength and energy, and they don't do them well at all.

Many scientists stress that it's important to be humble in this profession. Is it easy to be humble?

J.S.: Humility makes life easier. It helps me forgive myself for something that went wrong and approach the problem again.

P.S.: If you come up against a problem and manage to solve it or at least see that it can be solved, you're satisfied and happy. If the reverse happens, you may feel discouraged. Of course, it is impossible for everything to always work. You need to be able to come to terms with the fact that not all of your plans will work out, some of your ideas will fall through, it will be impossible to measure something, or a theory will prove wrong.

J.S.: Being humble is related to internal mobilization: if I don't understand something, I think about what I can do to understand it. Essentially, this boils down to curiosity.

Joanna Ida Sułkowska, PhD, DSc

is the group leader of the Interdisciplinary Laboratory of Biological Systems Modelling at the Centre of New Technologies and holds the position of Assistant Professor at the Faculty of Chemistry, University of Warsaw. In 2007, she obtained her doctoral degree at the Institute of Physics, Polish Academy of Sciences (PAS). She spent several years working at the University of California, San Diego. She has authored over fifty scientific publications, including in *Nature S&MB*, *JACS*, *PNAS*, *PRL*, and *NAR*. In her research, she combines her knowledge of physics, biology, and the mathematics of knot theory. As her greatest scientific achievement so far she regards describing the characteristics of entanglements in proteins, the mechanism of their emergence, and their links to biological functions. She has implemented projects supported by grants funded by the National Science Center (NCN), the Foundation for Polish Science, and the Polish Ministry of Science and Higher Education (Ideas Plus). She has won two grants from the European Molecular Biology Organization (EMBO). She has received prizes awarded by the PAS Institute of Physics and the University of Warsaw. In 2017, she received the UNESCO-L'Oréal International Rising Talent Grant and the DSc (*habilitation*) scholarship "L'Oréal Poland for Women and Science" as well as the "Person of the Year" Award, granted by the radio RMF Classic. In 2018, she received the National Science Center Award. She has taught lectures as part of the Children's University and Polish Children's Fund, and she is a mentor in the STEM program.

Piotr Sułkowski, PhD, DSc

is a theoretical physicist working on mathematical aspects of string theory and quantum field theory. He also conducts research in the field of biophysics. He is a Professor at the Faculty of Physics, University of Warsaw, where he leads his own research group, and a visiting faculty at the California Institute of Technology in the United States. He has also conducted his research at Harvard University, the University of Amsterdam, and the University of Bonn. Since 2013, he has been implementing a project supported by the ERC Starting Grant, the most prestigious scientific grant funded by the EU. He has also led projects supported by the EU's Marie Skłodowska-Curie actions grant, the Humboldt Foundation, the Polish Ministry of Science and Higher Education, and the Foundation for Polish Science. He is involved in the popularization of science – for example, he runs the "Ask a Physicist" initiative and Internet portal. He received the Polish Prime Minister's Award for Scientific Achievements, the Science and Higher Education Minister's Award, the PAS Stefan Pieńkowski Prize, the individual award "Crystal Brussels Sprouts" for outstanding achievements in the EU Seventh Framework Programme, the Capital City of Warsaw's Prize, as well as prizes and distinctions awarded by the University of Warsaw. He has won awards from the Foundation for Polish Science, the Polish Ministry of Science and Education and PAP, as well as from the Polish Physical Society for science popularization.

American scientists claim that it may be one of the drives we have, equal in force to the sex drive.

J.S.: That may be true. In my case, this exploration is like wanting to eat another candy (laugh). So it didn't work this time? You can try another. We don't give up.

Do two scientists like you who don't give up sometimes have leisure?

P.S.: When we have leisure, we for example go hiking in the mountains.

Do you really not talk about science then?

J.S.: We do. But not in the context of what needs to be done and when. We ponder a problem that we find particularly interesting. Calmly, without replying to emails or dealing with paperwork.

Is the fact that you study similar fields not overwhelming?

J.S.: It's good to have someone to talk to about science. If we worked in completely different fields, for example I studied geology and Piotr music, I would also think it's good that we can advise each other how to apply for grants or lead groups. Our life together is another thing. I understand that I'll spend some time alone when Piotr goes to a conference or sits at his computer at night, because he is working with scientists from the United States. He understands that I come back home late a lot more often, because the nature of the work done by my research group re-

quires this, and on Sundays I start the day by reading emails. That makes life easier, makes it easier to understand each other in marriage.

P.S.: On the other hand, while we have written several papers together, our research subjects are nonetheless different – we work and spend time in different groups.

J.S.: On the plus side, we sometimes attend the same conference. Last year, for example, we went to Vladivostok together, and we had a chance to see the region. There was one drawback, though. We've been married for some time, but have sometimes lived apart. First, Piotr was on a fellowship in England. After that, he would visit the Netherlands through the whole of his doctoral studies. Fortunately, we lived together in San Diego, where I was working as a postdoctoral researcher, and Piotr worked at Caltech in Pasadena, where he spent several days a week. But we had to survive somehow. Consequently, we know that we both find science very important, and if we think of the future, we must be able to cope with that.

> Scientists should work for as long as they have the vigor to do so. There are plenty of people who are older than me, and I learn from them, from their experience.

Don't you regret a little that you left the United States?

P.S.: My field of study doesn't require much more than a simple computer, a place where I can work, and international contacts. What matters are the resources to meet with people or go to conferences, but it doesn't matter that much where I work on a daily basis. Aside from that, the possibilities of working together and staying in touch are now greater than ever – there are emails and phones. For example, Asia went to Paris yesterday morning and was back in the evening.

What about earnings?

P.S.: They are important. In Poland, if someone gets a decent grant, they can enjoy a decent standard of living. However an assistant professor who only receives an average salary can hardly be expected not to try to make some extra money. And that typically happens at the expense of science. In other countries, there are these and other problems, too. In the United States, for example, there are many scientists under short-term contracts, their future is uncertain. There are always pros and cons.

J.S.: I agree. If I worked at a US university, of course apart from those that top ranking lists, I would not have the same opportunities to create as I do here. By building my group, I have the feeling that I can change and develop Polish science to a certain degree. And that's another thing that inspires me.

Is Poland no longer being described as provincial, compared with a lot more developed countries? It seems to me that Polish science is generally doing well.

P.S.: Especially if we consider the ratio between the spending and the results. But a lot depends on the field, too. Astronomy, computer science, many branches of physics are at a world-class level, but there are less worldly disciplines as well. It's hard to generalize about all these things, lump them all together.

J.S.: In addition, the sense that things are bad sometimes follows from the fact that people say so. There are good institutions, too, and we should take pride in them. That doesn't mean we should rest on our laurels, but we should not create a bad atmosphere where there is none. If something is not right, we should try to change it. I can see a chance for change in the positive direction.

What is needed to achieve this?

J.S.: Definitely a certain change of mentality. I don't believe that a change of generations is needed. In my opinion, scientists should work for as long as they have the vigor to do so. There are plenty of people who are older than me, and I learn from them, from their experience. Sometimes there are things that I simply need to discuss with someone who knows more, because I'm not able to browse through all the publications, even in this Internet era. It's good to be able to think together with someone about something that already happened, instead of duplicating solutions that someone else has already proposed.

Are you thinking about going abroad again?
J.S.: I think we should definitely go one day, not on a permanent basis, but for a few months, maybe a year or two. That's necessary to change topics after some time or at least see what is happening in the world, to prevent stagnation. But that also means that my post will be temporarily vacant, so someone will be able to come here. Stirring water in the right direction can only bring good results.

You have a lot going on in your lives.
P.S.: It's good to have tenure, not to worry that your contract will expire in two years, so you should only focus on writing as many publications as possible. Regardless of that, it's great to working in an international environment, to meet, talk, make contacts, because that always invigorates you, mobilizes you to work.

Finally, a stereotypical question. What are your professional dreams?
P.S.: I'd like the research I'm currently conducting to yield some results in two to six months. That's my small dream. My bigger dream is that my direction of research will prove truly important and provide an impulse for broader development. In more general terms, it would be great if some new, unexpected phenomena were discovered, for example at CERN. We would have something to work on, and that would provide an impulse for all of us in high energy physics.
J.S.: As a physicist, I need to understand fundamental laws. As a human being, I need for them to find direct applications in medicine. This means commercialization and clinical trials. That's my long-term dream.

Interview by Katarzyna Czarnecka
Photos by Jakub Ostałowski