

ACADEMIA

I JUST NEED A MICROPHONE

Prof. Hanna Bogucka, head of the Department of Wireless Communications at the Poznań University of Technology, discusses unnecessary inhibitions, the usefulness of microphones, and the links between people and technology.

ACADEMIA: Women are strongly underrepresented in the world of science and technology, not just in Poland – as was confirmed by the President of the European Research Council, Jean-Pierre Bourguignon, during the Polish Science Congress in Poznań back in February. What can be done to attract more women to the field?

HANNA BOGUCKA: Indeed, female technical scientists or female engineers are relatively rare. I think the reason for this lies in the roles traditionally assigned to women as early as childhood. The popular belief is that girls do not like to play with technical toys, or that they're not good at math. As a result, they often lack confidence in their own technical and scientific capabilities. Intellectual support from parents, kindergartens and schools could help change this. Girls and young women have to learn not to fear asking questions, exploring or trying new things without inhibitions or assuming some things are not for them. This will also require change in the educational system and sensitive teachers who do not stereotype.

How many women scientists work in your field of wireless communications?

Not many. Only a few attend our main event, the Polish National Radio Communications, Broadcasting and Television Conference, accounting for about 5% of participants. This is the case at international conferences as well, although there are a few well-known female professors who have gained significant success in this field. Unfortunately, I have not noticed the number of female scientists in my field increase. A significant part of this problem is that in Poland, on average, women earn less than men, and scientists do not make a lot of money as it is. Thus, a female scientist is usually much worse off than a business-



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man, for example. In addition, her career in science usually coincides with the age when she wants to get married and start a family. It is difficult to reconcile everything, when a genuine career in science and complex research work require a lot of time.

These days research work, especially at the beginning, requires students to work closely with experienced professionals. Were you lucky enough to have such a mentor?

Yes, it was my advisor, Prof. Krzysztof Wesołowski. In addition to having good master-student relationships, he also knew how to create good scientific work atmosphere and environment, encouraging young scientists and appreciating their contribution to various types of research projects. I enjoyed the opportunities offered to me, traveling abroad to scientific conferences, collaborating with foreign universities

and working on important, innovative projects. Once I gained experience, I used this as a basis for building my own department. Now I try to impart this knowledge to my younger colleagues.

In the course of your career have you ever felt that you were treated differently than your male colleagues?

Fortunately not. And I have never witnessed the so-called glass ceiling for myself. The only gender-related problem I can think may be that my voice is not as loud as my male colleagues, especially during the lively discussions of our projects at the meetings where we sometimes argue. But a microphone solves this problem.

You are a member of the Institute of Electrical and Electronic Engineering (IEEE) Communications



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specializes in radio communications, cellular and wireless networks, including new transmission and reception techniques, spread-spectrum systems, multi-carrier modulation, optimization of transmission, as well as programmable and cognitive radio. She heads the Department of Wireless Communications at the Poznań University of Technology and has authored over 160 domestic and foreign publications.

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Society's N² Women initiative. How many women belong to this organization? Which countries have the most representatives? How well is Poland represented by comparison?

I am also a member of IEEE Women in Engineering (WIE) and IEEE Women in Communication Engineering (WICE). These organizations aim to highlight the participation of women in technical sciences, in particular at the IEEE. They want to help women succeed in their professional lives, promote and reward their achievements. There are also special sessions held during scientific conferences devoted to the problems of women in science and various informal meetings for networking. I should mention that men are also members of these organizations. I don't have the exact numbers, but it seems to me that they include a significant number of Polish women, including those living outside of the country.

You conduct research at the Poznan University of Technology. To what extent is your research department open to foreign employees?

Recently our department welcomed a new colleague who had returned from abroad. He received his master's degree in Dublin and did his doctorate in Berlin. Three years ago he applied for a FUGA grant from Poland's National Science Center, which enabled him to work at our University, and once the project ended he was able to stay on full-time.

We cannot overestimate the opportunities for collaborating with outstanding colleagues within the EU framework. Without a doubt such collaboration broadens our scientific and cultural horizons. We publish joint papers, develop new ideas and forge interpersonal bonds. It is also important to surround ourselves as often as possible with people who have an independent, often completely different view of our work. This allows us to verify our hypotheses and examine scientific issues.

To what extent is adequate financial support important in a scientific career?

I have a very pragmatic view of a career in science, especially when it comes to young people. Financial support is very important so you do not have to worry about material things and supporting your family, so you can concentrate on your work in a way that is calm and creative. In addition, especially when it comes to technical sciences, theories should be supported by experiments, sometimes by creating a system to demonstrate the effectiveness of a new solution, so it is necessary to finance the equipment.

Have you ever applied for an ERC grant?

I have applied for EU funds within several EU programs, succeeding many times, but I have never tried for an ERC grant.

Why do you think so few Polish scientists apply for ERC grants and even fewer receive them?

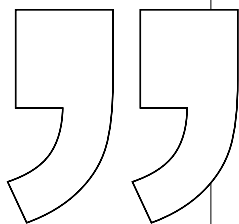
I believe that the success rate in these competitions, just like in competitions for FET (Future and Emerging Technologies) projects, is so low that many scientists consider the work it takes to apply a waste of time. My colleagues from other countries seem to feel this way. If the application process takes several months of your time, and the possibility of receiving the grant is 3%, then no wonder people feel discouraged. Even if the idea is innovative and the application is very good, losing just a single point during the assessment, such as for inaccurately describing how the results will be disseminated, can be enough to entail failure. Often it is a matter of luck, depending on who happens to be reviewing your application.

Why is it so difficult to convince Polish industry to harness innovative solutions? And when we do manage to do it, why is it so difficult to implement them?

Simply put, innovations are expensive. First, they require a lot of research without any guarantee that the results will be significant. The best example is the pharmaceutical industry, which spends huge amounts of money on research. Such investments prove profitable when they happen to develop an effective drug, but this is not always the case. Some research results

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In my opinion my department, as well as the Department of Electronics and Telecommunications, and the Poznań University of Technology as a whole, are open to hiring foreign scientists. We also have many PhD students from other countries. Besides, one's nationality is not relevant in science. Knowledge, ambitions, good ideas, perseverance and diligence are what's important.

How can scientists representing other cultures and other nationalities contribute to Polish science?


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land in the trash can. Most of them simply cannot afford to finance the research and innovations of Polish companies because they are expensive and risky, and they also require a long-term perspective. We are talking about genuine innovations here, not just improving upon existing solutions. The National Center for Research and Development finances applied research, carried out with contributions from businesses. This idea of supporting innovation is good, but my experience shows that companies are only willing to participate in such projects and harness the results of joint research if their own contribution represents a small share, or when the project involves improving solutions that guarantee a quick profit. Of course, this does not apply to all companies and the entire Polish economic scene, but, unfortunately, it does apply to the majority. Notice that some spectacular innovations do not require large financial expenditures, such as new computer applications or other kinds of software solutions.

Can a scientist working in industry have the same job satisfaction as he or she would have doing research projects in the lab?

That is an individual matter, but I believe so. Someone who likes to see the results of their scientific work in practice will certainly enjoy working in industry. In technical sciences, the process of developing a new solution usually involves first developing a theory, followed by experiments in a lab, a demonstrator, prototype and industrial tests in a production hall, and finally applications. So this process involves both lab and industrial work.

You are a member of the editorial board for the journal *Recent Patents on Telecommunications*. What are the main advances that have been made in the field in recent years?

That journal has changed its name to *Recent Advances in Communications and Networking Technology*; I was involved with it until 2014. Currently I am the executive editor of *Transactions on Emerging Telecommunications Technologies*. The key advances in telecommunications definitely include new transmission methods, in particular coding, MIMO (Multiple Input, Multiple Output) multiple-antenna technologies and massive MIMO systems (with a very large number of antennas), dynamic access, spectrum sharing, software-based approaches to managing and controlling telecommunications networks, and network virtualization.

How can cognitive radio technology, one of the areas of your research, be ground-breaking for the future of telecommunications?

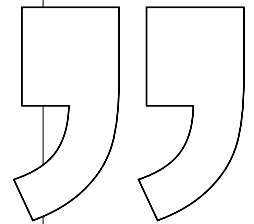
First of all, this technology allows for better, more efficient use of spectral resources (the frequency band

of electromagnetic waves), which can help provide better telecommunication services within a naturally limited band. Second, it uses artificial intelligence to improve this efficiency and gain access to the network, such as the Internet, anywhere, anytime and using any technology.

Your field is evolving very rapidly. Where do you see it in ten years?

The development of the “Internet of Things” will be key, as a way of connecting people and devices. It is estimated that by 2022 there will be about 30 billion

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connected and communicating devices, a number several times higher than the world population of people. Most of these devices will be connected to the Internet wirelessly. The use of millimeter wave technology for radio communication is quickly evolving, which will present even more opportunities for providing telecommunications services, including multimedia. This should make our lives much easier and, combined with artificial intelligence algorithms, help create intelligent networks and cities. Accessing vast amounts of data, stored and processed on the cloud or through “fog computing” techniques that have recently been developed, will most likely require assistance in the human perception of such data – which means developing augmented reality technologies.

Remote control and robotics will certainly evolve, replacing people in performing certain onerous tasks and partly replacing them in industrial production, the operating room, and other various types of services, as well as in everyday life.

INTERVIEW BY ANNA KILIAN

PHOTOGRAPHY BY JAKUB OSTAŁOWSKI

This is the English translation of an interview that was approved by the author in the original Polish version.