In the course of the ITSC practical course the CPT conducted a series of interviews with interesting members of the chemistry faculty. Our interview partner today is Prof. Dr. Wolfgang Schuhmann. Prof. Dr. Schuhmann is the leader of the "Elektroanalytik & Sensorik" group at the RUB. He achieved his diploma at the university of Karlsruhe in 1982 and his Ph.D. five years later at the technical university in Munich. After his Ph.D. he stayed in Munich as the leader of the group "Amperometrische Biosensoren". From 1990 till 1993 he stayed as a visiting professor at the university of Texas in Austin. After his habilitation he became in 1996 a professor of analytical chemistry at the Ruhr-Universität Bochum. The focus of his research is, amongst others, on the microelectrochemical investigations of fuel cell catalyst and battery materials as well as new materials for electrocatalysis and photoelectrocatalysis.

Prof. Dr. Schuhmann

? *How would you describe the topic of your research in a few sentences?*

! The field of electrochemistry is very broad. About 40 % of the research group is working on energy conversion, which means they are dealing with electrocatalytic water splitting, to finally convert wind and solar energy to chemical bonds. Another big topic is the bioelectrochemistry, which is about immobilizing enzymes on electrode surfaces. Possible applications for this are bio sensors or bio fuel cells. One could imagine, that miniaturized bio fuel cells, for example in implanted sensors, deliver energy to some kind of small devices in a human body. A third part deals directly with the conversion of solar energy. Here we are looking for a way to convert solar energy directly to hydrogen, through deductive material research on semiconductor materials. Additionally, we are doing a lot of method development. For example, electrochemical scanning microscopy is something that we are doing for years now. Therefore, a company has been founded in this institute, which sells such appliances. Regarding nano-electrodes and nano-electro chemistry, we are doing a lot of development on devices and methods. We work, for example, on DNA-chips which we are using as sensors for multi resistant bacteria. In this case we use nano-electrodes to do measurements in single, living cells. Overall there is a great variety of things and topics on which we are working but in general it is, as i said, all about electrochemistry.

? *That means with fuel cells and solar power, the production of regenerative energy is a great deal of your work?*

! Not only solar energy. If you think about how to save excess electricity for example, and how to make it accessible again, then you can only do it by using chemical bonds. Nowadays, there are battery storage facilities in northern Germany which can save only a relatively small amount of energy. The reason for this is that in a battery, the active mass which actually stores the electricity is located inside of the battery. If we look at an e-car, there are a lot of common batteries merged to a big one, with a lot of battery management, which is giving the e-car the power of a sports car. But the overall quantity of electricity, which is produced worldwide, is a much greater amount. It could be conserved by using pumped storage facilities, but then there is the question where to store such great volumes of water. The other possibility is to save the energy in form of chemical bonds. This means that you can produce some valuable compounds, for example hydrogen from water or by reducing CO_2 to carbon. Those compounds could then be used to produce electricity in the absence of wind or sun.

? *How does the typical beginning of your workday look like? Do you have some daily routines, like a brief meeting of your research group, for example?*

! We are a very big group here, a few more than forty people in total. Therefore, a daily group meeting is not possible, simply because of the amount of time it

would consume. Typically I come to work at around half past eight in the morning and then have some brief talks with my co-workers. Sometimes, for special occasions, someone needs more time for our discussions. Then, there is the everyday work. Discussions in the faculty council, lectures, phone calls or e-mails to answer or a meeting with a cooperation partner from the biology or material science department. Usually I leave around eight in the evening, heading home. And there, I start working. [laughs]

? *In the early 90s, you were researching in Austin, at the University of Texas, for some time. From your view: What are the main differences in research and university life between the US and Germany?*

! I think the overall equipment for the staff at American universities is worse than in Germany. They usually have an open space office with partitions of around four feet in height. The laboratories are still well equipped and more cooperative. But many things only get done because of money. There is, for example, the center of electronic microscopy where you have to pay when you want to do a measurement. Of course, this can also be an advantage when you can buy a claim for different devices. This is not so far developed in Germany. On the other hand, American scientists always need third-party funds, because there is no basic funding at their universities. If you do not have third-party funds, there is absolutely nothing you can do. For example, the use of the premises are coupled to third-party funds, and they will be taken away from if you can't secure funds for your research projects. In general, at American universities, everything is much more dynamic, but thus also much more unsettled. It is also common, that you are in the laboratories on Saturdays or Sundays and to get only get five days of annual vacation.

? *Or have to work overnight...*

! Working during the night is a controversial matter. In my opinion, there is nothing wrong with working overnight. For example, when I have a measurement that works best during nighttime. But the question is, is it expected to work then or are you doing it out of your own decision. For a reason, that I do not understand, we have a definition called "Work-Life Balance". If you think about it, it means that work is something different than life, that the one thing is good and the other is bad, and that you have to create a compensation between those two. I do not know if it is really has to be like that. When I have a job that fulfills me, and I like what I am doing, there is nothing negative about it. You can look at it as self-determined and non self-determined work. If I have a self-determined job, which I enjoy, then I do not know if there is a difference between work and leisure time. For me, it would be a punishment to go home and mow the lawn. I would favor much more a discussing with my co-workers about some crazy ideas for future research projects.

? *When did you actually decide to study chemistry?*

! I think it was when I deselected chemistry in school. In my schooldays, you could only deselect one of the three natural sciences, thus physics, biology or chemistry. And for chemistry the teacher was not that great, so I deselected this one. Back then, you had to apply at a university via the ZVS, the "Zentrale Vergabestelle für Studienplätze". I applied for chemistry as my first preference, physics as my second and history or German philology as my third. I am glad it became chemistry, because I think the description of nature in physics is something different than the change of nature in chemistry. I assume would have done something with history or German philology too.

? *Especially in the beginning of their study, many students develop doubts if they have made the right choice. Was this the same in your case?*

! No. [laughs]

? *Then you always knew what you wanted to do?*

! I started '75 with my study, shortly after the student movement. At this time the students had not the assurance that, whatever they do, there would always be someone who is supporting them financially or otherwise. A lot of people think it is more difficult to study nowadays, but today the available decision options just get more doubted. Also it is much more common, that your parents tell you: "Why, go ahead and do what you like." Back then, about 70 % of the young people decided at the age of 15 to do an apprenticeship, found a honorable vocational education, and worked eight hours a day. Today, maybe around 10% make that decision. You have always to look

at the whole social environment whether such a question is to be asked at all.

? *Regarding your study and scientific career: Were there any jobs you had to do, although you did not like it at all?*

! During my study, I had to work in the metalworking industry. It was a job where you had a quota to punch up to 3000 pieces a day. I had to work with a guy who, every morning when he used his swipe card to register his working time, said: "Shit, still eight hours to go!". I thought, that is not how I want to end. I think it is a great motivation not to end like that. Nowadays, there are also some things I do not really like to do. For example, to check if we have bought a pack of gloves five years ago from third-party funds instead from the basic funds, like we were supposed to. Things like that are always annoying, because this wastes more valuable lifetime than it would actually be necessary.

? *You are now working as a lecturer at the RUB for a relatively long time. From your point of view: Would you say that the students changed somehow during this time?*

! Yes. [laughs] I held Analytic Chemistry I lecture for 18 years straight. While I am growing older the young people, who are sitting in front of me, stay the same age. A lot changed during the last 20 years, especially how young people understand certain things. Last semester, we had the situation, that students did not come to the exercises if they could not receive any bonus points. That was a complete mystery to me. I always thought you are studying something out of your own interest. Especially during the introductory phase of the study, this kind of school-like thinking is much more present than 20 years ago. The feeling that you are entitled to something, before having actually done anything for it, has increased, not only among students, but in our society altogether. Formerly, students thought if they are working hard enough they will have a better future. Today students know, no matter what they are doing, it is very hard to reach the same standard of living that their parents had. I wish sometimes that, particularly during the introductory phase, our work is more appreciated. What the students actually do, is to take it for granted. Like: "I can come and go when I want, but the Professor has to be on time and prepared". Last year I received an email, Friday night at 11 pm, and on Sunday I already got a reminder that I still have not sent an answer. These are things that are unusual.

? *This might be comprehensible for everybody...*

! Yes, but there is the development of the students: When they come back in the fifth semester to hear Analytic Chemistry III, there is some loss of students but also a maturation of the remaining students. Thus most students now know why they are studying, which makes the overall situation better. The shift of the adolescence process in our society, that could be observed during the last 20 years, also applies to the university. The university can be seen as an image of the whole society. If I look at the Analytic Chemistry I exams, the average grades are getting worse. I believe that the scholastic educational background is of lower quality today, because more and more people are receiving an Abitur who maybe would not have passed it 20 years ago. Of course, those people are also represented by the clientele in the lectures.

? *And they stay there until they are sifted out...*

! When I was a student, we had 120 free places in the lab courses and 350 beginners. The exams were always adjusted in a way, that the number of free places has been sufficient. I do not think we ever did that at the RUB. I believe, the loss during the initial phase is not dependent on sifting, but on the insecurity of the young people. They often question their choice and when they then did not participate in the exams for two semesters, their desire to study chemistry was not quite genuine. Additionally, during the transitional phase from school to university, the self-responsibility increases dramatically. It is hard to compensate, when the students are in a phase of their life, where they do not know where to go on.

? *Many finish their Abitur at the early age of 17 or 18, due to G8...*

! I am not sure if that is a reason. In the past, people completed secondary modern school at the age of 15, took up an honorable apprenticeship and made a choice for their whole life. At the age of 17 or 18 you should be capable of making decisions effecting your whole life, but many young people today cannot. I do not think a year more or less would make a big dif-

ference in that regard. My three sons are now around that age, so I know a lot of young people who do not know what to do with their lives after the Abitur. Two years from now, I believe, they will still not know. But after some time they start to show tendencies and then they are capable of making such an important decision. Look at the first semester for example: Students have to work hard because everything is concentrated, but it is not too hard. They just have to want it. Consequently, you do not get sifted out, unless you sift yourself out, due to a lack of motivation. I know of no discussion among the professors in the last 21 years where the sifting of students was discussed, due to the cause that there were too many new students.

? *What becomes more important to you with your advancing age? Also in reference to your working place?*

! When you are a young scientist you want to write great publications and do great stuff. If you are lucky, that works out, and I believe it worked out for me. Furthermore, the research goals we have here are important, which is one of the reasons why I can get up in the morning and come to work. For me it is not a question how to get fast into retirement, but how can I do what I love for as long as I want. I will reach the age of 61 soon and I want to stay here for some more time. Overall I can say I do not plan any big changes just because I turned 60.

? *If you were young and at the beginning of your career again, would you do something different?*

! If I would be young today, I would do something like internet based massive mobile phone data analytical chemistry. This is a fascinating topic, one could imagine that data collected with cell phones may be used, for example, to prevent the spreading of malaria. People would then combine malaria tests with their mobile phones and the results could be analyzed. With such a massive data approach you could also track the spreading of a virus in real time. This is something that would greatly fascinate me. Something where you would need to combine new techniques with your own field of expertise.

? *A new app is about to be released soon that allows a mobile phone, with an integrated camera, to check fruits and vegetables in the supermarket for harmful substances ...*

! I am not sure if it would work or if things like that are more like religion. We live in a fearful world, even when the world, at least in Germany, is safer than ever before. When I passed my drivers license, an estimation of 30000 people died every year in traffic accidents. Until today that number went down to only 3000, but we do not allow our children to go to school alone any more, when that was absolutely normal in the past. Today we fear everything. I do not understand why, but we became a generation of fear. And that leads to a market for certain things. But as an analytical chemist I am skeptical if such a device would work. For such things, I would like to see the fundamental science, to see if this could work at all. You simply cannot test against thousands of unknown substances with an optical analysis when it comes to fruits with different levels of maturity.

? *Was there a special reason why you came to the Ruhr-Universität in Bochum?*

! Yes, I got a call to come here [laughs]. When you habilitate and get your first call, that is only a singularity. There are only around five open positions every year. Then there is no possibility to say: "No I do not go there". I had three little kids, at the age from one to five and a temporary employment for half a year left. Of course I applied for the position in the analytic chemistry department. I have been to Bochum one or two times before, so I said yes and we moved here.

? *Do you have a favorite place in Bochum? A restaurant or a park for example?*

! I still like to go to the "Blauer Engel", the "Clochard" or the "Bermuda3Eck", but I also like that, in Bochum, you can take a stroll along the Ölbach, or go cycling without being subjected to heavy traffic. If you know your way around the Ruhrgebiet it is a lot nicer than many people believe. Actually, I like the Ruhrgebiet as a whole. When we moved here from Munich, where was only one zoo in the area, here we have 7 or 8 nearby. There is also a lot of variety in the area and I think that the quality of life in the Ruhrgebiet is very, very good. Here, Students can get an apartment for a reasonable price, while they have to pay much more in Munich. That is something one should think about.

? *We are now nearly at the end of the interview. Is there something left you want to tell our readers?*

! Do something that brings you joy.

? *These are good closing words. We thank you for your time.*