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To be, or not to be...Electrochemist?

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That is the question we should ask ourselves when addressing the topic of this special issue about “Future tasks of electrochemical research.”

Even though the Nobel Prize in chemistry has been awarded in 2019 for research intimately related to electrochemistry, the word “electrochemistry” is not mentioned a single time in the press release of the Royal Swedish Academy of Sciences [1]. Also, the three awardees (John B. Goodenough, M. Stanley Whittingham, and Akira Yoshino) would be more considered physicist, chemist, and engineer instead of electrochemists. This nicely illustrates the current dilemma of electrochemistry, being such an interdisciplinary field of research that it is hardly identified as a discipline by itself. Whether you measure extremely precisely a very small amount of molecules in the brain, or coat a car by metal electrodeposition, electrochemistry is everywhere, and the same fundamental concepts, such as the notion of electron transfer kinetics and potential distribution, are responsible for the observed effects, even if scales and types of application are completely different! Pushing these thoughts to the extreme would lead to a statement similar to the one pronounced very long time ago as a welcome address of the Electrochemical Society, claiming that “.... scientific theories point so strongly to the electrical nature of matter and of chemical changes, that we might properly consider that all chemistry is electrochemistry” [2]. Obviously, this is exaggerated, but the truth, and at the same time a trivial statement, is that without electrochemistry, our present world would look completely different. We crucially need electrochemistry in our daily life, and the progress in this field of research over the last decades has contributed in a very considerable way to shape our current society. This has

been well expressed in an editorial in *ACS Nano* from 2016, which states in the very first sentence that “This is the golden age of electrochemistry” [3]. I perfectly agree with this sentence in terms of the amount of scientific activities; however, I’m less convinced that this is true when considering this sentence from the viewpoint of electrochemistry as a scientific discipline. Electrochemistry, as a discipline, has experienced a tremendous loss of visibility. Professor positions, which previously were clearly identified as being in charge of representing the field of electrochemistry in a given University, have gradually disappeared around the end of the last century and were replaced by more fashionable profiles. Many activities, whether they are related for example to analytical aspects, energy storage/conversion, or materials science, still use the same electrochemical concepts and tools, but are no longer identified as being specific aspects of electrochemistry. The training of our students has experienced a similar tendency. Instead of explicitly advertising the virtues of electrochemistry, courses about this topic are now often diluted in the curriculum and sometimes hidden behind more trendy titles. Teaching rather fuzzy notions, like quality management and sustainable development, which obviously might have very tight connections with electrochemistry, will not help to educate future scientists, able to develop brilliant ideas if they don’t acquire first an extremely solid scientific know-how, including also the basics of electrochemistry. It will rather result in formatted scientists, able to follow and obey ISO certifications instead of thinking out of the box. The more and more premature specialization of our students, rewarding them master’s degrees by following courses with sexy titles will not lead to the type of broadly educated and open-minded scientists that we need for the next paradigm changes in science. Most likely, we are partly responsible for this general loss of scientific depth and missing visibility of electrochemistry as one of the most exciting parts of science of the twenty-first century. When I advertise an open position in my group, I sometimes avoid using the word “Electrochemistry” (at least in

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the title), knowing that its popularity among students is rather limited, and just the name could even scare some of them.

A direct consequence of this lack of identity and absence of clear societal recognition are the problems we encounter when raising funding for fundamental studies in this area of research. As a global tendency, many of us, and this not only concerns electrochemists, are chasing sources of money instead of pursuing ideas and dreams. It is more and more difficult to find financial support for fantasy-driven research in general, and this is even more true for basic aspects of electrochemistry. Funding agencies and companies, luckily with some exceptions, are following a short-term return-on-investment philosophy, forgetting that all the current success stories in electrochemistry, from batteries to medical devices, have started decades or even centuries ago with some extremely fundamental experiments, which, at that time, didn't have the objective to save the world, but were just designed to better understand certain phenomena. Only research fueled by curiosity and not by the accomplishment of deliverables and milestones can lead to real breakthroughs, which eventually will become game changers in a more or less close future.

Therefore, our three biggest tasks for the future of electrochemical research are to fight for adequate funding of fundamental studies, to defend or eventually restore a solid and well-identified electrochemical training of students instead of the increasingly spreading of diluted and superficial pseudo knowledge, and to conquer a better social visibility and recognition as a discipline. The latter aspect is also far from obvious, because it is much easier to fascinate the general public with galaxies, the behavior of animals, or sociological studies, than with the properties of nanoelectrodes. This

means that we have to invest more time and effort for making electrochemistry more popular.

In conclusion, we are facing quite some challenges for the next decade or so, but there is light at the end of the tunnel. In recent years, at least in some countries, centers of excellence in electrochemistry have emerged and have been funded, accompanied by adequate professor positions; some students start to understand, eventually only after having left the university that the basic notions of electrochemistry can be very helpful in their scientific life; a young and dynamic generation of scientist is currently rising, which seems to be proud of being electrochemists, [4] and hopefully will come up with plenty of fresh ideas and concepts.

So, let's make electrochemistry great again!!

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