

## A Hands-on Description of Hands-off Chemistry

When I was asked to write this Editorial as part of the ACS Diversity & Inclusion Cover Art Series and talk about my experiences as a chemist with a disability, I immediately agreed—although I cannot say that I fully made up my mind on how to best tackle this issue, despite me being a wheelchair user for all my life and a computational/inorganic chemist for significant parts of it. I have a congenital condition called *Arthrogryposis*, which in my case affects all four extremities and has left me with little to no movement in my arms, hands, and legs since birth. When you see me for the first time, you probably would not expect me to work in such a hands-on field as chemistry. Nevertheless, here I am. I hope this little text—written by mouth with the help of a special self-developed writing aid—provides some food for thought.

So, let us start with what is probably an unpopular opinion of mine, shall we? I do not like to sort people into communities, and I do not like to be sorted into one. I find the division into these more or less arbitrary categories counterproductive, especially if that means looking at every aspect of a person's life through that particular lens. I also do not like the thought of me serving as an inspiration to anyone. I am a chemist who uses a wheelchair and cannot use his hands, just as there are chemists who wear glasses or who have a larger than average shoe size. My physical disability does not have much influence on my ability to be a scientist. Sure, it prevents me from working in the laboratory, but so does most of my friends' height prevent them from becoming professional basketball players. While this might be different for people with other disabilities or with chronic diseases, I do not think much about having a disability in my everyday life, and I do not like to talk about it. Most of the time, it is simply not an issue for me.

Yet, I have contributed a handful of talks and articles on this matter. That is because I am aware my story describes an unusual situation. I am also aware that the comments above are written from a rather privileged perspective. However, in my experience, very few things truly deserve the label "impossible". Everything else should, in principle, be achievable with a little gumption and goodwill—just like being a chemist with a disability.

For me, it all started with a failed chemistry test in grade nine. I became more ambitious, which led to the point where everything "clicked" and I discovered the beauty of the subject. Two years later, I had no doubt that I wanted to become a chemist. The obvious question was, how could I without ever holding a reaction flask myself? While (mouth-)written and oral exams did not pose any problems, the question was, how could practical courses be organized? The responsible professors and other faculty at Philipps University Marburg came up with a clever procedure, which we later called "Zuguckikum"—a portmanteau consisting of the German words "zugucken" (to



watch) and "Praktikum" (practical course). I was full time in the laboratory and learned by looking over my fellow students' shoulders. On two occasions I even did the laboratory work "by myself" by telling a fellow student what he had to do, and so he did, without hesitation and irrespective of the consequences for his own health. (He is alive and well—and heading toward an academic career.) In cases where this was not possible, I got compensatory tasks, which were designed in a form that matched the amount of work my nondisabled classmates had to perform. This concept worked so well that I was able to get a normal, not-so-normal chemistry degree, and later a Ph.D.

Nearly 18 years after I started my academic journey, this all sounds rather easy. However, success was not granted. That is because people with disabilities face two major, often intertwined, barriers in their lives. The first is a societal one. I was born in a Central European country into a loving and supportive family with the necessary financially sound background. This helped a lot along my way. If one of these factors is

missing, it can become much more challenging. When I first mentioned that I wanted to study chemistry, the reaction was surprise but mainly encouragement and support. The people in charge at my alma mater also never said, “We cannot do that!” They always said, “How can we make this work?” We made it work by thinking outside the box, while still adhering to the study and exam regulations (vide supra). I obviously could not have done any of this on my own. It needs a milieu of open-minded people, including family and friends, classmates, and faculty, who do not confuse intelligence with the ability to physically grasp things. Fortunately, I had all of these: teachers and professors who recognized that the effort was worth it and a boss who always believed in my abilities and whom I have been successfully working for since 2013, first as a Ph.D. student and now as a postdoc at Karlsruhe Institute of Technology. However, the creation of this milieu was not within my control but the responsibility of each individual involved. I am very lucky that my classmates and colleagues always made it very easy for me in this regard—and I have the impression that they also got something out of it.

The second important point is—and anybody who knows me can probably guess what comes next—logistics. If you use a wheelchair, it is obviously crucial to know how to get from A to B efficiently and how to maneuver in unknown terrain. But that is not all, of course. Functioning logistics also include possible adaptations for exams and practical courses, the setup of accessible workspaces, or thorough and more flexible time management in the broadest sense. In my case, this mainly means that it takes a little longer to get somewhere. For others this might also include that they need a bit more time for certain tasks at work due to their individual circumstances. While people with disabilities usually learn this from an early age on, it is important for employers and co-workers to also adapt to these situations. Thanks to modern technologies, a lot of these points can be addressed more easily today than might have been the case a few decades ago. Logistical problems undoubtedly often have a financial component—but the good news is that they too are, in principle, solvable. The societal responsibility, I mentioned earlier, is here primarily with the funding and public agencies. A few thousand dollars for a roll-under fume hood, for a height-adjustable desk in the office, or for automatic doors at the entrance of the building, for example, will certainly not blow the budget. However, the madness of bureaucracy can be tough when it gets to the applicability of special disability funds. This is also a part of logistics where one just has to fight through, but this good fight is worth it.

In the end, becoming a chemist has turned out to be not too much of a problem for me, but as indicated above, the tricky thing about disabilities is how individually different each case can be. Someone with my disability has naturally different requirements than someone with a paraplegia who has full movement in their arms and hands, for example. Also, even within the same type of disability, the specific requirements for each workplace adaption or other adjustments to the specific personal conditions can vary widely.

However, one quality of a good scientist is creativity. We should foster that creativity to generate an environment in which a disability is not much more special than a shoe size. In such an environment, there should no longer be a need for Editorials like this one. In such an environment, we can more fully open the world of chemistry to a group of talented people that probably never dreamt of pursuing a career in this field. As is always the case in life, different backgrounds bring different perspectives—

for all persons involved, and we need that to tackle the problems of our time.

One thing is clear: I definitely do not belong to the artists’ community. I therefore asked my friend Lutz Hammelmann—a very talented artist—to design the cover art for this issue of *Inorganic Chemistry* as part of the [ACS Diversity and Inclusion Cover Art Series](#). It shows a brick wall in the background that gradually transforms into a poster wall. The brick wall represents the societal and logistical barriers that have to be torn down to get full inclusion. Who among the four figures in this picture has a disability is open for interpretation and not really important because, first, tearing down the brick wall is a collective endeavor and can only succeed as such. Second, once this is achieved, the only important thing remaining is the scientific debate in front of the poster wall, which again makes it irrelevant who has the disability and who does not.

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