

The Accidental Scientist

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When Dr. Tamir Gonen was working to develop microcrystal electron diffraction (MicroED), his greatest challenge was “convincing the scientific community that [it] really does work.” This powerful method utilizes samples a billionth the size of what’s normally required, enabling him to generate subatomic-resolution images to discern the structure of proteins and open the door to potential development of new therapies for such diverse diseases as cataracts, diabetes and Parkinson’s.

Dr. Gonen steps into the *U* Magazine spotlight.

When did you first start to think seriously about science?

It was not until I was at university. In high school, in South Africa, where my family had moved from Israel, my teachers steered me away from science because my English was not very good, and they were concerned that I would bring down the ranking of the school’s science program.

One of my science teachers actually went to my parents and told them I had no aptitude for science and I should do something else instead. After moving to New Zealand, I began to pursue a degree in business at the University of Auckland. And I was bored out of my mind. At the end of the year, I was procrastinating about what to do the next year because I didn’t want to go

back to studying business. My sister was going to the same university, and I said to her, “Enroll me in whatever it is you are doing.” I didn’t realize she was enrolled in pre-med, so that’s what she enrolled me into. During that year, I did chemistry and biochemistry, and I really liked it. I changed my major, and I ended up graduating with a double major in inorganic chemistry and biological sciences. I kind of became a scientist by accident.

What was your first science experiment?

One day, when I was a kid, there was a cockroach in my room — one of those big brown indestructible ones that we have in Israel — on its back. I looked at it, and I wondered what would happen if I ran electricity through this thing. I had a simple nine-volt battery and I fashioned some electrodes, and I found that, depending on where you put the electrodes, you could move different legs, and that fascinated me.

Who is your science hero?

That would be Michael Rossmann [professor of biological sciences at Purdue University]. Michael was there from the very start of structural biology. He was responsible for some of the most important developments in the field, and he moved freely between different approaches to doing things. He had such an open mind. Scientists, sometimes they know one thing and they just want to stick to it, but he wasn’t like that. He could look at the bigger picture and say, “Maybe we should do things this way or that way,” and I find that quite inspiring.

Where are you happiest?

I find that disconnecting from the world is quite nice, and the only way to actually do it is on a cruise ship, where you are completely out of reach. That's become a favorite of mine, and my wife and my kids also seem to enjoy cruising quite a lot. So, I guess I'm happiest somewhere in the middle of the ocean. When I'm at work and in the lab, I am happiest when I am using the electron microscope. You sit there in the dark, and it's a very comfortable environment, it's temperature controlled and it's silent, and you block out the whole world and you really zoom in and you focus on those atoms. I find that quite relaxing. A friend told me years ago that a good way to be a scientist and maintain a healthy work-life balance is to apply what he called "the rule of double guilt." The rule of double guilt works like this: If you are at work and you feel guilty that you're not at home, and when you're at home you feel guilty that you're not at work, that's when you know you have a good balance.

What do you consider to be your finest achievement?

My finest achievement is creating a welcoming and supportive environment in my lab. Over the years, I have recruited the best PhD students and postdoctoral fellows to my lab, and I provided them with all the resources they needed to succeed and grow in their careers. Most of my past trainees are now tenure-track assistant professors at top universities in the U.S., and this I consider to be a real legacy. I am very proud of every person who has been trained in my lab, and I continue to do all I can to support them and their careers, even after they leave.

What do you consider to be your chief characteristic?

I have strong opinions, and I am not easily persuaded. Just because, for example, there's a bunch of literature that says something cannot be done doesn't mean that I won't spend time trying to do it. I need to persuade myself. And once I've decided something, it's very hard to change my mind.

What are the qualities of a great scientist?

An open mind. You go to meetings and you will hear people saying, "Oh, this will not work or that will not work," and very often it really is just an opinion and nothing is backed up by data. And, so, I think one of the greatest qualities of a scientist is to keep an open mind and to really follow your nose. If you have a hunch that you can make something work where everybody else tells you that you can't, I think that's precisely what you need to work on and see if you can, in fact, get it to work. Having said that, it is possible to find yourself going down a pretty deep rabbit hole, and so another very important quality for a scientist is to know when to stop. Otherwise, you are just going to end up wasting your time. It's important to follow your nose, follow your hunch, but also to know when to change course. And, finally, to be able to convey your science to other people. If you can't do that, no one will know what you are doing and it will be as if it never happened.

What do you appreciate most in your colleagues?

I appreciate the collegiality of the colleagues in my lab and my department. The more established people in the lab help the newer people; it really is a very supportive culture, and I

appreciate that because it makes it very fun for me to come to the lab every day. It is a very nice environment to be part

What is your motto?

I don't have one, but if I did, I would say it is follow your nose and keep an open mind.

When don't you think about science?

When I'm on a cruise. That's the only time. It is very, very difficult to turn science off. It's just all the time there in the back of my mind. And these days, with all the technology, you're always connected and, so, it's always there. But on a cruise, in the middle of the ocean, you're forced to be disconnected, and there's so much else happening around you to distract you. I think that's really the only time I am not thinking about science.

If not a scientist, what would you be?

I think I would have been a chef. I quite enjoy cooking. I enjoy trying new recipes, but I very rarely go by a book — I don't even own a cookbook. I just try stuff, and I usually cook with pretty healthy ingredients, no heavy creams or butter. I think my approach to cooking is more like a biochemistry experiment — plus or minus 10 percent of this or that, and it's usually OK.

What's your most treasured possession?

My Aria Pro II electric guitar that I bought when I was 16 years old and on which I taught myself to play. I spent hours and hours and hours with that guitar, and I have been carrying it around

with me across four continents. It probably is the only possession I still have left after all the cullings of stuff each time I have moved.

What keeps you up at night?

Now that we have clearly demonstrated that MicroED — something that most of the scientific community thought was a fool's errand — is a very powerful method, what keeps me up at night is thinking about what will happen over the next five-to-10 years. Now that we have this new and powerful method, we can seek answers to questions that we couldn't even ask before. We can look at orbitals; we can look at bonds in atoms; we can look at charges in atoms; and we potentially can discover new medicines. Now, I must project what might happen next. I see my job now as trying to come up with a bigger picture and trying to project my vision for this lab and for this field that we started over the next five-to-10 years. I have a lot of sleepless nights thinking about that.

To which superhero do you most relate?

Maybe Iron Man. He's heavy on technology, and he can fly. Flying is very important for a superhero. If I could fly, then I would not have to rely on planes, and that would be just fine.

What are you most compulsive about?

I like to have a neat space to work in. I don't like there to be a lot of clutter, a lot of stuff. I find it distracting.

Where does your inspiration come from?

I don't know that I have a source of inspiration. I think I've really just been following my nose and rolling with the punches. I didn't start out with the intention of becoming a scientist; I thought I was going to go into business. Even after I changed my focus to science, I thought I would get my bachelor's degree and move on and get a job somewhere doing something, I'm not sure what. Then I ended up entering graduate school, and even then I was pursuing something completely different from structural biology; I was going to do functional assays on proteins, electrophysiology. I'd actually accepted a scholarship in Australia to go and work with Peter Gage [an internationally recognized leader in membrane physiology, biophysics and neuroscience], but then the structural biologist Edward Baker moved to the department where I was doing my summer project and I started talking with him and I became very interested in structural biology and worked with him. So, I look at my whole career as being a series of interconnected events and just following my nose and doing one thing at a time and seeing where that goes.

What is the best moment in your day?

Some days, it is when I get into the office and I know that I actually will get to work in the lab or use the microscope. Other days, the best time is taking my walk or getting home and playing soccer with the kids. It changes day-by-day.

What has been your greatest challenge?

Convincing the scientific community that MicroED really does work. Many of my scientific colleagues had tried to do something similar for decades, but, for whatever reasons, they couldn't get it to work. We were able to figure out how to do it, but there was 20 or 30 years worth of negative literature that we had to work against. The challenge really has been persuading people that this really does work, and that it works really well. I think at this stage, the majority of scientists in the field accept that the method works. There still are a few people we need to persuade, but I think that will happen with time.

What is your definition of happiness?

Being able to pursue the science that most excites you at any moment, without funding constraints.

What is your definition of misery?

Not being able to get a really good cup of coffee readily — that is misery. I think the coffee is, in general, quite awful here. It would be great if we had more very good specialty coffee shops. I think about other coffee-drinking countries in the world: Israel, amazing coffee; New Zealand, amazing coffee. When we lived in Seattle, we became coffee snobs because coffee was amazing there. And then you come to L.A., and most places sell you what I call gasoline

How would you like to fix in the world?

We always focus on what's wrong with the world, but there is a lot of good, advanced science that is making our lives today vastly better than they were just a century ago. With modern

medicine, people live much longer than ever before, and I find this quite inspiring. Having said that, there still are a lot of things that we need to work on: creating even better medicines, providing affordable health care to everyone, providing for basic needs like housing — which is a terrible problem in L.A. Things are, in many ways, better than they've ever been, but we still have a lot of work to do.

What music do you listen to while you work?

That changes depending on what it is I am doing. It could be anything from very mellow elevator music playing in the background if I need to focus on something to, if I don't really need to focus, Ozzy Osbourne, Metallica, Led Zeppelin, Black Sabbath — something very loud.