

Ari intro: This is Small Matters – the audio series where we sweat the little things. I’m Ari Daniel.

Shanta Dhar has been addicted most of her life ... to chemistry. These days, she’s using chemistry to find a cure for cancer – and she’s getting closer all the time – I’ll get to that in a minute – but it all started when she was 12.

Dhar: I grew up in India. I always wanted to do chemistry.

Ari tape: When you were 12, what did you love about molecules?

Dhar: You can use one molecule to make another molecule. And then you find molecules in everything you talk about in life. It was magical.

Ari: When Dhar grew up and went to college, her dad encouraged her to study math or medicine. But Dhar refused. All she wanted was chemistry. And she was really good at it.

Dhar: Throughout the 10, 15 colleges, I ranked number one.

Ari: And these days, she’s an assistant professor of chemistry at the University of Georgia.

Dhar: My father – now he’s really proud of me. We talk a lot.

Ari: Dhar likes to tell her dad about what she’s doing in the lab – which, among other things, is nothing less than finding a way to defeat prostate cancer.

Dhar: Cancer cells are very clever. They will find way to fight with the current therapies, ok, and still grow.

Ari: Dhar’s approach involves using these tiny, tiny spheres called nanoparticles. They’re like little, round chemical soldiers.

Dhar: Yes, actually, armed and directed.

Ari: Let’s take each of those in turn. First, the arming. Dhar stuffs these nanoparticles with a few different drugs –

Dhar: You need to have a chemotherapeutic, which can treat cancer. You need to have an anti-inflammatory reagent to reduce inflammation – for example, aspirin. And something else, which can inhibit metastasis.

Ari: That is, the spread of cancer.

Dhar: So that you just give a single injection of the nanoparticle and it will release all the three drugs.

Ari: Once Dhar loads up these nano-warriors with her chemical brew, she then has to direct it to the prostate. Dhar puts a molecule on the outside of the nanoparticle that interacts with a molecule only found on the surface of a prostate tumor cell. And once the nanoparticle kind of docks there, the tumor cell engulfs it. The nanoparticle then targets a structure inside the tumor cell called the mitochondria.

Ari tape: So if the cell were a car, what would the mitochondria be?

Dhar: It would be your engine.

Ari tape: Ok, you are trying to destroy the engine in the car, and then the car can't run anymore.

Dhar: Yes.

Ari: Targeting the mitochondria makes the cell literally commit suicide. And this specificity – of getting the drugs into the mitochondria inside the tumor cells – is key to Dhar's strategy. Chemotherapy today tends to wreak havoc on lots of cells in the body. But Dhar delivers her drugs directly to the offending tumor cells.

So far, she's done all of her experiments in petri dishes. Soon, though, Dhar will start working with mice, and then pigs. And eventually, maybe years down the road, she's hoping for a clinical trial with actual people.

In the meantime, her day-to-day work takes a lot of effort and a lot of creativity. Dhar told me that some of her best ideas on how to design these nano-soldiers didn't actually come to her in the lab.

Dhar: For me, most of the time – it's after my workout when I take shower in the gym. Immediately something comes to my mind. The only thing I do other than my research is working out.

Ari tape: Those are your two things.

Dhar: Those are my two things, yes.

Ari tape: And do you ever take a break from either?

Dhar: No, unless I'm sick, I never take break.

Ari: Dhar works 14, 16 hour days. And she loves it – she wouldn't trade it for anything in the world. She's not doing it alone, either. <door> Dhar was eager to take me into her lab to introduce me to her team of students and postdocs – Kasey Darley, Rakesh Pathak, and Sean Marrache – each of them just as committed to the cause, each for a different reason.

Darley: Um, I think my dad has a lot to do with it. My dad, when he had his stroke, he couldn't walk or talk for 6 months. And so, coming back and seeing, if I can do something to prevent someone from going through any disease, then that would be awesome.

Pathak: This chemistry is very useful for the human being. You can cure some diseases. Here, what we are doing is we are working on the interface of chemistry and biology.

Marrache: I wanted there to be some sort of application to what I was doing. My uncle, he actually has lymphoma. So it's kind of a way that to myself say that I'm helping towards that cause, and perhaps, one day, maybe we can help treat it.

Ari: Their advisor is beaming – Shanta Dhar is so proud of her students, and what they're achieving together to battle cancer. Her eyes are wide as she lets me in on a little secret.

Dhar: You have to just love your molecules.

Ari: There's no doubt that Dhar loves her molecules. But it's also clear that she's all lit up because she's surrounded herself with a group of people who are just as enchanted with chemistry as she is.

<fade up music>

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