

Where there's wool, there's a way

Professor Tebello Nyokong wants to produce students who push the boundaries of innovation

Sarah Wild

A small figure walks across the entrance of Rhodes University's chemistry department. Purse in hand, she almost makes it to a door before she is stopped by a student. Their voices carry in the empty hall: "Hello, prof. I'm a student at MUT [the Mangosuthu University of Technology] and I would like to do a master's with you."

"Please talk to my secretary and make an appointment," says the lab-coat-clad woman.

Luckily, I have one. It has taken months to secure an interview with Tebello Nyokong, a distinguished professor, research chair in medicinal chemistry and nanotechnology and director of the Centre for Nanotechnology Innovation.

On the next day, Science and Technology Minister Naledi Pandor is arriving to unveil the centre's latest acquisition. The R17-million time-of-flight secondary ion mass spectrometer allows researchers to describe the composition of nanostructured materials and their surfaces. Previously, the researchers had to rely on international collaborators to analyse samples.

"I have to go to a lot of meetings," she says, sitting at a table in her large, bright office in the chemistry building. "Not really here at Rhodes, but I have a lot of international commitments. There are some things I can't really say no to."

She starts to tick them off on her fingers: the World Academy of Sciences (she is on their committee for chemistry), L'Oreal/Unesco selection committee for the Women in Science in Sub-Saharan Africa fellowship (she was named a laureate in 2009), a letter from United Nations secretary general Ban Ki-moon, asking her to be part of a commission "to develop a model for science in the developing world".

She gives a hearty belly laugh, a surprisingly deep sound for so small a woman: "Those are things you just don't say no to."

There is much about Nyokong that is surprising. Despite the accolades and prestige, she says that, when people think of her, they "think about sheep and that letter".

"Sheep?"

"I was named one of the 21 icons [a photographic project to showcase leadership in South Africa]." She gets up to retrieve a newspaper supplement from a well-ordered pile on one of the shelves that line the side of the room. It is a large black-and-white photo of Nyokong in a field of sheep, holding a shepherd's hook and wearing a lab coat.

"I grew up being a shepherd — from a shepherd to a scientist, I think that's what they're trying to portray," she says. Born in Lesotho in 1951, Nyokong went to school on alternate days, tending sheep on the others.

The letter she refers to is one she wrote to her 18-year-old self, which has since been widely distributed and published. In it, she raises ques-



The Shepherdess: Professor Tebello Nyokong, a scientist in nanotechnology and medicinal chemistry, as she appears in photographer Adrian Steirn's 21 Icons South Africa series. Photo: © Adrian Steirn, 21 Icons

tions that resonate with many young people in South Africa, especially previously disadvantaged students who are often the first member of their family to go to university.

"What about your family?" she writes to her younger self. "Will they understand why you need to go to university? Let me tell you, they will not. They would like you to work and support your brother and sister so they can complete their schooling. You know this is fair since you were supported. The family believes

you have enough education. All they wanted was for you to be more educated than they were."

It would appear that she found a compromise: working until her younger sister finished high school and then going to the University of Lesotho, from which she graduated in 1977 at the age of 26. Now, she is recognised as one of the leading scientists in the country, and a recipient of the Order of Mapungubwe.

But she finds herself in the same unfortunate position as many of the country's researchers: frustrated and feeling foolish because she cannot commercialise the products she and her centre have developed.

"I call it the Centre for Nanotechnology Innovation, but where is the innovation? We are innovating new materials for applications, but how do we get to the applications side? I know nanotechnology, but the intellectual property, the language,

the amount of blah blah blah ... it's really, really difficult for my brain," she says.

The nanotechnology she is famous for is a topical skin cancer treatment, but that invention remains in the laboratory and has not made it as far as clinical trials. Her shoulders slump as she explains what happened: a series of bureaucratic failures, protocols expiring and "I just didn't have the heart to go back again".

The technology hinges on a specific kind of molecule, metallo phthalocyanines (MPCs), which react to light. She dabs a finger on her skin. "You put the drug on the cancer on the skin. It will take time to distribute itself and then you put light on it."

The light increases the energy in the MPCs and they produce oxidants, "free radicals, the ones that make us age, the ones that kill us", she says.

Because the treatment is so targeted, it does not damage healthy tissue to the same extent as other cancer treatments, such as chemotherapy.

Binding these MPCs to nanoparticles makes the therapy even more targeted, because then they are bigger and cannot leak into surrounding healthy tissue, she says.

Silence falls once she finishes explaining the science. It lengthens.

"There is one of my students ... who is so clear. They want to form a company from their projects. How do you help someone like him? How do you [teach] them to draw up a business model? Get capital? They want to take their projects into reality, but how do we do that?"

I ask whether this is a problem unique to Rhodes University, a relatively small tertiary institution, with a strong teaching and basic research focus, in a city that does not have established industry, but she shakes her head.

"I'm not blaming them, the university. It's a concept [commercialisation and innovation] that we [South Africa] don't really have. The former technikons had it, universities of engineering have it, but it's a bit foreign [for universities teaching the basic sciences]."

Unlike countries such as the United States, South Africa does not have a culture of venture capital, angel donors or strong industry-university collaboration. Industry expenditure on research and development has been declining steadily for a decade and, although organisations such as the Technology Innovation Agency exist, its focus is further along the innovation pipeline: taking prototype to pilot phase, rather than helping to guide a prototype.

She waves her hands in frustration. "I would like to support my students. I don't have the kind of energy any more to start again [trying to commercialise my inventions], but I would like to put the right young people in the right place."

She has faith in her students, and they in her.

Gugu Kubheka, a chemistry master's student under her supervision, says: "She [Nyokong] believes in small successes. There are no short cuts. [She tells us] you don't need to be intelligent in this world. You need to do the work and put in the hours."

Kubheka is one of the 40 postgraduate students Nyokong and the centre's two permanent staff members are supervising. Aside from the more than 500 articles Nyokong has published, she has supervised more than 70 postgraduate students.

Asked whether the postgraduates are similar to the sheep she used to watch over, Nyokong erupts into another deep bout of laughter. "Sheep, they behave, unlike goats ... Postgraduate students, they are like goats. But I encourage them to argue."

"There is a way that you can argue your point scientifically without being rude. We want to train people who can think. If they cannot think, what use are they to this country? They have to be innovators. We have to give them the platform to be innovators, otherwise we are not doing them a service."

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