

Address to Wits University Engineering and Built Environment Graduates

Occasion of receiving Honorary Doctorate of Engineering

Hazel Sive

December 12, 2022

Vice Chancellor, members of the Wits Council, Leadership, faculty, students, families and friends, and all protocol observed, Good Afternoon!

I'm Hazel Sive, a proud Wits alumna, with undergraduate degrees from Wits in Chemistry and Zoology. Today I am deeply, deeply honored to be receiving an Honorary Doctorate of Engineering. This is one of the greatest honors of my life. Thank you so much.

But more important, Congratulations Engineering and Built Environment Graduates!

Congratulations on your wonderful degree achievement! Your degree is prestigious and powerful and will set each of you on track for good jobs and excellent careers.

So, please join me in a round of applause for the graduates, for their supportive families and friends, and for their caring, expert professors!

Like each of you, I've been supported by family, friends and teachers, some of whom are here today. My cousins Mike and Amanda Marler, Maureen Joffe, my friend since the first day at Wits, my dear Professor Barry Fabian, and friend and Member of the Wits Foundation Board of Governors, Lebogang Montjane.

It's been more than 40 years since I received my Wits degrees. Truly it does not seem so long because life can zip by.

It was a great privilege to be educated at Wits, and the training I received here has been the most important and useful of my life. I've been lucky to work at several excellent universities, but Wits is the university closest to my heart. I'm sure each of you will remain a proud Witsie forever.

Like many of you, I'm a kind of engineer, architect and planner, and have spent my career in construction and design. Mine is a different kind of engineering than some of you are trained for, but relevant to yours. And so, I thought today I'd tell you two stories, and a bit more, that I hope you will find interesting and even useful.

Long ago, the first story, when I was a Chemistry major at Wits, I loved organic chemistry and learning how large, interesting molecules are built. But to be honest, and perhaps you'll be surprised, I was not a model student – and social life sometimes cut into my studies. In particular, I learned almost no Physical Chemistry - thermodynamics, delta G, entropy and so on.

I want to tell you that this has not been a problem, because I realized later that you can fill in your knowledge gaps. In fact, years after I graduated from Wits, I needed to teach Physical Chemistry, so I read a book, taught myself, and it turned out actually to be very interesting!

And this story matters, because equally important to what you know now, is to keep on learning – filling in the bits you missed or are not sure about, and all that will be new during your career. Don't be scared to admit to yourself or someone else what you don't know. Go look it up, ask, or figure it out. I still work hard to fill the gaps of my knowledge. This is Lifelong Learning and I guarantee if you do it, it will empower you in all aspects of your life.

The second story is a longer one, that also started at Wits, in the Biology building. While I was a student here, Professor Robin Crewe gave me a project to discover how a certain type of ant, called *Odontomachus*, sang to communicate with others. It was known that the ants moved one of their front legs over their head to make a sound, but that was all.

I set about finding out, using the scanning electron microscope to explore their heads. The ants had to be fixed, and then coated with silver, so the electrons could reflect off the sample.

The electron microscope was huge, a tall column in a darkened, cool room. It was incredibly exciting that I was entrusted to use it. You put the sample on a platform in a chamber, applied a vacuum, and then the sample was bombarded with an electron beam. With a joystick I could rotate the sample in the beam and look at the highly magnified image on a little screen.

And as I looked, I came across a patch of ridges on the head of the ant – maybe ten ridges, exactly the same height and exactly parallel. I had no idea what this meant, but thought it was amazing that such perfect geometry could be built in an ant.

So, I took some pictures and showed them to Professor Crewe. His face broke into a grin – you've discovered the musical instrument, he told me. The song was made because hairs on the front leg of the ant moved across the ridges on the head and the spacing between them gave the frequency of the song.

I still can feel the tingle that came with the excitement of that discovery, and I have those pictures to this day. That was one of the ways I started to become fascinated with how life was designed and built.

This fascination was greatly augmented by the guidance of Professor Barry Fabian, who taught us that an egg, one single cell (the building block of life you've likely heard of) magically goes on to become an ant, a frog, or a person, you, made up of a staggering 100 trillion cells, with intricate organs like eyes, kidney, heart and brain. And if you are an ant, with a set of parallel ridges on your head.

Not only did Professor Fabian explain this in lecture, but for another research project, he introduced me to the South African claw-toed frog, *Xenopus*. I was tasked with collecting frog eggs, growing them to the next step called 'embryos', that grow to become tadpoles. I did this on the top floor of the Biology building, keeping thousands of embryos in rectangular plastic dishes.

One day, as I looked into my dishes, I noticed that all the embryos of the same age were doing exactly the same thing at the same time. When they were a few hours old, all of them were spherical, next day all were kidney bean shaped with a black dot on one end, and two days later they all had eyes and long tails. It was a revelation, truly Magic!

How did the embryos know what to do? Did they have a built-in timer? How did a simple frog egg know to become a complicated tadpole with eyes and a brain? Were there chemicals involved? Could I isolate these?

And so, I started on my career path of discovery, design and building, around the construction of life.

Constructing people, is very, very complex. Like all engineering, building life requires materials (cells) that are joined together according to plans (genes and DNA). Our understanding is incomplete, but even so has led to new medicines, new vaccines, new cancer therapies, and someday will help build replacement kidneys or hearts for people whose own are failing. It is extraordinarily powerful information.

My research group has contributed unique and crucial knowledge, defining dozens of genes (the plans) and novel processes by which cells work together to build the face and brain. We've determined what contributes to some facial and brain disorders, and suggested groundbreaking potential therapies, including modified lipids and hydrogel implants. I don't have time to tell you more today, but please look online to learn more about our research!

Much of our work has used frogs as a model for people - the same kind of South African frogs I first met in the Biology building. What I learned about frogs at Wits has eventually made me a world expert in this system.

And this story matters, because I realized long ago that research is a way to discover amazing things, and it helped lead me on my life's path as a scientist. For you, some unexpected event, your own revelation of what is really interesting, may help you decide where to put your talent and your time.

Well, you've had two stories, and finally, here's the bit more I promised. My career road might seem like a straight path, but really, it's been quite windy, and when I graduated from Wits more than 40 years ago, I had no idea what I would do with my life.

I had no idea that I would build an important research program, become a professor and award-winning educator, and later Dean of a major College of Science at Northeastern University, Boston, USA. I would not have known how to do this and would have been intimidated to even consider it.

Rather, when I graduated, I found work as a high school science teacher. A couple of years later, I decided to enroll in a PhD program. And after I'd obtained the PhD and done more research, I was invited to apply for Assistant Professor positions. I had no training in how to be a professor, so I learned on the job. And after years working up the ranks of faculty, I accepted the job of Dean of Science. Once again, I had no training in this, so it's more learning on the job, but now that is not intimidating, rather it's an honor to contribute.

This way, I've walked through life, finding that each step opened possibilities, and suggesting what the next step could be. Moving through life step by step could be a good plan for you, and your own useful and interesting career pathway will be revealed.

In summary, on this wonderful celebratory occasion, I've motivated you to keep learning, all your life. I've told you how I found Magic in research and encouraged you to look for some spark that will help you decide where to put your effort. And I've suggested that walking through life one step at a time is a great way to build a career.

Your prestigious Wits degree will set you on your path, and I hope you will all find good jobs and forge excellent careers.

My warmest congratulations to each graduate on your wonderful achievement!

Thank-you for the accolade of receiving this honorary degree today.