

“Make the most of life” – Michael Thackeray

[Text of the speech delivered at the UCT Faculties of Science and Commerce graduation on 19 December 2014]

It is wonderful to be home on African soil and at UCT today. As a past student, I have fond memories and a deep appreciation of the high-quality education I received at this prestigious university. It is a great honour to address you.

My congratulations to the students on your hard-earned accomplishments. South Africa needs your skills and your talents, as does Africa – and the world. Daunting challenges confront humanity: a burgeoning population – a widening inequality gap between the haves and have-nots – the rise and spread of lethal diseases.

Equally important is the harnessing and storage of energy that will lessen our dependence on fossil fuels, provide a means for slowing global warming, and minimise the interruption of power supply that plagues South Africa today. I would like to use electrical energy storage – or simply batteries – to tell a story about South Africa’s scientific and commercial contributions to this field. It is also a story about recognising or creating opportunities, and making the most of them when they come your way.

I imagine that many of you are feeling uncertain about the future – both as young individuals embarking on your careers, and as members of a generation that must grapple with challenges of immense proportion. 41 years ago, when I was sitting exactly where you are now, I was also uncertain about my future. I can assure you that the thought of a battery career was furthest from my mind. In those days, batteries leaked and corroded my transistor radio and the floor under the backseat of my 1959 Volkswagen beetle – there was nothing enticing about that.

On my arrival at UCT in 1968, I enrolled for a BSc degree, but with no clear aim or direction in mind. A year later, [Professor Morna Matthias](#), an inspiring lecturer in the [geology department](#), introduced me to the beauty of the crystalline world, gemstones and the history of the earth. Something stirred within me. [Professor Luigi Nassimbeni](#)’s colourful character and mastery of crystallography drew me to the chemistry department, where I stayed to do a master’s degree. I am indebted to them for exposing the road I was to follow.

Unsure of whether my future lay in academic research or industry, and how I could capitalise on my love of crystallography, I headed for the [CSIR](#) in Pretoria, whose charter was to undertake research in the national interest. It was the mid 1970s – the time of the first oil crisis in the Middle East when the price of oil quadrupled and petrol rationing was imposed. This event catalysed worldwide efforts to look at electrified transportation as an alternative to petrol-powered vehicles. And so, Johan Coetzer, my mentor at CSIR, suggested that I study battery materials for my PhD project.

Batteries may sound dull, but I suddenly discovered that they were exciting – they are a form of ‘inorganic life’ that is dependent on the structure of matter – on crystallography. When batteries are fully discharged, they are considered ‘dead’. When charged, crystal structures can be packed with energy or ‘life’. We talk of the ‘lifetime’ of batteries.

Today's challenge is to pack as much energy into as small a space as possible, safely, to allow your cell phone or laptop computer to last longer – or, better still, to enable your electric vehicle to travel further on a single charge without polluting the atmosphere with noxious exhaust fumes and CO₂.

Johan Coetzer and I were structural chemists, not battery scientists. Our advantage in the mid-1970s was that our minds were not contaminated by conventional thinking in the battery community – we worked outside the box. One idea led to another and to a sequence of discoveries. With Anglo American’s support,

the ideas began to flourish, but not without moments of despair when problems seemed insurmountable. We needed help to drive the science to technology development and to commercialisation.

Collaborative projects were therefore established between CSIR, Anglo American and the [Atomic Energy Research Establishment](#) and a battery company, Beta R&D, in the UK and, a little later, Mercedes Benz in Germany.

Johan's technology was based simply on a mixture of table salt, or sodium chloride, and iron filings. By extracting the sodium from the salt at elevated temperature, iron chloride was formed, thereby creating a viable rechargeable sodium battery, later to be called the Zebra battery.

In 1981, I reached a crossroads at CSIR. While Johan's Zebra technology was commanding the attention of industry, my curiosity was being drawn to lithium batteries that I sensed offered more scope than the Zebra system. I wrote to a world authority on battery materials at Oxford University, John Goodenough, to ask if I could spend a year at his laboratory.

And so I left the Zebra team, but remained in close contact with them. Johan's Zebra batteries went on to power Mercedes buses that transported the athletes at the Olympic village in Barcelona in 1992; they are now being manufactured for electric vehicles in Europe and for back-up energy storage in the US.

I was awed by Oxford – and extremely apprehensive about my ability to achieve anything significant at such an esteemed university. My concern was unfounded. I had taken an idea to Oxford to use structures related to the semiprecious gemstone 'spinel' as a battery electrode. The idea generated surprising results that ultimately led to materials used in many of today's electric vehicles, such as the Nissan Leaf and the Chevy Volt.

Funding for lithium battery research at CSIR started to dwindle in the early 1990s, just as Sony introduced the first rechargeable lithium-ion batteries to power the early cell phones and laptop computers. CSIR terminated its investment in lithium battery research, on the grounds that there was no local industry in South Africa to support the technology. I was offered a fellowship to do research of my choosing, but with the instruction 'no lithium batteries'. I felt deflated – that I was being deprived of a highly relevant scientific mission.

Fate intervened. I received an invitation from [Argonne National Laboratory](#) outside Chicago in the United States to join a new lithium battery initiative sponsored by the US Department of Energy. It seemed a perfect opportunity – but there were no guarantees. The decision to head for the US was highly unsettling for Lisa and our young daughters, Caryn, Anna and Lara.

Our move to Chicago did not have an auspicious beginning. On our approach to landing at O'Hare airport in Chicago – when we were just 6 feet from touchdown – the pilot opened the throttle hard and aborted the landing. There was a stunned silence in the aircraft. Lisa looked at me and quietly said: "Thank God, we are going home." We were told that there had been another aircraft in our path. Well, we didn't go home, but have been fortunate to return 'home' frequently.

Over the next 10 years, research at Argonne capitalised on the battery platform created in South Africa, from which several more advances were made. Like CSIR's technologies, the advances were implemented in battery products and licensed worldwide. These successes were not individual efforts; they were achieved by teaming and the cross-fertilisation of diverse minds across the globe, both young and old.

On graduating today, you have become a vitally important resource to serve the needs of society, whether in science, commerce or some other discipline. So the world beckons as you embark on your careers – the future lies in your hands. So my hope for you all is that you will:

Find a passion; follow a cause;
Aim high; do what you want to do;
Ask for help if you need it;
Be guided by instinct; take calculated chances;
Be bold; and have that bit of luck.

I close with words from [William Makepeace Thackeray](#), a distant cousin and author in the Victorian era, who cautioned against setting short-sighted goals during the passage through life:

*Do not be in a hurry to succeed.
What would you have to live for afterwards?
Better make the horizon your goal; it will always be ahead of you.*

Good luck to you all. Thank you.