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Genetics 2.0

My eyes were opened to the mind-boggling implications of gene editing after I watched a YouTube video seven years ago by Kurzgesagt, which was titled 'Genetic engineering will change everything forever – CRISPR'. You can watch it here. CRISPR is of course a reference to the revolutionary CRISPR-Cas9 gene editing technique discovered by Jennifer Doudna and Emmanuelle Charpentier, which allows for the easy, fast and cheap editing of an organism's genetic material, or DNA. The comparison often used is word-processing, where editing genes becomes almost as easy as cutting and pasting text in a word document. And what Kurzgesagt meant by "everything forever", is that when it comes to what is called germline editing, genetic changes are hereditary, meaning once you edit certain genes, the resulting changes will be permanently inherited through the DNA of all subsequent generations of that organism. That essentially means, for the first time in history, human beings have the theoretical ability to completely and permanently alter our entire biosphere – and ourselves. I have subsequently started thinking of this moment as the First Biological Revolution, or Genetics 2.0.

What does this mean? We can edit crops to become more resistant to heat stress from climate change, more resistant to pests and diseases and more productive, to increase food security. We can possibly, over time, 'edit out' mosquitoes' ability to carry Malaria or Zika virus, and we are starting to cure genetic disorders in humans, like sickle cell anaemia. We can also potentially create 'super humans' who are genetically engineered, before birth, to be free of certain diseases, and be stronger, faster or smarter than was previously possible. But this raises many ethical concerns.

Is it right to edit a baby's DNA if that baby had no say in the matter? If we can create genetically superior humans, what happens to the rest of us? How can we create gene editing therapies and cures to benefit all of humanity and not just the super-rich who can afford it? What will in future be seen as disabilities? How do we ensure that gene editing research reflects the genetic diversity of Earth's human population, and does not just benefit certain ethnicities that are in the majority? These are complicated questions, and as gene editing technologies progress and become more commonplace, these questions will soon take centre stage. That is why this edition is focused on where we are currently at with regard to gene editing developments.

We look at how genetic diseases are being cured, at the ethical principles we need to keep in mind, at the technologies currently available, at the role of DNA barcoding in helping to combat wildlife trafficking, and at South Africa's research contribution to the burgeoning field of gene editing. And of course, there is a lot more exciting science in our Featured Articles section – like the giant marine monsters that ruled the seas off South Africa millions of years ago and the latest in quantum technologies.

We hope this edition makes you ponder all the exciting and scary implications of this new Genetics 2.0 era, and that you enjoy the read.

Warm regards,



Fanie (RS) van Rooyen (Editor)