STEM CELLS, THE NEW HEROES OF FERTILITY !

Ruth Appeltant

The current epoch, characterised by unprecedented levels of biodiversity loss, is often referred to as the 'sixth extinction'. One of the most dramatic examples of this is the sad 'rhino story'. Very few rhinoceroses survive outside national parks and reserves, a consequence of persistent poaching and habitat loss. According to the International Union for Conservation of Nature Red List of Threatened Species, also known as the IUCN Red List, three species of the five – the black, Javan and Sumatran – are critically endangered. The greater one-horned or Indian rhino is vulnerable, while white rhinos are classified as near threatened in Africa. When we consider subspecies, the western black rhino has been declared extinct since 2011 and northern white rhinoceroses have become functionally extinct since the last male, Sudan, died in 2018. The only two remaining northern white rhinoceroses are kept under 24-hour guard in Ol Pejeta Conservancy in Kenya. This conservation crisis catalysed my research focus on fertility preservation of endangered species. In my research at the University of Oxford (United Kingdom), I discovered that the lack of egg cells in females was a crucial bottleneck for the conservation of this iconic animal species.

Artificial reproductive technologies are playing an increasingly broad role in fulfilling the desire to have children, breeding superior food breeds, maintaining genetic diversity in climate-resilient local breeds and saving endangered species. As illustrated in the rhinoceros example, those old females on the brink of extinction are in desperate need of artificial reproductive techniques. Without any eggs, there is no source material to grow in the lab even via specialised techniques.
This was the direct trigger for me to think bigger and brainstorm about how to create eggs. Stem cells offer a groundbreaking solution as new heroes in the world of infertility. My current position as research professor at the University of Antwerp gives me an opportunity to fulfil my lifelong dream of taking care of the future by taking care of biodiversity and fertility. Establishing my own research group dedicated to this endeavour has been a longstanding aspiration, and realising a research plan to safeguard endangered species will be the finishing touch. An opportunity to investigate the science questions I believe need to be solved gives immense satisfaction. "Yes, we can…" change the world.

The most promising approach to obtaining eggs when the individual has no eggs naturally, is in vitro gametogenesis, or the production of so-called 'artificial' or 'lab-created' eggs from stem cells. In my lab we develop two methods. A first source of stem cells relies on the presence of already existing stem cells in the ovary. If ovaries are absent, we will convert easily available body cells, such as cells from skin biopsies, into stem cells and transform these into eggs. This approach, once deemed speculative, is now on the cusp of practical application, providing a promising avenue to conserve biodiversity and enhance human reproductive health. The idea sounded futuristic and unreal only ten years ago, when no one would have imagined that eggs could be produced from other body cells. This might become a reality that gives us hope, motivation and energy to preserve biodiversity and improve the quality of human life.

An animal such as the rhinoceros can be a pioneer in awareness and action. If certain technologies are developed for one species, the transition to similar applications in other species and to human medicine will be relatively easy. Each organism has its own unique role in maintaining ecosystems –

and thus the quality of life on our planet. The rhinoceros is the flagship of the endangered species, but every animal, every plant plays its part in ensuring that our systems – and therefore ourselves – survive. When we look at the specific role of the rhinoceros, we see that it affects the ecosystem in different ways. In Africa, rhinoceroses are a keystone species, integral to maintaining the ecosystem.

The importance of science cannot be overstated. The role of fundamental science is pivotal in addressing global challenges, but its impact is maximised when coupled with innovative applications. What people expect from a high-quality life can be achieved through continuous improvements and advancements in science – but not everything in the academic world is a bed of roses. The financial sword of Damocles hangs over every project: no money, no research. Finding sponsorship and funding necessitates a mountain of administrative paperwork with uncertain outcomes and requires an enormous network of colleagues and stakeholders. Moreover, it is difficult to convince potential funders about the necessity and added value of a research area when the science is very technological and effectively incomprehensible to non-experts.

Making science visible for the lay public can enhance comprehensibility. Where scientific work is sometimes difficult for a layperson to understand, art can both educate and generate emotions, provoking more interest in the scientific approach. With this in mind, I was privileged to host the exhibition *FREIGHTED* by Fritha Langerman, professor at the Michaelis School of Fine Art (University of Cape Town) at the University of Antwerp (Belgium) from September 2023 until March 2024. Working on the same reality from completely different perspectives is exciting, and it felt great to bring science and art together. This travelling exhibition focuses attention on the rhino's dire situation. The representation of a rhino as a crate comprised of several reproductions from across the world offers a fragmented picture of a rhino. Reality confronts us with the fact that seeing a rhinoceros could soon be reduced to these digital prints. This surprising and intriguing approach forces us to reconsider humanity's role in the biodiversity crisis.

We have lost the northern white rhinoceros already. Solving the problem naturally is no longer possible, as no males means no reproduction. However, Langerman uniquely illustrates that the rhino is in a fragmented state, but that science may yet be able to pick up some fragments (stem cells) to collate all the pieces back together. So, while the extinction of the northern white rhinoceros highlights the limitations of natural reproductive methods, interdisciplinary approaches – encompassing both scientific and artistic perspectives – are crucial for raising awareness and driving conservation efforts. I advocate for increased support for interdisciplinary research to address the pressing challenges of biodiversity loss and to foster future breakthroughs in conservation science.

Mammal Hall, Natural History Museum, London.
Photograph: Fritha Langerman, 2017


THE
PALL MALL GAZETTE
An Evening Newspaper and Review.
No. 1.—Vol. I. TUESDAY, FEBRUARY 7, 1895. Price Twopence.
A fine bull rhinoceros was shot in Mashonaland by Arthur Eyre in 1895. It was bought by Cecil John Rhodes for £250 and presented to the South African Museum in Cape Town.
The Daily Teleg
LONDON, FRIDAY, MARCH 16, 1894
Mr Rowland Ward has, now on view in Piccadilly, a superbly mounted example of Rhinoceros simus, being one of two shot by Mr R.T. Coryndon last July in the north-west of Mashonaland. Coryndon, still in London, has been assisting the taxidermist. The animal stands at 6 ft 1½ in. at the withers; length between uprights, 12 ft 1 in. The specimen is not remarkable for the length of its horns.
THE CHOLERA IN ENGL
DISASTROUS RAIL
The
LONDON, WEDNESDAY, NOVEMBER 30, 1893.
Richard Lydekker says that "the white rhinoceros Ceratotherium simum simum, found south of the Zambezi River, has been hunted on such a scale that its destruction is just a matter of time." According to the famous hunter Frederick Courtney Selous there are still 10 - 20 of these rhinos left in north-east Mashonaland in 1880.
Times
The Morning Post.
LONDON, WEDNESDAY, MAY 7, 1893.
Lord Lionel Walter Rothschild opened his menagerie and museum of natural history at Tring in 1892. He approached Coryndon to procure the white rhinoceros that had been shot in Mashonaland. As this was not available, Coryndon offered to shoot another white rhino for the collection. At the same time, he was approached by the superintendent of the Museum of Zoology in Cambridge, who wished for a similar specimen. In September 1893, Coryndon reported that he had shot two white rhinoceros bulls and preserved their hides and skeletons.

Exhibition detail. Reimagined newspaper articles from the 1890s that chronicle the declining population of the southern white rhino in what is now Zimbabwe.

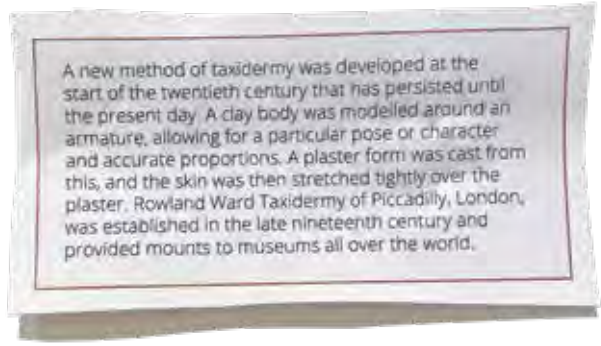
Southern white rhino IVF foetus.
Drawing: Fritha Langerman

Carl Akeley and Theodore Roosevelt were early proponents of the 'preservation paradox', the idea that hunting and collecting specimens could, paradoxically, help conserve a species. By the late nineteenth and early twentieth centuries, there was a growing awareness that many large game species were declining. Akeley, a pioneering taxidermist, and Roosevelt, a passionate hunter-conservationist, sought to ensure that these animals would be available for public view forever, preserving them in museums as their wild populations dwindled.

A plaster cast of a baby rhino head at the American Museum of Natural History, New York.

Indian rhino taxidermy specimen, Berlin Natural History Museum.

Photographs: Fritha Langerman



Bronx Zoo, 2017. Photograph: Fritha Langerman