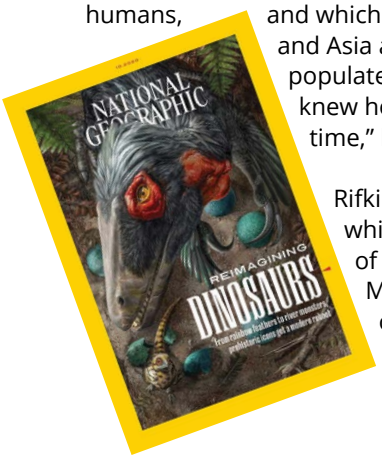
As a bioarchaeologist, Dr Riaan Rifkin studies ancient disease organisms at a molecular (DNA) level and works in the field of molecular archaeology. His research entails visiting excavation sites to search for DNA in sediments and human remains.

TRACING ANCIENT HUMAN DISEASES

Dr Riaan Rifkin, a research fellow at the University of Pretoria (UP), was honoured with a profile in *National Geographic* magazine for his work on tracing the DNA of ancient human diseases.

The National Geographic Society funds his research at the Centre for Microbial Ecology and Genomics (CMEG) at UP. Spending time in cave sites, searching for ancient DNA in sediments and human remains, is part of Rifkin's daily routine. He is looking for clues concerning the past prevalence of common and novel human diseases. He wants to find out "which diseases plagued ancient humans, and which of these were taken to Europe and Asia as our ancestors left Africa to populate these regions. Our ancestors knew how to overcome illnesses at that time," he says.



Dr Rifkin was profiled in the October 2020 edition of *National Geographic*.

Rifkin is a bioarchaeologist at CMEG, which is housed in the Department of Biochemistry, Genetics and Microbiology in the Faculty of Natural and Agricultural Sciences at UP. He holds a master's degree in prehistoric rock art from the Rock Art Research Institute at the University of the Witwatersrand, as well as a PhD from its Institute for Human Evolution. "My research focused on the use of red ochre – a soft clay-based earth pigment – by ancient southern Africans going back 100 000 years, and what this might tell us about the cognitive and social evolution of our species. While ancient humans likely used red ochre as a symbolic body cosmetic, our experiments have shown that this also proved to be a very good sunscreen, insect repellent, and animal-hide tanning ingredient."

Ancient humans using red ochre powder for these purposes were already very 'modern' at least 100 000 years ago, "before our species left Africa for Asia and Europe," he says.

Based on his work with the OvaHimba in Namibia, where women use red ochre daily, he developed an interest in the possible influence of diseases in our African ancestors. "The OvaHimba informed me that the red ochre mixture also prevented them from being bitten by mosquitoes. As mosquitoes are important disease vectors still today – including Zika virus, West Nile virus, Chikungunya virus, dengue, and malaria – I started to gather information concerning ancient African diseases, and how these would have influenced the evolution of our species in Africa."

As a bioarchaeologist, he studies ancient disease organisms at a molecular (DNA) level and works in the field of molecular archaeology. He says: "My research at UP focuses on discovering ancient DNA from southern African archaeological sites, including sediments and human remains. The remains span the period from circa 75 000 to 1 500 years ago. My primary aim is to generate a sub-Saharan African disease baseline database that precedes the departure of *Homo sapiens* from Africa after circa 75 000 years ago."

He recently secured funding for a five-year project through the Benjamin R Oppenheimer Trust, which awarded him a fellowship for his studies in molecular archaeology. The long-term objective of the fellowship is to contribute to alleviating the adverse influence of ancient re-emerging 'ancestral' diseases on contemporary humans.

But why study ancient diseases? And how can novel data about prehistoric pathogens benefit modern society? The impact of disease on prehistoric humans is illustrated by the fact that roughly two thirds of modern-day hunter-gatherers, such as the Kalahari San and the Tanzanian Hadza, succumb to disease before reaching 15 years of age. Despite the fact that many of the approximately 400 recognised human pathogens had a profound influence on human evolutionary history, many are still implicated in the deaths of millions of people annually.

"So, even in our modern day and age, we are not immune against pathogens. Epidemics caused by Zika virus, avian influenza and even the *Yersinia pestis* bacterium – the causative agent of the 'black death' plague – still pester modern human society. But recognising which disease-causing pathogens were brought from Africa to the rest of the world, after our ancestors left the continent some 65 000 years ago, is a challenging venture," says Rifkin.

This entails determining the evolutionary relationships between ancient African human populations and pathogenic and beneficial microbial species, and exploring the ways in which emerging 'ancestral' human diseases are expected to affect modern-day sub-Saharan African populations. The final step is producing policy guidelines for the integration of novel DNA information into epidemiological models about disease emergence and outbreak-response planning.

This involves integrating archaeology, molecular ecology and palaeo-epidemiology. While this innovative approach is promising for interpreting past human lifestyles, it also holds great potential for predicting the emergence of new diseases.

Article by Primarashni Gower republished from University of Pretoria News. https://www.up.ac.za/news/

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A Himba woman shows a tourist how red ochre is made and applied.

CURRICULUM CORNER

LIFE SCIENCES: GRADE 11
Biodiversity: Microorganisms and diseases

LIFE SCIENCES: GRADE 12
DNA, the code of Life: Deoxyribonucleic acid
Genetics and Inheritance: Mitochondrial DNA

PHYSICAL SCIENCE: GRADE 11
Chemical systems: Lithosphere

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