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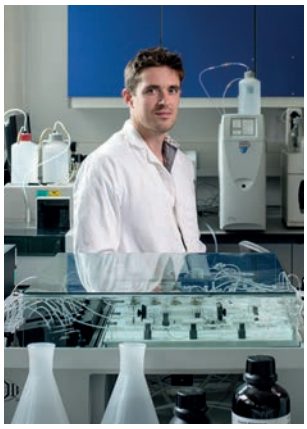
JOSEPH COOK

YOUNG LAUREATE

COUNTRY UNITED KINGDOM
AGE 29
LOCATION GREENLAND/UK
PROJECT EXPLORE AND COMMUNICATE HOW POLAR ICE MICRO-ORGANISMS HELP SHAPE OUR WORLD



Since he first set eyes on it, the Arctic has exerted an irresistible allure for Joseph Cook: "It's a captivating landscape, serene, with giant rivers that carve their way through the ice, vivid neon blues, pinks, greens – it's not the empty, white wasteland people imagine. For me, there is also the fascination of exploring an immense living system at the extreme end of life on Earth, and which may affect our own future."

Dr Cook is a glacial microbiologist, an explorer of the microscopic "frozen rainforest" on the surface of the Greenland ice sheet. The top few metres of the Arctic's ice are a biological realm whose dimensions, role and impacts are still a scientific mystery. His Ice Alive mission aims to bring to light how this relatively unknown ecosystem helps shape the ice of the northern hemisphere, how it may drive changes in the Earth's climate, nutrient and carbon cycles, which in turn affect humanity.

"It's estimated there are a hundred million billion trillion micro-organisms living in the top few metres of Earth's ice. Through their colour, they affect how much solar energy Earth's ice reflects back into space, in turn influencing how fast the ice melts," Cook explains. "These tiny organisms are, in my view, both amplifiers of climate change and architects of the ice surface. That's why we have to understand what they do and how they do it.

"Greenland is the ideal natural laboratory to study the fundamental processes controlling life on ice that are likely transferable to the mountain glaciers that are expected to disappear completely within decades."

Cook has so far undertaken five field seasons in the Arctic. His Rolex Award funds will take him and his team onto the Greenland ice sheet in 2017 to explore how ice microbes engineer their survival in this hostile environment, their role as climate influencers and the possible services they can provide to humanity. The team will carry out field studies of the "cryoconite holes" which the microbes sculpt into the ice as their habitat – and how these in turn influence glacial physics and ecology. These holes are thought to cycle carbon at comparable rates to the soils of the Mediterranean.

Their field samples will be analysed back in the UK in a series of biogeochemical, microbiological, metabolic and molecular tests, informing new numerical models designed to shed new light on bio-glaciological processes from the micro to global scale.

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"Unlike most life on Earth, these organisms are somehow adapted to be highly active at temperatures from 0.1 to 1 degree. This means they probably contain genes and chemical pathways of great value to humanity – such as cold-tolerance, novel antibiotics, structures to absorb pollutants, and proteins which capture light. They may have hundreds of valuable end uses," he says.

A passionate science communicator, Cook plans to share his newly won knowledge with the public through a series of films, public talks, museum and art gallery exhibitions.

For Joseph Cook, the Arctic is not the final frontier, but an under-appreciated part of Earth's inner space, ripe for exploration, discovery and learning.

PROFILE

Since he began rock climbing at age 11, Joseph Cook has been captivated by the great outdoors, and imbued with a spirit of exploration and discovery. His first visit to a scientific camp on the Greenland ice sheet was, in his words, "a life-changer", cementing his determination to illuminate the unseen world of ice microbiology with the light of science.

Cook, who was born on 23 November 1986, graduated in physical geography from the University of Sheffield in 2008, before doing his PhD in microbial carbon dynamics on glaciers and ice sheets. In 2013, he joined the University of Derby as lecturer in geoscience. In 2016, he returned to the University of Sheffield as a full-time research scientist. He has won more than a dozen awards, grants and scholarships, has published prolifically on glacial biology, and is an eloquent and passionate communicator of his research to the public.

Part of his Rolex Award will fund the making of a documentary film, *Ice Alive*, a sequel to his prize-winning short film, *Life on Earth's Cold Shoulder*. He is already arranging public lectures, feature articles, museum exhibits and collaborations with artists and writers to share with the public the fascinating and fragile miniature world of Arctic micro-organisms.

CONTACTS

Email: jmcook1186@gmail.com
T: +44 79 2115 4354
http://tothepoles.wordpress.com
Twitter: @tothepoles