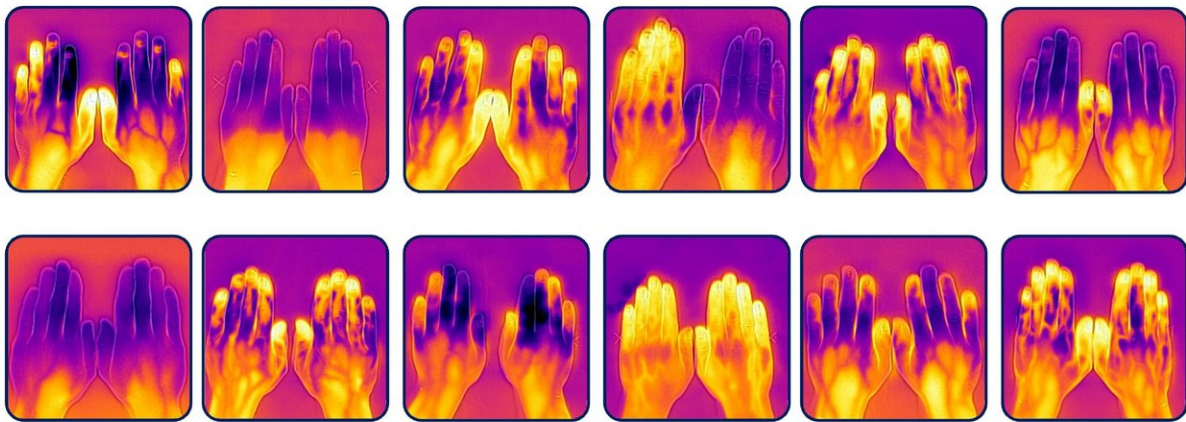


Muscle more important than fat in regulating heat loss from the hands

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Multiple thermal images of hands from the study, showing a range of different temperatures among volunteers who took part in the study. Credit: S. Payne

In the first study of its kind, Cambridge biological anthropologists have shown that muscle mass is able to predict the rate of heat loss from the hands during severe cold exposure, while body mass, stature and fat mass do not.

According to Stephanie Payne, lead author of the study published this week in the *American Journal of Physical Anthropology*, "Hands have a large surface area-to-volume ratio, which can be a challenge to maintaining thermal balance in cold conditions. We wanted to study the

influence of body size and body composition on [heat loss](#) and rewarming in the hands to determine whether they affect [hand](#) temperature and dexterity in cold conditions."

These results are important for understanding our thermoregulation (the body's ability to regulate its temperature), according to Payne. "We always thought that fat (acting as insulation) was the most crucial factor in thermoregulation, but it's actually muscle playing the vital role. The body is this amazing, dynamic system which uses muscle to generate heat to keep the rest of the body warm, including your hands."

Volunteers from around Cambridge, including University students and local residents, took part in the study. After having their vital statistics taken and body composition analysed to measure the amount of fat and [muscle](#), each volunteer plunged their hands into ice cold water for three minutes. The rate at which volunteers' hands heated up again was measured and recorded using a [thermal imaging camera](#).

Volunteers were of European origin and aged between 18 and 50. Payne further explains, "Many populations across the globe have developed vasoregulatory adaptations to deal with severe cold. Some populations lose blood flow to the hands very quickly to make sure they retain their body heat internally, whilst others, for example the Inuit, have periodic pulses of blood to the hands to combat frostbite."

As a National Geographic Young Explorer, Stephanie is currently researching human populations from across the globe with her next study focusing on [body](#) proportions from Himalayan populations.

Payne also predicts possible commercial uses for this type of study. "Being aware of the effects of [body composition](#) on how cold your hands get is crucial. For example, women and children are less likely to have a high [muscle mass](#) so cold-weather gear, such as gloves, should be

produced and marketed with that in mind."

Stephanie is part of the Phenotypic Adaptability, Variation and Evolution (PAVE) group and is a current PhD student and recipient of a Trinity Hall Graduate Research Studentship

More information: Stephanie Payne et al, Body size and body composition effects on heat loss from the hands during severe cold exposure, *American Journal of Physical Anthropology* (2018). [DOI: 10.1002/ajpa.23432](https://doi.org/10.1002/ajpa.23432)

Provided by University of Cambridge

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