The ‘Physiological’ need to Adapt

The role of physiology in delivering on climate change adaptation goals

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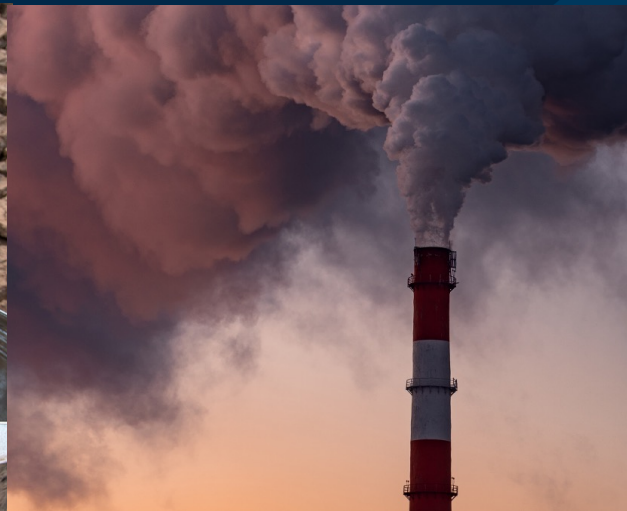


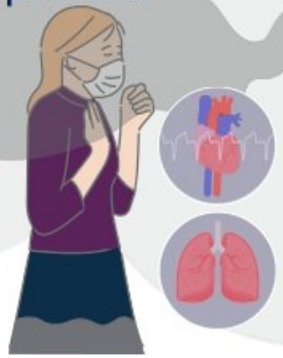
Climate & physiology

“Climate change is the single greatest threat to a sustainable future but, at the same time, addressing the climate challenge presents a golden opportunity to promote prosperity, security and a brighter future for all.”

Ban Ki-Moon, Former Secretary-General of UN

Physiology is an **essential** part of the **scientific response** to climate change as it helps us understand the consequences on the **human body.**

Rising temperatures



Air pollution

Extreme events

Food and water safety

Need for sustainable nutrition

Poor mental health

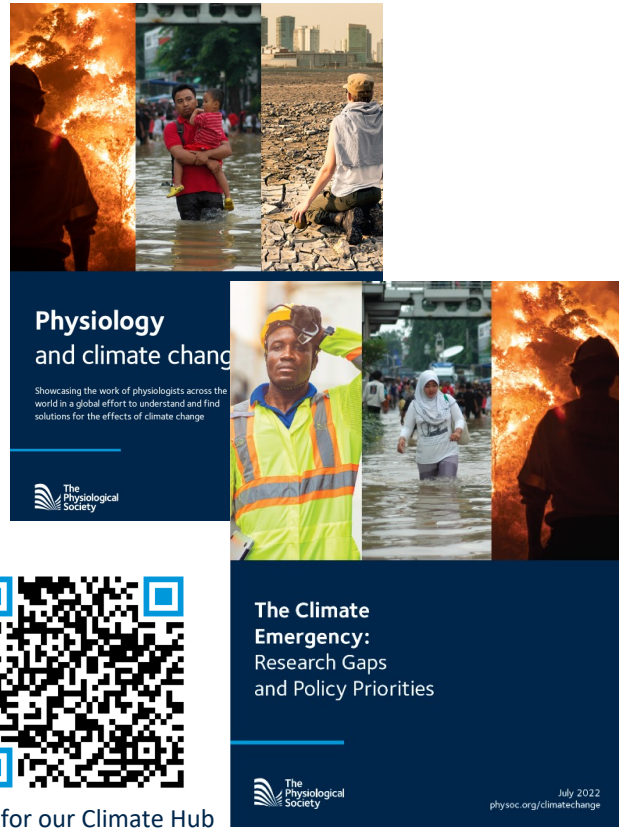
The Physiological Society

Physiology explains the **impact** of climate change on the very **future of our species.**

physoc.org/climatechange

The Physiological Society & Climate Change

- Climate Change Hub (physoc.org/climatechange)
- *Physiology & Climate Change* - **November 2021**
- Roundtable with Wellcome Trust - **January 2022**
- *The Climate Emergency: Research Gaps & Policy Priorities* - **July 2022** and.
- Event with Foundation of Science and Technology - **July 2022**.
- Events with the Parliamentary & Scientific Committee in **January 2022** and **November 2022**.
- Planned summit on the Impact of Extreme Heat on Vulnerable Populations is scheduled for autumn **2023**.



Scan for our Climate Hub

Physiology & Climate Adaptation

- Physiological research is essential to climate adaptation, for example:
  1. **Physiological responses to extreme heat:** Using thermal physiological principles to keep people cool without relying on energy consuming air conditioning systems. E.g. modification of the skin temperature at which individuals feel hot, allowing people to feel cool in warmer temperatures.
  2. **Protecting vulnerable populations:** Including older people, disadvantaged groups, people with co-morbidities, pregnant women. E.g. Understanding the physiological pathways through which maternal heat strain is passed on to the foetus to develop public health guidance for pregnant women.
  3. **Sustainable, healthy diets:** As climate change impacts food production, nutritional physiology is required to maintain healthy diets that meet our body's requirements. E.g. development of sustainable proteins.
  4. **Develop effective countermeasures:** Informing the development of effective tools such as PPE kits and safe working practices for people working in extreme environments. E.g. early warning systems ahead of heat waves.
  5. **City and building design:** Urban planning can help develop cooler spaces which achieve greater levels of thermal comfort and reduce the reliance on air conditioning. E.g. bringing together physiologists, botanists, architects and local government planners to develop green cities.

Temperature regulation

- Heat resulted in 3,271 excess deaths in 2022
- The determination of the conditions that are safe and acceptable to humans is underpinned by an understanding of the physiology and pathophysiology of temperature regulation

International Journal of Biometeorology
https://doi.org/10.1007/s00484-021-02105-0

ORIGINAL PAPER

An advanced empirical model for quantifying the impact of heat and climate change on human physical work capacity

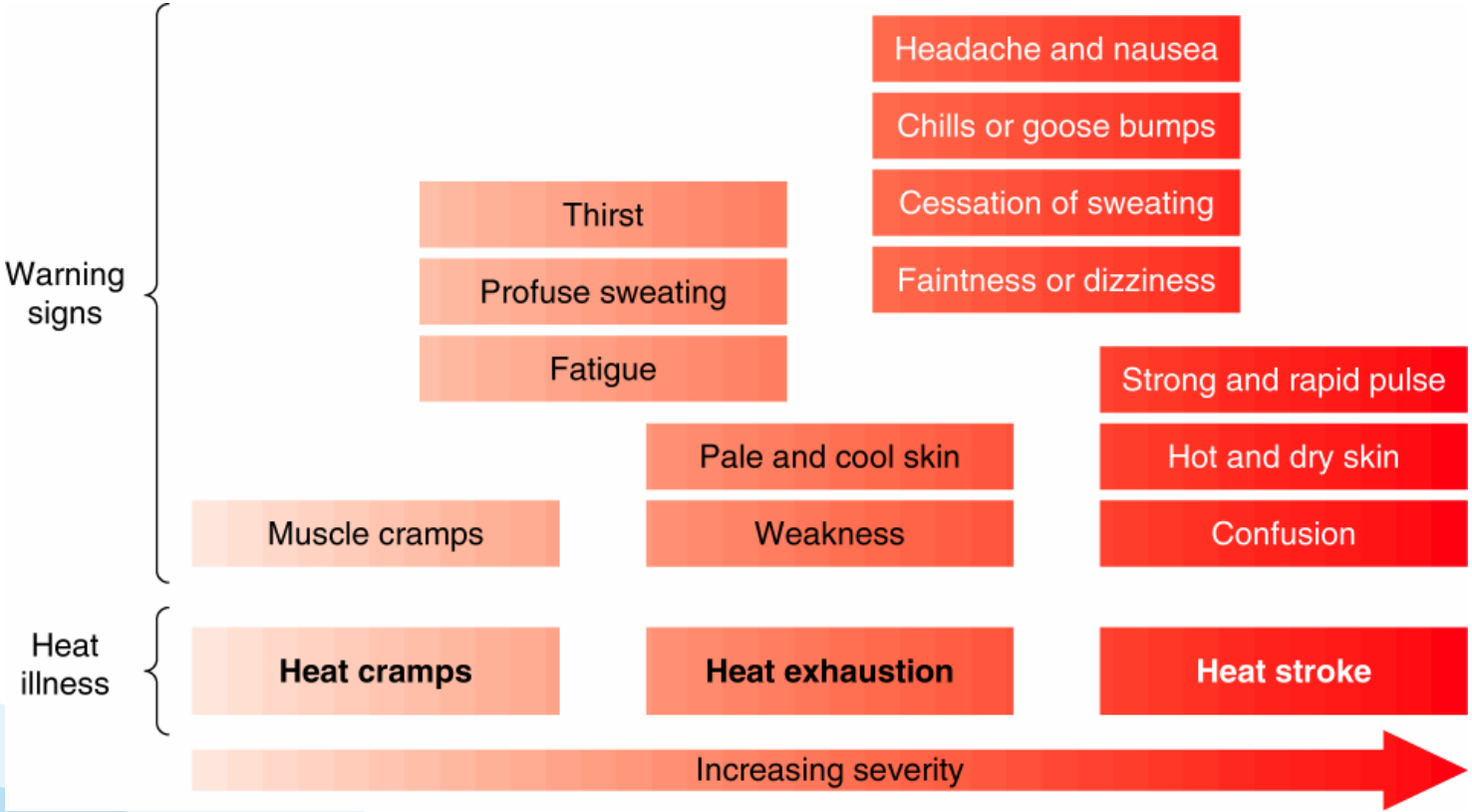
Josh Foster[1] · James W. Smallcombe[1] · Simon Hodder[1] · Ollie Jay[2] · Andreas D. Flouris[3] · Lars Nybo[4] · George Havenith[1]

- Human exposure to increased environmental heat directly impacts the global economy by decreasing occupational productivity. Cost:
  - Australia EUR 5.52 billion per year
  - Germany EUR 3.02 billion in 2004

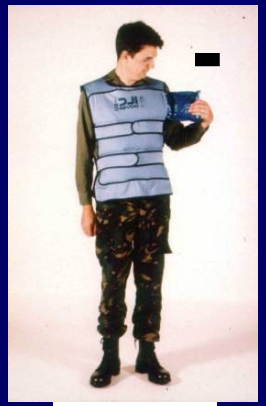
Zander et al, 2015; Hübler et al, 2008; Foster et al 2021

Warning signs of heat disorders

The Physiological Society



Cooling equipment & approximate powers



40-75W

200-350W

200W

350+W

300W

300W

30W

Cycling - Athens 2004, Beijing 2008, Rio 2016, Tokyo 2020(1)

Sir Chris Hoy

Sir Bradley Wiggins

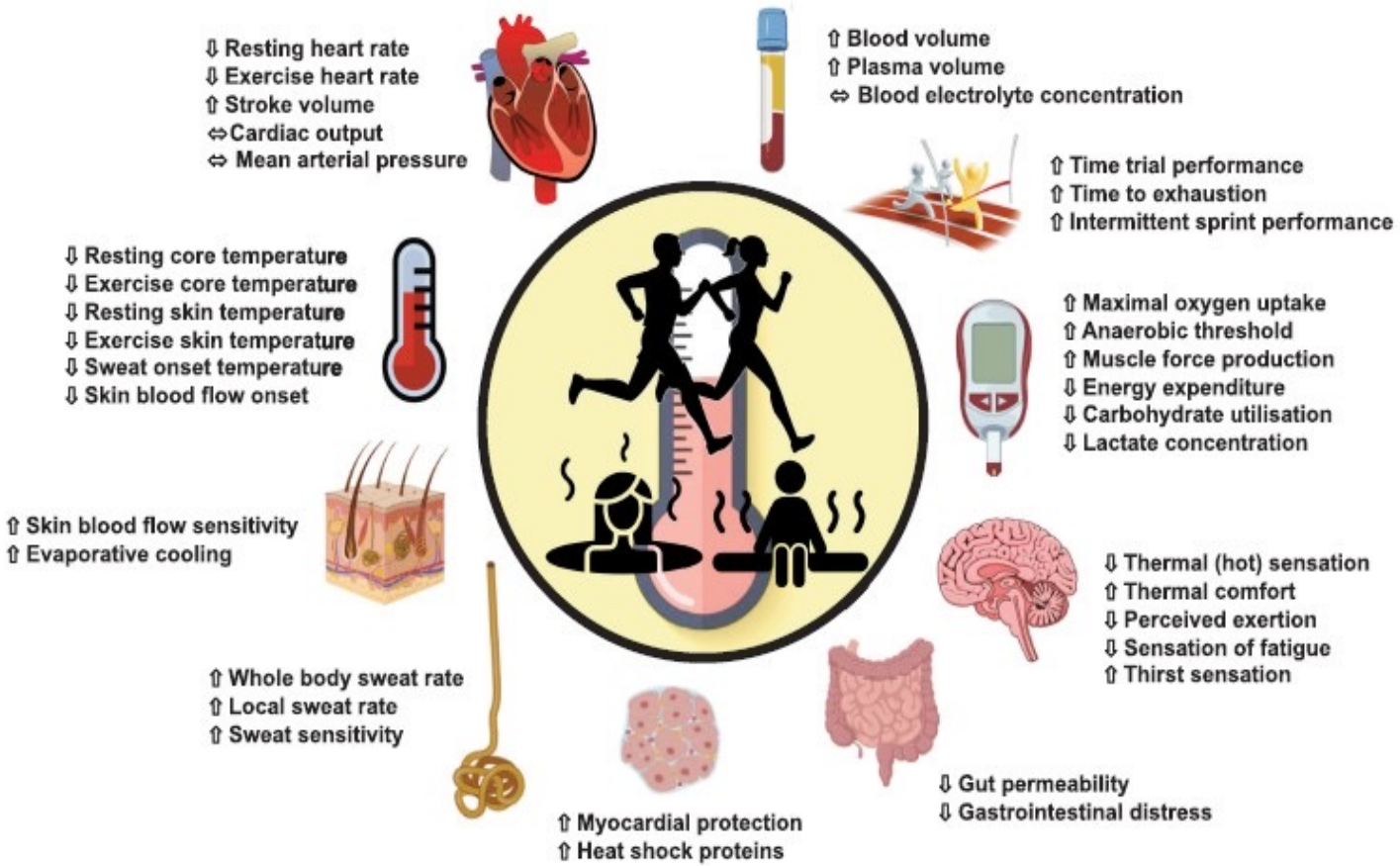


Figure 1. Summary of adaptations to thermoregulatory and performance physiology following exercise heat acclimation.

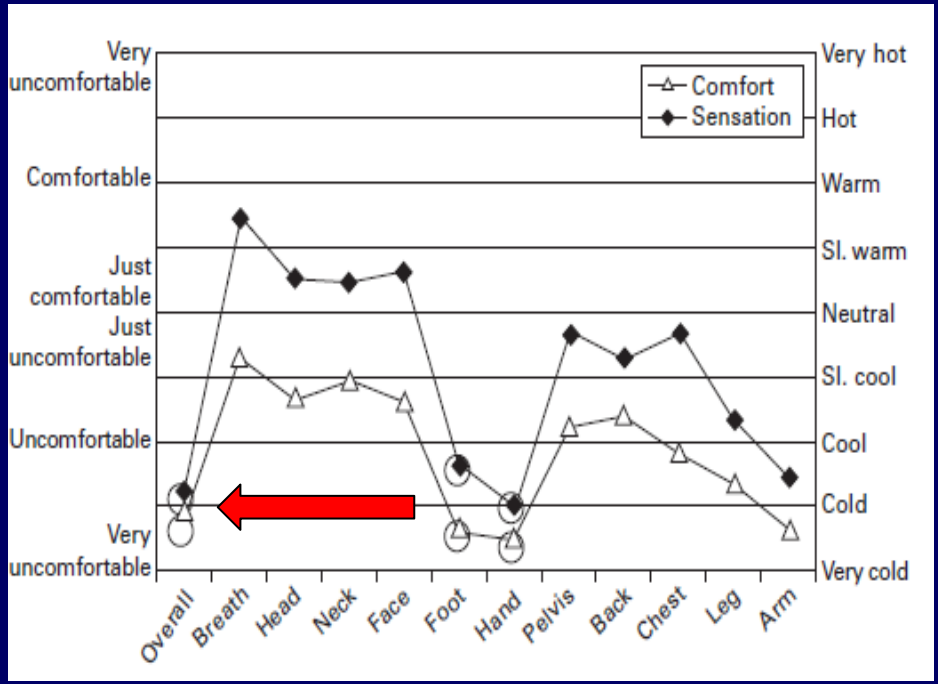
Gibson et al (2020)

Thermal Comfort

- Behaviour is driven by the perception of thermal comfort
- An understanding of the determinants of human thermal comfort is a prerequisite for the design of acceptable environments

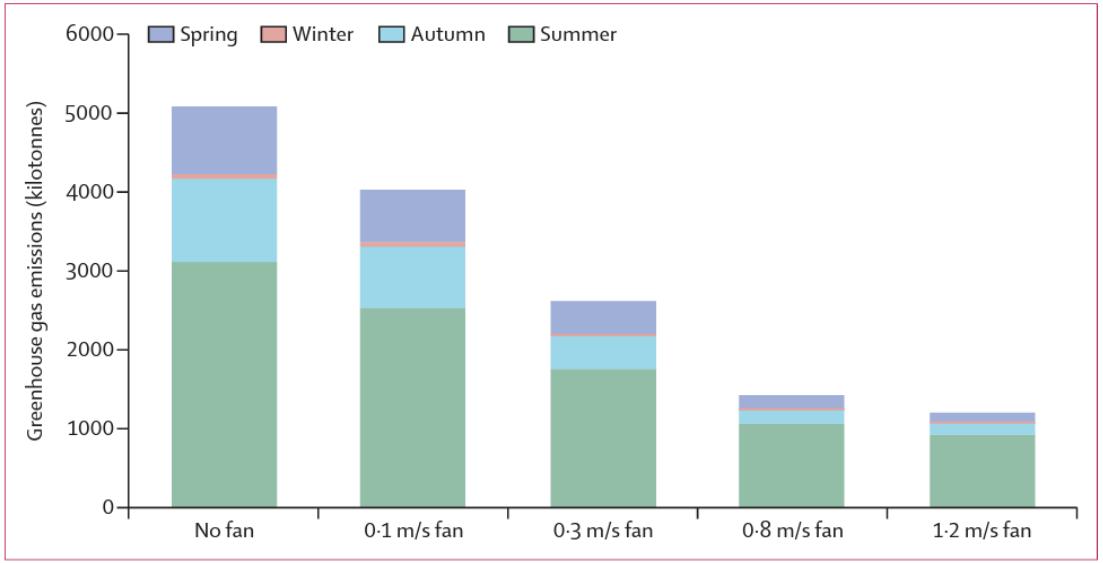
Ratio of regression coefficients (Tc/Tsk):
Thermal comfort (1:1)
Vasomotor changes (3:1)
Metabolic heat production (3.6:1)

(Chatonett & Cabanac, 1965; Frank et al, 1999)



Adapted from Zhang (2003)

Cooling differently



If we increase air velocity across the skin the thermal comfort threshold temperature is increased by 3-4 °C

Ollie Jay. The Heat and Health Research Incubator, University of Sydney

Conclusion

- An understanding of how the body works normally and responds to challenge, is a prerequisite for the maintaining of health, optimal capability and comfort
- This understanding comes from physiology

Any questions?

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