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FRONT MATTER: EDITORIAL

Global heating: Attention is not enough; we need acute and appropriate actions

Introducing HEAT-SHIELD ambitions for inter-sectoral collaboration to tackle temperature issues related to workplace heat

"Welcome to the world of *Temperature*!" With these words the present journal was launched as a publication with special focus on temperature issues and their essential importance for life.[1] The shared focus and international collaboration is more relevant than ever as our future world will involve more heat and increased prevalence of heat-induced issues. Even with the least pessimistic climate scenarios predicting only small increases in the average global temperature, we will face higher frequencies of heat waves and marked increase in the total number of hot days in the vulnerable regions of the world.[2]

Scientists in thermal physiology, occupational epidemiology, and climate research focusing on workplace heat impacts have repeatedly observed the immense impact that current heat situations have on humans. Given the projected worrying climate scenarios, it is urgent to tackle the temperature issues and to collaborate among different disciplines to improve heat resilience and mitigate the detrimental effects of rising environmental temperatures. For the workers exposed to environmental heat or heat stress due to industrial heat production, the problems are also very pertinent (see, e.g., refs. 3 and 4), whereas the proximity of the problem may vanish in the air-conditioned political office far away from the occupational settings. For company managements, the incentive to address the heat issue may be particularly high when productivity becomes affected or when workers need to be sent home because they got sick from heat-related issues. For both the public and private policy/decision maker, the associated financial issues often generate concerns about how to address the heat and health problems—what will it cost if I have to install additional cooling, is it even possible and won't it be detrimental to productivity if we strive to improve the workers' health and well-being? However, not only direct productivity losses will impact economy of an enterprise and we emphasize that the epidemiological aspects also should be a part of the decision-making evidence.

The balance between interests calls for inter-sectoral collaboration and the conversion of good intensions into action. Combined with a strong belief that improved health and productivity, in fact, can and should go hand-in-hand, these considerations are some of the cornerstones in HEAT-SHIELD, an inter-sectoral research project funded by the European Union (http://cordis.europa.eu/project/rcn/200678_en.html). The project is dedicated to improve heat resilience in European workers and provide know-how to the European community ranging from the individual citizen to public and private policy makers to implement methods and procedures that may secure health and productivity during present and future climatic scenarios. However, HEAT-SHIELD is also dedicated to collaborate with researchers all over the world and exchange knowledge on how sustainable and feasible solutions can be implemented and how scientific knowledge can be translated into actions that may be adopted by workers and policy makers.

The project's mission would be easily achieved if we, literally, could provide a shield toward all heat sources, but air-conditioning or other artificial approaches are far from feasible in many occupational settings and they are often very energy consuming implying a heavy burden on the economic bottom line, and, unless produced by sustainable sources, also detrimental to the global green bottom line. The ambitions and aims of the HEAT-SHIELD project are illustrated in our logo (see Fig. 1), where the red temperature sign signifies the temperature

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Figure 1. The HEAT-SHIELD logo with the read temperature sign signaling the potential danger of excessive heat stress and hazard to human health. The dark green font represents the complementary color to the red risks and symbolizes the HEAT-SHIELD dedication to improve heat resilience in workers and provide knowledge to the community ranging from the individual citizen to public and private policy makers to implement methods and procedures that may secure occupational health and productivity during present and future climatic scenarios.

issues associated with working under high heat stress and the dark green font indicates our ambitions of producing sustainable solutions to counter-act the detrimental influence of excessive workplace heat.

What can we do and what can you do?

Occupational heat stress has been an issue for ages[3] and it is quite clear that problems will aggravate leading to a very difficult future ahead and, from a physiologic perspective, will become nearly impossible task to tackle if global temperatures keep rising. Thus, the heat load in tropical and sub-tropical regions will become massive and spread into the temperate climate zones.

Experiencing effects on your own body is often an eye-opener and some stakeholder climate organizations take politicians on "observation journeys" to dessert or arctic areas to make problems pertinent and visualize how rising temperatures affects our globe. In HEAT-SHIELD, we also intend to "narrow the distance" between the actual problems and the public and private policy makers. It is clear that the global perspective requires that public and private organizations, industries, producers, providers, and consumers of energy collaborate and do not neglect the problem. Ice melting in the artic areas or drought in dessert may provide powerful pictures and seem to persuade some politicians to take action. Analogously epidemiological analyses quantifying the number of victims during heat waves or providing pictures with the prognoses of large tropical areas becoming unsuitable for living (implying mass migration) are warranted to show the spread of heat problems including how these will increase and become a global issue if not dealt with. We do not want to provide obscure or erroneous pictures, but balanced yet clear and apparent analyses identifying the magnitude of the problems. However, pilot HEAT-SHIELD field studies in southern Europe (see ref. 4) indicate that the loss of working hours and, hence, the economic impact is considerable. In the upcoming years, larger-scale observational studies combined with smaller intervention studies will further document the problems and demonstrate practical prevention methods. Studies will test and validate the "real-life" impact of sustainable solutions that are feasible to implement even in small- or medium-sized companies.

The need for these types of field/case studies relate to the lack of direct transferability from laboratory-generated knowledge to outdoor or occupational settings. This is exemplified by the observations that cognitive performance in many laboratory studies remains unaffected even at the maximal tolerable heat stress, whereas performance in professions dominated by cognitive tasks seems to be markedly affected by heat stress. In contrast, for vigorous exercise performance the influence of a given temperature level (translated into prevailing heat indices such as WBGT or UTCI) in the laboratory is often much larger than similar temperature levels in an ecological setting.[5] However, subsidiarity and feasibility are the main motivation for the field studies that will lead to the screening of solutions that subsequently will be publicly available via an open access portal that also will provide individual advice and local heat warnings for subscribers (workers, managers, and organization than can use the service for free). Some professions e.g., firefighting and the gold mining industry have a long history of

research in high-tech interventions, individual guidance, and acclimatization procedures that may be used for inspiration, but industry- and region-specific solutions must be considered and the importance of translation of knowledge into practical solutions should not be neglected.

Actions must also be economic as policy makers and business managements with that focus may worry that improved occupational health is detrimental to productivity. However, via the proof of concept and exemplification through case studies in five different strategic industries representing approximately half of the gross domestic product across the world and through involvement of the management in such industries, it is our ambition to provide evidence and examples for the inspiration and/or generalization of the idea that improved health and productivity can go hand-in-hand. In fact, the "black, red, and green bottom lines" should be considered together and the HEAT-SHIELD project intends to tackle the heat issue with a holistic approach. We believe that this is a very important driver for action and actual implementation of sustainable solutions.

The present journal has the logo "Temperature is life" and emphasizing that thermal balance and work-life balance are of major importance for occupational health, we believe that *Temperature* can be a central venue for the scientific focus, sharing of knowledge, and global collaboration to tackle future climate change challenges. The HEAT-SHIELD project intends to contribute strongly and welcomes researchers worldwide to join, discuss, and, most importantly, take action in their specific geographical and expertise areas.

References

[1] Romanovsky AA. New research journals are needed and can compete with titans. Temperature. 2014;1(1):1-5. doi:10.4161/temp.27666.

[2] IPCC. Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of working groups I and II of the intergovernmental panel on climate change, CB Field, V Barros, TF Stocker, D Qin, DJ Dokken, KL Ebi, MD Mastrandrea, KJ Mach, G-K Plattner, SK Allen, M Tignor, PM Midgley (Eds.). Cambridge, UK: Cambridge University Press; 2012.

[3] Schneider S. Heat acclimation: gold mines and genes. Temperature. 2016;3(4):527-538; PMID:28090556. doi:10.1080/23328940.2016.1240749.

[4] Ioannou L, Tsoutsoubi L, Samoutis G, Bogataj LK, Kenny GP, Nybo L, Kjellstrom T, Flouris AD. Time-motion analyses as a novel approach for evaluating the impact of environmental heat exposure on labor loss in agriculture workers. Temperature. 2017;4(3):330-340. doi:10.1080/23328940.2017.1338210.

[5] Junge N, Jørgensen R, Flouris AD, Nybo L. Prolonged self-paced exercise in the heat—environmental factors affecting performance. Temperature. 2016;3(4):1-10. doi:10.1080/23328940.2016.1216257.

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