

## PRELIMINARY OBSERVATIONS AND CONCLUSIONS

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### INTENTION

It is virtually impossible to highlight all the new facts, the progress and the discussions emerging from this conference, in view of the large number of papers and the briefness of the papers. The oral discussions may add considerably to the written text and has not yet taken place. However, we feel that we should at least attempt to analyze the trends and developments. We are aware of the fact that such an analysis may show a bias, depending on our personal knowledge and interest.

### CONTENTS

About one hundred qualified and interesting papers have been accepted from all over the world. The East-European scientists showed their interest in participation, which is currently frustrated by insufficient financial support. The traditional dominance of West-European and North-American countries is being counteracted by participants from many other places. The contributions have been grouped in 15 topics, dealing with all aspects of the thermal environment, but also with non-thermal aspects of work. The main topics proved to be heat strain control, thermoregulation, work in the cold, and clothing and materials.

### TRENDS

A general trend is that few papers have been submitted dealing with coarse observations, as happened often in the past. Instead, many papers deal with a deeper analysis of physiology and heat transfer, showing that progress is being made.

The interest in heat strain has shifted from general heat strain to the breakdown of individual variance in heat strain. Relatively many papers deal with the influence of age, mainly from Japanese who are studying socially determined activities, but fitness seems to be the predominant factor. Systematical separation of the factors (fitness, age, gender, fatness, acclimatization, body size) is not yet common.

Progress is being made in the generalization process of clothing insulation and vapour resistance values. Tools are becoming available to estimate insulation in a reference condition and the effects of motion and wind on insulation. The mechanisms of wet and dry heat transport inside clothing are analyzed in a physical way, studying condensation and absorption.

Mathematical modelling is becoming a powerful tool for the study of heat transfer processes. Many applications include so many variables that experimental approach is too expensive and the problem too complex to oversee. By means of model studies the heat balance in the extremities is studied, the heat and moisture transfer in clothing, and the human heat balance in outdoor conditions. Models have become accepted as a database compilation and are no longer restricted to specialists publishing in not application oriented journals.

As a spin off of the Gif conflict many heat control protocols and devices are being developed. Prominent are the cooling garments. Effectivity and feasibility have been shown, but there is a power requirement problem, restraining their use. Heat strain control by protocol is still widely investigated.

### TOPICAL DEVELOPMENTS

- The production technology of semipermeable materials has so advanced that the porosity can be controlled and within limits be adjusted to the desired value.
- Functional design of clothing continues; next to comfort safety plays an increasing role.

- Inspired by European standardization activities the safety aspects of touching hot and cold surfaces are studied.
  - Finger temperature or finger blood flow is gaining in interest as an indicator of the thermal state of the body, both with regard to thermal control and **CIVD**, and also to study age differences.
  - Very elegant equipment for active noise reduction and tympanic contactless temperature measurement has been developed.
  - The effects of wearing protective clothing on the wellbeing of workers is **becoming** subject of study.
- A shift in approach of fire-fighting heat strain is observed, more studies being done in (simulated) field conditions compared to laboratory studies.

#### TOPICAL LACK OF DEVELOPMENT

- There is a drive for integration of protection against various threats into single materials, in view of the bulk and weight of the clothing. Integrated materials are shown, but relatively few.
- Thermal sensation for clothed persons is more complicated than for nude. The use of psychological methods is indicated, but better progress is waiting for implementation of these methods on a larger scale. One good example is shown.
- Few papers deal with heat acclimatization. However, some papers deal with the still debatable effects of cold acclimatization.

#### DISCUSSIONS

- The discussion of the importance of counter-current heat exchange for heat conservation keeps going on. Effectivity of CC heat exchange seems difficult to define.
  - Stroke volume is proposed as a criterion value for heat and exercise tolerance, superior to heart rate or core temperature.
  - There is a renewed interest in the calculation of body heat content in cold conditions. The usual weighing between core and skin temp may deviate largely.
  - The influence of body composition on cold tolerance is being confirmed.
- A strong belief in the existence and relevancy of selective brain cooling is expressed. It is not sure if this ends the discussion.

#### OTHER REMARKS

It has been shown increasingly difficult to obtain industrial sponsorship for conferences. We thank W.L. Gore and Associates for their generous support.

The number of participants tends to drop to the the number of speakers. This is due to the general policy not to provide travel funds if not a presentation is given. This sure enough is good for the active participation of all, but increases budgetary problems.

-NOTES-

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# Indices

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d'Ambrosio, F.R. 84  
An, S.K. 26  
Anthony, A. 110  
Anttonen, H. 192  
Aptel, M. 94  
Avellini, B.A. 226  
Banta, G.R. 12, 14, 228  
Barker, R.L. 26  
Bell, G.W. 2  
Benedictis, P. De 204  
Bennett, B.L. 12  
Berger, X. 172  
Bergh, U. 176, 6  
Björklund, R.A. 98  
Blazejczyk, K. 82, 142  
Boie, H. 164  
Bomalaski, S.H. 232  
Bortkiewicz, A. 206  
Bossi, L. 96  
Bothorel, B. 218  
Boucher, S.H. 28  
Brinck, H. 132  
Bristow, G.K. 56  
Bröde, P. 18  
Buono, M.J. 14, 228  
Cabanac, M. 214, 220  
Candas, V. 22, 94, 218  
Cben, F. 60  
Chen, R. 162  
Chen, Y.T. 232  
Cordier, A. 32  
Daanen, H.A.M. 106, 222  
Danielsson, U. 6, 70, 116  
Desruelle, A-V. 218  
Dirks, E. 162  
Ducharme, M.B. 104, 128  
Edwards, E. 36, 36  
Endrusick, T.L. 188  
Enomoto, H. 120  
Epstein, Y. 108  
Farnworth, B. 148, 150  
Fortuin, H.M. 170  
Fothergill, D.M. 208  
Frim, J. 96  
Gadzicka, E. 206  
Gavhed, D.C.E. 66, 76, 114  
Giesbrecht, G. 42, 56  
Goodfellow, E.A. 38, 184  
Grahn, S. 66, 16  
Granberg, P-O 54  
Griefahn, B. 18  
Grivel, F. 22  
Gruchala, J. 206  
Guidoin, R. 162  
Guthe, T. 98  
Hagan, R.D. 12  
Hassi, J. 62  
Havenith, G. 8, 74, 236  
Hayashi, C. 158  
Heaney, J.H. 14, 226, 228  
Hedges, D. 208  
Herrmann, C. 22  
Heslegrave, R. 96  
Heus, R. 152  
Hexamer, M. 180, 230  
Hoelt, A. 22, 218  
Holmér, I. 60, 66, 76, 82, 174  
Holmes, C. 210  
Hong, K. 24  
Hong, S. 68  
House, J.R. 210  
Hunold, S. 180, 230  
Ilmarinen, R. 16, 90  
Imamura, R. 158  
Inoue, Y. 8  
Isoda, N. 120  
Jeong, W.S. 216  
Jozwiak, Z. 206  
Jung, S-K. 24  
Kajaste, T. 88  
Kanda, K. 198  
Keefe, A.A. 4  
Kempainen, R. 16  
Kenney, W.L. 2, 8  
Kielblock, J. 100  
King, M.W. 162  
Klüwer, L.D. 98  
Korhonen, O. 122  
Koszada-Wlodarczyk, W. 206  
Krasnecky, D. 166  
Kubo, H. 120  
Kulsrud, A-H. 98  
Laakkonen, A. 16  
Laapio, H. 62  
Lindhölm, H. 16  
Lindhölm, T. 16  
Livingstone, S.D. 4  
Li, X. 216  
Llewellyn, M.G.A. 156  
Lotens, W.A. 30, 50, 74, 106, 152, 222, 236  
Louhevaara, V. 88  
Lun, V. 42  
Lusa, S. 88  
Madsen, T.L. 12  
Mäkinen, H. 90, 194  
Mäkinen, T. 200  
Makowiec-Dabrowska, T. 206  
Malchaire, J.B. 140  
Maw, G.J. 28  
McCullough, E.A. 68  
Meinander, H. 40

- Mekjavic, **I.B.** 42, 196  
Menzies, R.W. 162  
Millard, C.E. 92, 160  
Mittleman, K. 110  
Monchoux, F. 32  
Moran, **D.** 108  
Morariu, **G.I.** 186, 196  
Morrison, **J.B.** 208  
Moyer, R. 166  
Nelson, **D.A.** 134  
Nevola, V.R. 156  
Nielsen, R. 72, 154  
Nilsson, H.O. 60, 66, 76, 82, 174  
Niskanen, J. 192  
Nolan, R.W. 4  
Nunneley, **S.A.** 134  
Ohnaka, T. 114, 116, 118, 198  
Oksa, J. 200  
**Ota**, K. 198  
Palczynski, C. 206  
Parsons, K.C. **46**, 144  
Pimental, **N.A.** 226, 228  
Popplow, J. 96  
Provenzale, D. 110  
Pyykkö, I. 122  
Radwan-Wlodarczyk, Z. 206  
Raman, E.R. 130  
Riccio, G. 84  
**Rijswijk**, **A.W.** van 204  
Rintamäki, H. 62, 192, 200  
Rissanen, S. 62  
Rodahl, K. 98  
Sari, H. 172  
Sawicki, J. 166  
Schneider, M. 172  
Schwarzenau, P. 18  
Scruggs, **B.** 26  
**Serin**, G. 32  
Seto, M. 198  
Shalev, I. 26  
Shapiro, Y. 108  
Shodai, Y. 198  
Smolander, J. 62, 122, 88  
**Sun**, J. 42  
Taylor, N.A.S. 28  
Thellier, F. 32  
Thomas, N. 48  
Tiemann, **A.** 164  
Tikuissis, P. 104, 126, 128  
Tipton, M.J. 58  
Tochihara, Y. 114, 116, 118, 198  
Toftum, J. 72, 154  
Tokura, H. 158, 216  
Tsuchiya, J. 198  
Tsuzuki, K. 114, 118  
Tulppo, M. 88  
Tuomi, P. 88  
Tuzuki, K. 198  
Uglene, **W.** 150  
**Viljanen**, **A.** 16  
Vrikkotte, T.G.M. 30  
Wammes, L.J.A. 30, 152, 222  
Warrell, A. 166  
Watanabe, Y. 116  
Webb, P. 136, 138  
Werner, J. 132, 138, 180, **230**  
White, M.D. 220  
Williams, F.W. 12  
Wilmore, K.M. 14, 228  
Wmdle, C.M. 58  
**Xu**, **X.** 182  
Yamashita, **Y.** 158  
Yanase, T. 120  
Yermakova, I. 80  
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Zappe, D.H. 2  
Zheng, **J.C.** 164

## Subject index:

- ability 88, 226
- active 38
- acute 16
- age 8, 114
- air cooling system 232
- air velocity 120
- aircraft passenger cabin 36
- angiotensin blockade 110
- applications 142
- aramid workwear fabrics 26
- atmospheric 194
- ballistic vests 30
- bath 116
- bathing 196
- bathroom 196
- biaxially 170
- bioclimatology 142
- blood 132, 222
- body composition 56
- body heat storage 8
- body movements 66
- body temperature 4, 98, 136, 118
- brain cooling 214
- branching 132
- buoyant 150
- cardiovascular strain 228
- chemical defence operations 96
- children 116
- climate 8, 108, 18
- clothing 32, 72, 76, 108, 154, 162, 176, 216
- clothing air layers 70
- clothing **comfort** 40
- clothing design 148
- clothing ensemble 74, 22
- clothing insulation 66, 68, 174
- cold 28, 54, 58, 192
- cold acclimation 216
- cold acclimatization 62
- cold induced vasodilation 106
- cold protection 190
- cold water 194
- cold water immersion 42
- cold weather 156
- comfort properties 24, 26
- condensation 176
- contact temperature 144
- contract research 50
- control 80, 230
- convection 70
- convective 128
- convergence 12
- cooling 60, 136, 198
- cooling garment 182, 180, 226, 230
- core 12
- core temperature 58
- counter current 130, 132
- cylinder 138
- density 164
- dilatation 220
- diving 164, 194
- drying 72
- elderly 120
- electric arcs 162
- environment 36, 94, 180
- environmental ergonomics: 46
- esophageal 222
- evaporative 218
- evaporative heat transfer 76
- exercise 6, 14, 110, 114, 118, 122, 218, 220
- fat 198
- fatigue 14
- females 110, 204
- finger 60, 62, 104, 106, 122
- fire fighting 12, 88, 90, 152
- fitness 8
- flame 166
- flow 132, 222
- food industry 192
- footwear 156
- hand 222
- head 190
- head cooling: 134
- headgear 190
- headsets 184
- heart rate 8, 14
- heat 14, 74, 110, 140, 226, 228
- heat exchange 142
- heat illness 16
- heat **loss** 72
- heat production 104
- heat savings 130
- heat storage 136
- heat strain 12, 90
- heat stress 2, 92, 100
- heat tolerance 16
- heat transfer 126
- hot 94, 116
- hot dry 18
- hot surfaces 144
- humidity 76
- hyperbaric 164
- hypercapnia 206
- hyperthermia 56, 208, 220
- ignitability 164
- immersion 56, 58, 116
- in ear 38
- individual 2, 62
- indoor climates 22
- industrial 100
- infantry 166
- infra red 42
- injury 54
- insulation 130, 150
- integrated 184

- inter individual 6
- knits 24
- laser 166
- layer 26
- legal 48
- legs 116
- light 190
- limbs 128
- liquid 182
- low friction 210
- males 110, 204
- management: 100
- material surfaces 60
- materials 148, 158, 164
- memory 206
- microclimate 226
- microclimate cooling 228
- military 160, 16, 92
- model 32, 74, 126, 134, 138, 142
- moisture absorption 76
- multiman 232
- muscular performance 198
- nares 220
- nitrogen narcosis 206
- noise reduction 38, 184
- normotensive 110
- old 118, 122
- outdoor 118
- oxygen 108, 164
- perceived 24
- perception 22
- personal protective equipment 48
- physical fitness 204
- pilots 96
- porous 170
- portable 232
- protection 166, 192
- protective clothing 94, 152, 158
- protective garments 6
- protective helmets 98
- psychomotor performance 98
- quality 50
- respiratory 208
- respiratory simulator 186
- rewarming 42, 56, 136
- seasons 118, 216
- sedentary 22
- sex 114
- shipboard 12
- skin 12, 144
- skin temperatures 22
- slaughterhouse 154
- sleeping bags 160
- solar heat load 82
- step rate 174
- strategies 210
- stress 4, 128, 202
- stroke volume 14
- subcutaneous 198
- summer 120
- surfaces 210
- sweat 140, 158, 218
- sweating thermal manikin 40
- synchronization 106
- synthetic fibre 160
- temperature 12, 14, 114, 218, 222, 230
- textile 158, 172
- thermal 116, 122, 128, 132, 196
- thermal balance 194
- thermal discomfort 30
- thermal environments 84
- thermal insulation 156
- thermal manikin 66, 174
- thermal physiological 182
- thermal sensation 28, 32, 118
- thermal state 22
- thermal strain 96, 220, 226
- thermoregulation 80, 138, 216
- threshold 222
- tolerance 226
- touching 60
- tympanic thermometer 42
- uhmw-pe films 170
- uniform 22
- vapour resistance 172
- vapour transfer 74
- visualization 172
- volitional fatigue 14
- volumetric pump 186
- walking 68, 210
- warm 180
- warm humid 18, 8
- warming 58
- water 42, 58, 116, 128, 156
- water vapour permeable 150
- wet 72
- wind 66
- winter 76
- work 8, 28, 88, 204, 226, 228
- work load 180
- workers 154, 162
- working environment 202
- young 118
- younger 122

-NOTES-

-NOTES-

