

Curriculum vitae

Povl Ole Fanger

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Academic Degrees

Professor Honoris Causa, Harbin Institute of Technology, China 2005
Doctor Honoris Causa, Syracuse University, USA, 2005
Doctor Honoris Causa, Technical University of Sofia, 2004
Doctor Honoris Causa, Catholic University, Leuven, Belgium 2004
Professor Honoris Causa, Tsinghua University, China, 2004
Doctor Honoris Causa, Hokkaido University, Sapporo, Japan, 2004
Doctor Honoris Causa, Technical University of Civil Engineering, Bucharest 2003
Professor Honoris Causa, Tianjin University, China, 2003
Doctor Honoris Causa, Silesian University of Technology, 2003
Doctor Honoris Causa, Moscow State University of Civil Engineering, 2002
Doctor Honoris Causa, Slovak University of Technology, 2002
Doctor Honoris Causa, University of Coimbra, Portugal 2001
D.Sc., Technical University of Denmark, 1970
M.Sc. in civil engineering, Technical University of Denmark, 1957

Academic Appointments

University Professor, Syracuse University 2006-
Senior Professor, Technical University of Denmark, 2004-
Distinguished Visiting Professor, National University of Singapore, 2001
Director, International Centre for Indoor Environment and Energy, 1998-2003
Professor, Technical University of Denmark, 1977-2004
Associate professor, Technical University of Denmark, 1967-77
Research associate, Institute of Environmental Research, Kansas State University, 1966-67
Assistant professor, Technical University of Denmark, 1959-66

Research

During more than 30 years, in charge of the indoor environmental research at the Technical University of Denmark. His research work over three decades has contributed to identifying the prime importance of the indoor environment for the quality of human life. Extensive interdisciplinary

studies have been conducted on the effect of the indoor environment on human comfort, health and productivity and on energy utilization in buildings.

In 1998 he received a 10-year Danish Government grant to establish a new Engineering Research Centre for Indoor Environment and Energy at the Technical University of Denmark. Dr Fanger became the first Director of the International Centre and the total grant is more than 15 million Euro. The grant enabled him to headhunt a number of world-class researchers to the Centre which became truly interdisciplinary, covering not only classic engineering disciplines but also medicine, chemistry and psychology. This enabled him furthermore to build new environmental chambers, unique in the world. After five years, the Centre was subjected to an international evaluation that declared it the world's best research centre within the field of Indoor Environment and Energy. The Centre comprises now more than 60 persons, including 40 graduate students, from 15 nations.

Introduced early indices for the quantification of thermal sensation and comfort (PMV/PPD). Identified the significance of turbulence intensity of an airflow for the perception of draught and quantified the effect in a new model for draught risk. Introduced models predicting discomfort caused by radiant asymmetry and by vertical air temperature gradients. These models are used in international, European and national standards and guidelines in many countries for the design, operation and development of buildings and their heating, ventilating and air-conditioning systems. The models are also used for analysis, comparison and optimization of building and environmental systems, and have been used as the basis for development of advanced instruments for measurement of thermal environment and thermal comfort.

Suggested sensory units for perceived air quality, the olf and the decipol, analogous to the corresponding units for light (lumen and lux) and for sound (Watt and decibel). Developed a comfort model for indoor quality predicting perceived air quality in the indoor environment and required ventilation in buildings. Showed in extensive field studies that pollution from building materials, processes and HVAC systems is often a major reason for poor indoor air quality. He and his associates showed for the first time that electronic devices, in particular personal computers, can be strong pollution sources. Demonstrated in practice how improved indoor air quality and decreased required ventilation can be achieved by a reduction of superfluous pollution sources. He and his associates established that the humidity and temperature of air has a strong and hitherto ignored impact on perceived air quality and ventilation requirements in buildings. They identified for the first time a significant impact of indoor air quality on human productivity and on Sick Building Syndrome symptoms, a relationship that has been demonstrated in seven independent studies in the laboratory and in the field.

Honours and Awards

Has received 76 honours and awards in 29 countries.

Honorary Doctorates/Professorships

- Honorary Professor, Harbin Institute of Technology, China, 2005
- Honorary Doctorate, Syracuse University, USA, 2005
- Honorary Doctorate, Technical University of Sofia, 2004
- Honorary Doctorate, Catholic University, Leuven, Belgium, 2004

- Honorary Professor, Tsinghua University, Beijing, 2004
- Honorary Doctorate, Hokkaido University, Sapporo, Japan, 2004
- Honorary Doctorate, Technical University of Civil Engineering, Bucharest, 2003
- Honorary Professor, Tianjin University, China, 2003
- Honorary Doctorate, Silesian University of Technology, Gliwice, 2003
- Honorary Doctorate, Moscow State University of Civil Engineering, 2002
- Honorary Doctorate, Slovak University of Technology, Bratislava, 2002
- Honorary Doctorate, University of Coimbra, Portugal, 2001

Membership of Academies

- Foreign Associate, US National Academy of Engineering, Washington D.C., 2001
- Foreign Member, The Royal Academy of Engineering, London, 1994
- Foreign Member, Russian Academy of Architecture and Building Science, Moscow, 1995
- Member, International Academy of Refrigeration, St. Petersburg, 2001
- Member, Danish Academy of Technical Sciences, ATV, 1975

Medals

- Honorary Medal awarded by the Technical University of Sofia at its 60 year jubilee, Sofia, 2005
- Pettenkofer Gold Medal, the highest Award of the International Academy of Indoor Air Sciences, Beijing 2005
- Knight of the Order of Dannebrog, Premier Degree, Royal Danish Award, Copenhagen, 2002
- Gold Medal of the International Academy of Eco-Energy, Baku, 2002
- KGH Honorary Medallion, the highest award of the Yugoslavian engineering society KGH, Belgrade, 2001
- Carl von Linde Memorial Gold Medal, the highest award of DKV, the German Society of Refrigeration and Air-Conditioning, Ulm, 2001
- REHVA Gold Medal, the highest award of the Federation of European Heating and Air-Conditioning Associations (first recipient), Naples, 2001
- Honorary Medal of the Brazilian Society of Indoor Environment, *Brasindoor*, Rio de Janeiro,

2001

- Hermann Rietschel Honorary Gold Medal, the highest award of the German Engineering Society VDI-TGA, Nürnberg, 1997
- John Edward Worth Silver Medal, The Royal Society of Health, London, 1997
- Hermann Rietschel Honorary Plaque, BHKS, Hannover, 1996. The highest award of the German Heating, Ventilation and Air-Conditioning Industry.
- Honorary Gold Medal of the Polish Engineering Society, PZITS, Warsaw, 1996
- Honorary Medal of the Finnish Engineering Society SULVI (FINVAC), Helsinki, 1994
- F.Paul Anderson Medal, the highest award of the American Engineering Society, ASHRAE, Los Angeles, 1992. The only non-American recipient.
- Hall-Thermotank Gold Medal, the highest award of the British Refrigeration Institute, London, 1990. For the greatest worldwide scientific contribution to refrigeration and air-conditioning.
- Napier Shaw Medal of Research, the British Engineering Society, CIBSE, London, 1989
- Knight of the Order of Dannebrog, Royal Danish Award, Copenhagen, 1987
- Louise & Bill Holladay Distinguished Fellow Medal, the next highest award of the American Engineering Society, ASHRAE, Toronto, 1982.

Honorary Memberships of Professional Societies

- Honorary Member of the Turkish HVAR&R Engineering Society TTMD, Istanbul 2006
- Honorary Member of the Society of Danish Engineers, IDA, which has only one other Honorary Member among 61 000 members, Copenhagen, 2005
- Honorary Fellow, European HVAC engineering federation REHVA, Vilnius, 2004
- Honorary Member of the Bulgarian Engineering Society BULSHRAE, Sofia, 2003
- Honorary Member of the Norwegian HVAC engineering society NORVAC as sole foreign honorary member, Trondheim, 2002
- First International Honorary Member of the Japanese Engineering Society SHASE, Tokyo, 2001
- Honorary Member of the Slovenian Engineering Society SITHOK, Maribor, 2000
- Honorary Member of the China Committee of HVAC as sole foreign member of the Chinese engineering society, Copenhagen, 1999
- Honorary Fellow of the British engineering society CIBSE, London, 1998
- Honorary life member of the Rumford Club for Building Services Engineering, London, 1996

- Honorary member of the Danish HVAC engineering society, DANVAK, Copenhagen, 1995
- Honorary member of Danvak-ing, a group under the auspices of the Danish engineering society IDA, Copenhagen, 1995
- Honorary life member of the Hungarian Society of Building Science, ETE, 1993
- Honorary member of the Italian engineering society AICARR, Milan, 1990
- Honorary member of the Russian engineering society ABOK, St. Petersburg, 1990
- Honorary member of the French engineering society AICVF, Paris, 1989
- Honorary member of the Royal Belgian Engineering Society, ATIC, Brussels, 1988

Prizes

- Birch & Krogboe Prize 2005 (250.000 DKK) “for groundbreaking research of great importance for society”
- Villum Kann Rasmussen Award (1.2 million DKK), Copenhagen, 1996. Highest Danish Award in Engineering
- Larsen & Nielsen Award (50.000 DKK) of the Larsen & Nielsen Foundation, established by one of Denmark’s leading construction engineering firms, 1970

Other Awards

- Honorary Plaque from United Technologies Research Centre/ Carrier “In Honour of contributions made in the field of indoor environmental quality”, Syracuse, 2005
- ASHRAE Presidential Honorary Certificate for “furthering the understanding of our industry’s impact on human comfort, health and productivity”, Atlanta 2004
- TVVL Presidential Honorary Certificate for “outstanding work and distinguished record of international leadership in advancing engineering inside HVAC “, Amstelveen 2004
- Distinguished Honorary Award, the highest award of the Russian engineering society ABOK, as the sole foreign recipient, Moscow, 2002
- Presidential Certificate of Appreciation for outstanding services in the indoor air sciences. International Academy of Indoor Air Sciences, 2002
- Best Paper Award, *Indoor Air* journal 1999-2001, Monterey, California, 2002
- Honorary recognition by the Danish HVAC engineering society DANVAK which established a research fund in his name, Copenhagen, 2001
- Civil Engineer of the Year, Odense Engineering School, 2001
- Distinguished Visiting Professor, National University of Singapore, 2000

- Fellow Award, The Royal Society of Health, London, 1997
- Best Paper Award, American Society of Heating, Refrigerating and Air-Conditioning Engineers, San Diego, 1995
- Centenary Milestone Paper in ASHRAE's Centenary edition, Atlanta, 1994
- AIRAH Lecture Award from the Australian engineering society AIRAH, Melbourne, 1994
- Founding Member of the International Academy of Indoor Air Sciences, Toronto, 1990
- Stockholm Building Award. Annual award for outstanding work for Building Technology and Sciences, 1988
- Invited member of the Norwegian HVAC society, Oslo, 1988
- Distinguished Service Award of the American Engineering Society, ASHRAE, Honolulu, 1985
- International Award of the American Engineering Society, ASHRAE, Atlanta, 1984. The first recipient of this award.
- SCANVAC Award, the Scandinavian Federation of HVAC Engineering Associations SCANVAC, Copenhagen, 1982.
- Fellow Award of the American Engineering Society, ASHRAE, Los Angeles, 1980
- Fellow Award of the British Engineering Society, CIBSE, London, 1975

Professional Society and Committee Affiliations

- President of the International Academy of Indoor Air Sciences, 1996-2002. Founding Member of the Academy, 1990
- President of SCANVAC, the Scandinavian Federation of Heating, Air-Conditioning and Sanitary Engineering Associations, comprising 20 000 HVAC engineers, 1984-
- President of the First International Indoor Air Conference, Copenhagen, 1978
- President of the First World Congress on Heating, Ventilating and Air Conditioning, CLIMA 2000, Copenhagen, 1985
- Vicepresident of REHVA, Representatives of European Heating and Ventilating Associations, 1981-1987; delegate for Denmark 1978-
- Vicepresident of IIR, the International Institute of Refrigeration, Air Conditioning Commission E1, 1972-79; 1987-1989
- International Society of Indoor Air Quality and Climate, ISIAQ, member of the board 1992-
- Member or past member of more than 40 national and international technical committees, working groups, and standards committees in organizations including ISO, CEN, EU, WHO, NATO, ASHRAE, EPA, DIN, VDI, ISIAQ, IAIAS.

Supervision and Membership

- Supervision of over one hundred M.Sc. and Ph.D. students and has attracted more than one

hundred international postdocs and visiting professors to join his research group at the Technical University of Denmark.

Editorial Activities

- International Journal of Indoor Air Quality and Health, Blackwell/Munksgård, founder of the journal and chairman of the editorial board, 1989-2004
- ASHRAE Research Journal Policy Group 2001-
- Journal of Asian Architecture and Building Engineering, member of the editorial board, 2002-
- Architectural Science Review, member of the editorial advisory board, 1999-
- Building Services Engineering Research & Technology, member of the advisory board, 2001-
- Intelligent Buildings, member of the Editorial Board, 1998
- Energy - The International Journal, member of the editorial board, 1975-80
- Energy and Buildings, Elsevier, member of the editorial board, 1977-
- Scandinavian Journal of Work, Environment and Health, member of the editorial board, 1977-91
- Environmental Psychology, Academic Press, member of the editorial board, 1977-90
- Ergonomics, Taylor and Francis, member of the board, 1980-90
- Edition Européennes Thermique & Industrie, member of the international scientific committee, 1994-1997

Invited Lectures

- More than 300 keynote lectures, opening lectures and other invited lectures in professional societies, at universities and at conferences in 40 countries.

Books and Book Chapters

Fanger, P.O., Popiolek, Z., Wargocki, P. (eds), Indoor Environmental Effects on Health, Comfort and Productivity, Gliwice, Silesian University of Technology, 2003 (in Polish).

P.O. Fanger: Indoor air quality. In: Nilsson, P.E. (ed.) Achieving the Desired Indoor Climate. Lund, The Commtech Group, Chapter 3.2, 2003.

P.O. Fanger: Perceived air quality and ventilation requirements. In: Spengler, J., Samet, J.M., McCarthy, J.F. (eds), Indoor Air Quality Handbook, McGraw Hill, Chapter 22, pp. 22.1-22.10, 2001.

P.O. Fanger: Mensch und Raumklima. In Horst Esdorn (ed.) "Raumklimotechnik.1. Grundlagen 16. Auflage, Springer-Verlag Berlin 1994, ISBN 3-540-54466-6, pp. 125-176, 1994.

P.O. Fanger: Indoor air quality perceived by human beings. In: Weekes, D.M., Gammage, R.B. (eds). The Practitioner's Approach to Indoor Air Quality Investigations. Akron, Ohio, American Industrial Hygiene Association, 1990, pp. 99-112.

P.O. Fanger (ed.): Proceedings of the CLIMA 2000 World Congress on Heating, Ventilating and Air-Conditioning, Vols 1-7, Copenhagen, 1985, 3100 pp.

Spengler, J., Hollowell, C., Moschandreas, J., Fanger, P.O. (eds). Indoor air pollution. In: Proceedings of the International Symposium on Indoor Air Pollution, Health and Energy Conservation, Amherst, Massachusetts, 1981, p. 534.

Fanger, P.O.: Prediction of local discomfort for man. In: Cena, K., Clark, J.A. (eds), *Bioengineering, Thermal Physiology and Comfort*, Amsterdam, Elsevier Scientific Publishing Co., 1981, pp. 221-227.

P.O. Fanger: Thermal discomfort caused by radiant asymmetry, local air velocities, warm or cold floors, and vertical air temperature gradients. In: Durand, J., Raynaud, J. (eds), *Confort thermique: Aspects physiologiques et psychologiques*, Paris, INSERM, 1979, 75:145-151.

P.O. Fanger and O. Valbjørn (eds): *Indoor Climate – Effects on Human Comfort, Performance and Health*, Proceedings of the first “Indoor Air” Conference, Copenhagen, Danish Building Research Institute, 1979, 895 pp.

P.O. Fanger: The prediction of comfort and acceptability of complex thermal environments. In: Stolwijk, J.A.J. (ed.) *Energy Conservation Strategies in Buildings*, New Haven, John B. Pierce Foundation, Yale University, 1978.

P.O. Fanger: *Thermal Comfort*. Copenhagen, Danish Technical Press, 1970, 244 pp.
 Doctoral dissertation reprinted several times, *inter alia* McGraw Hill Book Company, New York and sold in 13 000 copies.

Technical Papers

Has published more than 300 papers. The list comprises selected titles concerning indoor environment and energy published in peer-reviewed journals (1967-2006) and in peer-reviewed proceedings during two recent years (2004-2005).

Wyon, D.P., Fang, L., Lagercrantz L. and Fanger, P.O.: Experimental determination of the limiting criteria for human exposure to low winter humidity indoors (RP-1160). In: *HVAC&R Research Journal*, Vol. 12, Number 2, pp. 201-213 (2006)

Kaczmarczyk, J., Melikov, A., Bolashikov, Z., Nikolaev, L. and Fanger P. O.: Human response to five designs of personalized ventilation. In: *HVAC&R Research Journal*, Vol. 12, Number 2, pp. 367-384 (2006)

Sakr, W., Weschler C.J., Fanger P.O.: The impact of sorption on perceived indoor air quality, *Indoor Air*, Vol. 16, No 2, pp. 98-110 (2006)

Tamas, G., Weschler C.J., Fanger P.O.: Influence of ozone-limonene reactions on perceived air quality, *Indoor Air* (accepted)

Fanger, P.O.: What is IAQ?, In: *Proceedings of Indoor Air 2005*, Beijing, China, 2005, Vol. 1, Plenary lectures, pp. P1-P8 (on CD ROM)

Bakó-Biró, Z., Wargocki, P., Wyon, D.P, and P.O. Fanger : Poor indoor air quality slows down metabolic rate of office workers. In: *Proceedings of Indoor Air 2005*, Beijing, China, 2005 Vol. 1, pp.76-80 (on CD ROM)

Nishihara, N., Wargocki P., Wyon D.P., Tanabe, S., Fanger, P.O.: Cerebral blood flow, fatigue, mental effort and task performance in an office with two different pollution loads. In: *Proceedings of Indoor Air 2005*, Beijing, China, 2005, Vol. 1, pp. 377-382 (on CD ROM)

Bakó-Biró, Z., Weschler, C.J., Wargocki P., Fanger P.O.: Effects of indoor pollution sources and ventilation rate on ozone's surface removal rate and the occurrence of oxygenated VOCs in an office space. In: Proceedings of Indoor Air 2005, Beijing, China, 2005, Vol. 2, pp. 2320-2324 (on CD ROM)

Fang L., Zhang, G., Fanger P.O.: Experimental investigation of the air cleaning effect of a desiccant dehumidifier on perceived air quality. In: Proceedings of Indoor Air 2005, Beijing, China, 2005, Vol. 4, pp. 2976-2980 (on CD ROM)

Bakó-Biró, Z., Wargocki, P., Weschler, C.J., Fanger, P.O.: Effects of pollution from personal computers on perceived air quality, SBS symptoms and productivity in offices, *Indoor Air*, 14(3), 178-187 (2004)

Wargocki, P., Wyon, D.P., Fanger, P.O.: The performance and subjective responses of call-center operators with new and used supply air filters at two outdoor air supply rates, *Indoor Air*, 14, Suppl. 8, 7-16 (2004)

Wargocki, P., Wyon, D.P., Fanger, P.O., Kaczmarczyk, J., Melikov, A., Fanger, P.O.: Human response to personalized ventilation and mixing ventilation, *Indoor Air*, 14, Suppl. 8, 17-29 (2004) *Indoor Air*, Vol. 14, Suppl. 8, 7-16 (2004)

Toftum, J., Melikov, A., Tynel, A., Bruzda, M., Fanger, P.O.: Human response to air movement – evaluation of ASHRAE's draft criteria (RP-843), *HVAC&R Research*, 9(2), 187-202 (2003)

Fanger, P.O.: Providing indoor air of high quality: challenges and opportunities. In: Tham, K.W., Sekhar, C., Cheong, D. (eds) Proceedings of Healthy Buildings 2003, Singapore, National University of Singapore, Vol. 1, pp. 1-10 (2003).

Nakagawa, T., Wargocki, P., Tanabe, S., Weschler, C.J., Baginska, S., Bakó-Biró, Z., Fanger, P.O.: Chemical emission rates from personal computers. In: Tham, K.W., Sekhar, C., Cheong, D. (eds) Proceedings of Healthy Buildings 2003, Singapore, National University of Singapore, Vol. 1, pp. 468-473 (2003)

Goto, T., Toftum, J., Fanger, P.O., Yoshino, H.: Transient thermal sensation and comfort resulting from adjustment of clothing insulation. In: Tham, K.W., Sekhar, C., Cheong, D. (eds) Proceedings of Healthy Buildings 2003, Singapore, National University of Singapore, Vol. 1, pp 835-840 (2003).

Tang, J., Kaczmarczyk, J., Melikov, A., Fanger, P.O.: The impact of a personalized ventilation system on indoor air quality at different levels of room air temperature. In: Tham, K.W., Sekhar, C., Cheong, D. (eds) Proceedings of Healthy Buildings 2003, Singapore, National University of Singapore, Vol. 2, pp. 345-350 (2003).

Fang, L., Wyon, D.P., Fanger, P.O.: Sick building syndrome symptoms caused by low humidity. In: Tham, K.W., Sekhar, C., Cheong, D. (eds) Proceedings of Healthy Buildings 2003, Singapore, National University of Singapore, Vol. 3, pp. 1-6 (2003).

Wargocki, P., Bakó-Biró, Z., Baginska, S., Nakagawa, T., Fanger, P.O., Weschler, C., Tanabe, S.: Sensory emission rates from personal computers and television sets. In: Tham, K.W., Sekhar, C., Cheong, D. (eds) Proceedings of Healthy Buildings 2003, Singapore, National University of Singapore, Vol. 3, pp. 169-175 (2003).

Tham, K.W., Willem, H.C., Sekhar, S.C., Wyon, D.P., Wargocki, P., Fanger, P.O.: Temperature and ventilation effects on the work performance of office workers (study of a call centre in the tropics). In: Tham, K.W., Sekhar, C., Cheong, D. (eds) Proceedings of Healthy Buildings 2003, Singapore, National University of Singapore, Vol. 3, pp. 280-286 (2003).

- Fanger, P.O.: Ventilation for health, comfort and productivity. In: Proceedings of 4th international symposium on HVAC, Beijing, Vol. 1, pp. 1-7 (2003).
- Fanger, P.O., Toftum, J.: Extension of the PMV model to non-air-conditioned buildings in warm climates, *Energy and Buildings*, 34(6), 533-536 (2002).
- Wargocki, P., Sundell, J., Bischof, W., Brundrett, G., Fanger, P.O., Gyntelberg, F., Hanssen, S.O., Harrison, P., Pickering, A., Seppänen, O., Wouters, P.: Ventilation and health in nonindustrial indoor environments. Report from a European multidisciplinary scientific consensus meeting, *Indoor Air*, 12, 113-128 (2002)
- Wargocki, P., Lagercrantz, L., Witterseh, T., Sundell, J., Wyon, D.P., Fanger, P.O.: Subjective perceptions, symptom intensity and performance: a comparison of two independent studies, both changing similarly the pollution load in an office, *Indoor Air*, 12(2), 74-80 (2002)
- Wargocki, P., Bakó-Biró, Z., Clausen, G., Fanger, P.O.: Air quality in a simulated office environment as a result of reducing pollution sources and increasing ventilation, *Energy and Buildings*, 34, 775-783 (2002).
- Fanger, P.O.: Human requirements in future air-conditioned environments, *International Journal of Refrigeration*, Vol. 24, pp. 148-153 (2001).
- Fanger, P.O.: Good air quality in offices improves productivity, *Journal of Mechanical Engineering*, Vol. 46(7), 408-412 (2000)
- Toftum, J., Rasmussen, L.W., Mackeprang, P., Fanger, O.: Discomfort due to skin humidity with different fabric textures and materials, *ASHRAE Transactions*, Vol. 106, Pt. 2 (2000).
- Fang, L., Clausen, G., Fanger, O.: Temperature and humidity: important factors for perception of air quality and for ventilation requirements, *ASHRAE Transactions*, Vol. 106, Pt. 2 (2000).
- Fanger, P.O.: IAQ in the 21st century: search for excellence, *Indoor Air*, 10(2), 68-73 (2000).
- Wargocki, P., Wyon, D.P., Sundell, J., Clausen, G., Fanger, P.O.: The effects of outdoor air supply rate in an office on perceived air quality, Sick Building Syndrome (SBS) symptoms and productivity, *Indoor Air*, Vol. 10(4) (2000).
- Toftum, J., Fanger, P.O.: Air humidity requirements for human comfort, *ASHRAE Transactions*, Vol. 105, Pt. 2 (1999).
- Fang, L., Clausen, G., Fanger, P.O.: Impact of temperature and humidity on the perception of indoor air quality, *Indoor Air*, Vol. 8(2), 80-90 (1998).
- Wargocki, P., Wyon, D.P., Baik, Y.K., Clausen, G., Fanger, P.O.: Perceived air quality, Sick Building Syndrome (SBS) symptoms and productivity in an office with two different pollution loads, *Indoor Air*, Vol. 9, 165-179 (1999).
- Fang, L., Clausen, G., Fanger, P.O.: Impact of temperature and humidity on chemical and sensory emissions from building materials, *Indoor Air*, Vol. 9, 193-201 (1999).
- Fang, L., Clausen, G., Fanger, P.O.: Impact of temperature and humidity on perception of indoor air quality during immediate and longer whole-body exposures, *Indoor Air*, Vol. 8(4), 276-285 (1998).

- Toftum, J., Jørgensen, A.S., Fanger, P.O.: Upper limits for indoor air humidity to avoid uncomfortably humid skin, *Energy and Buildings*, Vol. 28(3), 1-13 (1998).
- Toftum, J., Jørgensen, A.S., Fanger, P.O.: Upper limits for air humidity for preventing warm respiratory discomfort, *Energy and Buildings*, Vol. 28(3), 15-23 (1998).
- Fanger, P.O.: Discomfort caused by odorants and irritants in the air, *Indoor Air*, Supplement 4, pp. 81-86 (1997).
- Knudsen, H.N., Clausen, G., Fanger, P.O.: Sensory characterization of emissions from materials. *Indoor Air*, 1997, 7(2), 107-115.
- Bluyssen, P.M. Oliveira Fernandes, E. de, Groes, L., Clausen, G., Fanger, P.O., Valbjørn, O., Bernhard, C.A., Roulet, C.A.: European indoor air quality audit project in 56 office buildings, *Indoor Air*, 1996, 6, 221-238.
- Arsen K. Melikov, Razmik S. Arakelian, Laila Halkjaer, P. Ole Fanger: Spot cooling - Part 1: Human responses to cooling with air jets. *ASHRAE Transactions* 1994, Vol. 100, Part 2.
- Arsen K. Melikov, Razmik S. Arakelian, Laila Halkjaer, P. Ole Fanger: Spot cooling - Part 2: Human responses to cooling with air jets. *ASHRAE Transactions* 1994, Vol. 100, Part 2.
- Geo Clausen, Linda Carrick, P.O. Fanger, Sun Woo Kim, Torben Poulsen, Jens Holger Rindel: A comparative study of discomfort caused by indoor air pollution, thermal load and noise. *INDOOR AIR 1993, International Journal of Indoor Air Quality and Climate*, Vol. 4, pp.255-262.
- R.J. de Dear, J.W. Ring and P.O. Fanger: Thermal sensations resulting from sudden ambient temperature changes. *International Journal of Indoor Air Quality and Climate*, 1993, Vol. 3, pp.181-192.
- Lars Gunnarsen and P.O. Fanger: Adaptation to indoor air pollution. *Environment International*, 1992, Vol. 18, pp.43-47.
- P.O.Fanger: Designing for good air quality in air-conditioned buildings. *Proc. of The Institute of Refrigeration 1990-1991, London, 1991, Vol. 87, pp. 41-50.*
- Philomena M. Bluyssen and P.Ole Fanger: Addition of olfs from different pollution sources, determined by a trained panel. *Indoor Air*, 1991, Vol. 1, No. 4, pp.417-421.
- P.O.Fanger: Air quality not just air quantity. *ASHRAE Journal*, 1989, Vol. 31, No. 7, pp.46-47.
- R.J.de Dear, H.N.Knudsen, P.O.Fanger: Impact of air humidity on thermal comfort during step-changes, *ASHRAE Trans.*, Vol. 95, Part 2, 1989, pp.336-350.
- P.O.Fanger: The new comfort equation for indoor air quality. *Proc. of IAQ '89 ASHRAE, Atlanta, 1989.*
- P.O.Fanger: Hidden olfs in sick buildings. *ASHRAE Journal*, 1988, Vol. 30, no. 11, pp.40-43.
- P.O.Fanger: Olf and decipol - New units for perceived air quality. *CIBSE*, Vol. 9, No. 4, 1988.
- P.O.Fanger: Introduction of the olf and the decipol units to quantify air pollution perceived by humans indoors and outdoors. *Energy and Buildings*, 12(1988,) pp.1-6.

P.O.Fanger, J.Lauridsen, P.Bluysen, G.Clausen: Air pollution sources in offices and assembly halls, quantified by the olf unit. *Energy and Buildings*, 12(1988), pp.7-19.

P.O.Fanger, A.Melikov, H.Hanzawa, J.Ring: Air turbulence and sensation of draught. *Energy and Buildings*, 12(1988), pp.21-39..

P.O.Fanger and N.K.Christensen: Prediction of draft. *ASHRAE Journal*, 1987, Vol. 29, No. 1, pp.30-31.

H.Hanzawa, A.K.Melikow and P.O.Fanger: Airflow characteristics in the occupied zone of ventilated spaces. *ASHRAE Trans.*, Part 1, 1987.

P.O.Fanger: Thermal environment - human requirements. *The Environmentalist*, Vol. 6, No. 4, 1986, pp.275-278.

G.H.Clausen, S.B.Møller, P.O.Fanger, B.P.Leaderer, R.Dietz: Background odor in spaces caused by previous tobacco smoking. Proc. of IAQ '86, *Managing Indoor Air for Health and Energy Conservation*, ASHRAE, Atlanta, USA, April 1986, pp.119-125.

P.O.Fanger and N.K.Christensen: Perception of draught in ventilated spaces. *Ergonomics*, Vol. 29, No. 2, 1986, pp.215-235.

P.O.Fanger: Radiation and discomfort. *ASHRAE Journal*, 1986, Vol. 28, No. 2, pp.33-34.

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