

Press Release

Thirty-three years of focusing on wearing comfort

Prof. Dr. rer. nat. Karl-Heinz Umbach

On 1 November 2009, after 33 years of working for the Hohenstein Institute, Prof. Dr. rer. nat. Karl-Heinz Umbach will be retiring from the institute. Following his physics studies and subsequent doctoral studies in the area of solid state physics, Prof. Umbach started as a scientific assistant at Stuttgart University. During this time he also completed the 2nd exam for teaching at institutions of higher education. He joined the Hohenstein Institute in 1976, assuming the management of the clothing physiology area. He has held the function of acting manager of the Bekleidungsphysiologisches Institut Hohenstein e.V. since 1993. As part of his work he refined and supplemented existing clothing physiology-related measuring instruments and also developed new devices and measurement methods as well as biophysical calculation models. In addition, he also established the method for a systematic construction of functional clothing in the scientific world through lecturing assignments at the universities of Stuttgart, Kassel and North Carolina State University in the US, as well as numerous publications and presentations. He has also contributed his know-how, for which he has been recognised worldwide, to a number international standardisation and other committees.

Prof. Umbach will continue to assist the Hohenstein Institute in an advisory capacity, and in particular provide support to Dr. Andreas Schmidt, the director of the newly established department "Function & Care", along with the department's scientific manager Dr. Jan Beringer.

In your opinion, what was the crowning achievement of your research work?

In the end, I was always looking for ways of transferring the wearing comfort of textiles from the area of subjective impression into something that can be quantitatively measured. In this way, I was able to build on work done by Prof. Dr.-Ing. Otto Mecheels and Prof. Dr. Juergen Mecheels, who established the clothing physiology area at the Hohenstein Institute after the 2nd World War until the 1970's. I consider myself a link in this chain, someone who was able to develop clothing physiology into a recognised

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scientific discipline and – which is particularly important – ensure that insights thus gained were implemented into market-ready products and continuously optimised.

Another important factor in this context was the ability to transform the complex scientific principles of clothing physiology into an assessment system that could be understood by textile manufacturers, retailers and consumers. Certainly the most important example in this area would be the wearing or sleeping comfort grade. This system uses easy-to-understand grades ranging from "1" for very good to "6" for fail, to provide information regarding comfort, allowing laymen to make comparisons between different products.

Prof. Umbach, what developments that have been derived from your research work are you particularly proud of?

In my view, the success of synthetic fibres and membrane laminates in the form of functional textiles represents a revolutionary development both for the textile and clothing industry, as well as for consumers. I am proud to have made a contribution to this development and hence play a part in helping along the practical implementation of clothing physiological research for textiles and clothing for everyone.

I was also successful in ensuring that clothing physiological concerns were included in international standards and technical delivery terms for occupational and protective clothing for the civil and military areas. These requirements are now binding and contribute to protect wearers in the workplace from physiological overload and hence health problems.

Today, functional textiles are part of the standard gear of just about any amateur athlete, but when you started your work at the Hohenstein institute in 1976, that was certainly not the case.

Natural fibres were always considered the ultimate fibre with regard to the heat and moisture management that is required to regulate body functions. Consumers as well as manufacturers and the trade had a negative view of the wearing comfort of synthetic fibres – they had an image of being of lesser quality.

But your research proved quite the opposite.

By using quantitative clothing physiology methods, I was able to prove that depending on their construction, textiles made of synthetic fibres were actually superior to natural fibres with regard to wearing comfort. We achieved our best results by combining the advantages of both fibre types while at the same time compensating for their disadvantages, e.g. two-layer textile constructions, or so-called double face articles.

And how did this idea fare in real life?

In 1980, the year of the Lincei Olympics, an Austrian athletic clothing manufacturer equipped the national women's team with the new two-layer product, with the synthetic fibre layer which lies next to the skin quickly and effectively moving sweat away from the body, while the outer layer consisting of cotton provided good buffering action against moisture. This kept the skin dryer, while the more effective sweat vaporisation reduced the body's moisture loss, which meant that the wearer did not only feel better on a subjective level but was also able to increase her physical performance. The success of these products with the female athletes and subsequently during its market introduction for amateur athletes was immense, and opened the door to further developments in functional textiles.

In the last few years, these functional high-tech textiles have started to play a sometimes crucial role for the German textile and clothing industry, as manufacturers were able to stand their own market-wise against cheaper imports from low-wage countries by offering consumers noticeably better and higher quality functional clothing.

Your knowledge was also in demand for the use of membrane materials for clothing.

Indeed, together with my team, I helped the first manufacturer of these laminates optimising his idea of combining a Teflon membrane with a textile carrier material, and hence contributed to the replacement of conventional Ostfriesen mink with its unsatisfactory breathability.

Almost everybody involved with functional clothing will be aware of "Charlie" the thermal mannequin and the Hohenstein skin model. But recently you also caused quite a stir among experts with other clothing physiological measurement methods. How did this happen?

We were successful in extending physiological measurement and assessment methods which were initially developed only for clothing to other application areas for textiles, such as covers, bed linens, mattresses, sleeping bags, vehicle seats and upholstered furniture. The newest measurement devices allow us to also study physiologically distinctive features. For example, we have the thermal mannequin "Charlene", akin to "Charlie's" little sister, which is mainly used to study and optimise the sleeping comfort of bed linens for children. By using the "sweaty hand" and "sweaty foot" we were able to study finished manufactured gloves and shoes for the first time, rather than just the textile sheeting material of which they are made. In connection with other testing methods, such as an electronic nose, it is possible to derive numerous new research approaches, along with an opportunity to significantly improve wearing comfort in these product areas.

Moreover, in the future it will also be possible to record and optimise the climatic sitting comfort of vehicle seats using a "sweaty bottom". Because this method does away with the hitherto required sitting tests using real-life test subjects in a driving simulator, which are very time consuming and expensive, we are also making a contribution to reducing product development costs at the manufacturer level.

What does retirement look like for you?

Horses and leading a "cowboy life" in the USA has been a longstanding passion of mine, so that is where I will be spending more time with my family. However, I will always maintain my ties with the Hohenstein Institute and contribute my know-how and ideas if required. At the same time I am also happy to devote more time to my private life, which I was not always able to do in the last three decades.

What advice would you like to give to your successors and your team at the Hohenstein Institute?

A researcher should never lose his or her curiosity, or the desire to get to the bottom of something. Sometimes this requires taking an unconventional route, which is exactly what is so satisfying about this work, which can also be very boring and stressful. I am taking this positive feeling with me into retirement.

Prof. Umbach, we thank you for talking to us!

Boennigheim, October 2009



Prof. Dr. rer. nat. Karl-Heinz Umbach has worked at the Hohenstein Institute since 1976; as the acting manager of the Bekleidungsphysiologisches Institut Hohenstein e. V. and director of the clothing physiology department he made a significant contribution to the development and establishment of this discipline in the research, testing and standardisation area. His work focused on the interaction between body, climate and clothing, wearing comfort and the physiological functions of textiles and clothing, functional athletic, occupational and protective clothing, climatic sitting comfort of vehicle seats and upholstered furniture, as well as the sleeping comfort of bed linens and sleepign bags. His international recognition as a certified expert in the area of clothing physiology is evidenced by almost 200 publications.



Skin model

At this time, the Hohenstein Institute has seven skin models in its laboratories, while 20 additional devices made at the Hohenstein Institute are in service world-wide.



"Charlie"

For the thermo-regulatory model of "Charlie", "skin temperature" is regulated at 16 sections and the respective heat flows are measured through the clothing. This makes it possible to provide varied assessments of thermal insulation in addition to the physiological function of a single garment.



"Charlene"

Children's thermo-regulatory systems are quite different from those of adults. As a result, the thermally segmented test mannequin 'Charlene' was brought into service at the Hohenstein Institute in 2008.



Climate chambers

Fans, warm walls, etc. are used to simulate the most varied of climate conditions in the four climate chambers of the Hohenstein Institute.



Driving simulator

Human test subjects also assess the physiological comfort of car seats in a driving simulator in the climate chamber. The use of a "sweaty bottom" is intended to reduce testing costs and hence also development costs of manufacturers in the future.



Human test subjects

Only through numerous experiments with human test subjects during the past decades has it been possible to make the extrapolations required to correlate human perceptions with laboratory results. Series of tests with volunteers are in the meantime primarily limited to the evaluation of completely new products and confirmation of tests carried out on the skin model and thermally segmented test mannequins.



Wearing and sleeping comfort grade

The Hohenstein Quality Label features "wear comfort grades" and "sleep comfort grades". These help at the Point of Sale (POS) when it comes to selecting garments and bedding with high levels of physiological comfort.

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