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NEWS

A life in science: a celebration of the career of Hans Hoppeler at the University of Bern

In 1971, a meeting happened that would change the face of respiration physiology. Hans Howald, from the Swiss Sportwissenschaftliches Institut, visited Ewald Weibel at the University of Bern, accompanied by a medical student – Hans Hoppeler – who was studying physiology with him. Howald and Hoppeler wanted to study mitochondria in human muscle to understand the link between the muscle and limitations in maximum power output, and they wanted Weibel, with his expertise in quantitative microscopy, to collaborate with them. This pivotal event in Hoppeler's career, and many others, was recently honoured in an Abschiedssymposium (parting symposium) on the occasion of his retirement as the Co-Director of the Department of Anatomy at the University of Bern. Friends and international colleagues from across the planet joined Hoppeler and his family to celebrate the fun and fascination that has defined his research career and life in science.

However, when Hoppeler entered medical school in 1967, he did not intend to become a scientist. 'My intention was to be a GP working in a rural area in Switzerland', Hoppeler recalls. But during the course of his studies he spent time in the lab of Howald, who had recently returned from Sweden, where he had learned to take minute muscle samples from human subjects. Hoppeler decided to couple this new technique with his interest in exercise physiology. 'At the time it was not clear whether there was any plasticity in muscle tissue, in particular human muscle tissue', says Hoppeler. So he, Howald and Weibel decided to compare the volume of mitochondria – in the muscle of trained athletes and untrained Swiss medical students – with their maximal oxygen uptake to find out whether muscle was structurally adapted in athletes to consume more oxygen, permitting greater power output.

Fig. 1. Hans Hoppeler with his wife, Barbara Grünig Hoppeler, at the Abschiedssymposium at the University of Bern on 8 November 2013. Photo credit: The Department of Anatomy, University of Bern, Switzerland.

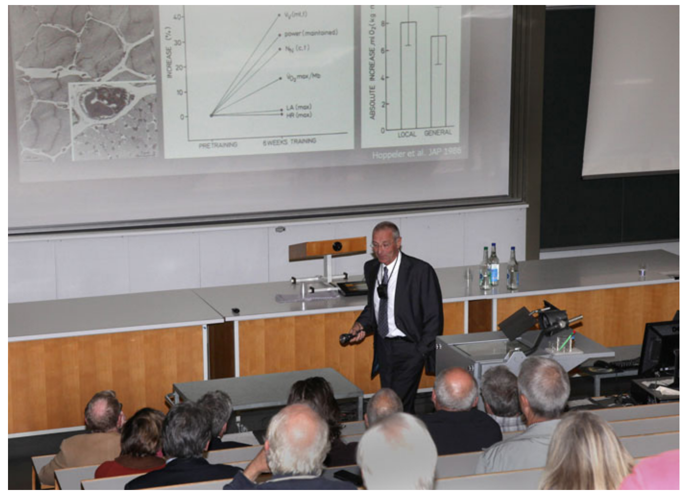

Fig. 2. Hoppeler presents data from his career at his Abschiedssymposium. Photo credit: The Department of Anatomy, University of Bern, Switzerland.

Hoppeler explains that perceived wisdom at the time held that the power that an organism could produce was simply set by the amount of oxygen that could be transported by its respiratory system, but this view did not take the role of muscle into account, which puzzled Hoppeler.

Working with Howald to collect the muscle samples and measure the students' maximal oxygen uptake ($\dot{V}_{O_2max}$), Hoppeler then measured the density of mitochondria in the athletes' and students' muscles from micrographs collected on Weibel's electron microscope. Plotting $\dot{V}_{O_2max}$ against mitochondrial density on a graph, the team came to the paradigm-shifting conclusion that 'an individual's maximum oxygen intake is limited not only by the capacity of the oxygen transport system but also by the oxidative capacity of the mitochondria in the skeletal muscle' (Hoppeler et al., 1973). In other words, muscle is plastic and muscle power output is not simply limited by the supply of oxygen, it can be altered by exercise.

And this is where Hoppeler's life in science might have ended, had it had not been for Weibel's persistence. After graduating in 1974, Hoppeler took a medical post at the hospital in the nearby town of Burgdorf, despite Weibel's best attempts to entice him back to comparative physiology. But when Weibel established his now-legendary collaboration with Dick Taylor from Harvard University, USA, to study the structure–function relationship between the respiratory system and muscles in animals ranging in size over three orders of magnitude – known today as 'the Kenya study' – Weibel finally had the perfect lure. 'I realized I needed Hans to take care of the mitochondria part of the muscle', he explains. During the ensuing 18 year collaboration, the three scientists systematically dissected the respiratory system – from the lungs through to the mitochondrial oxidative cascade that powers movement – to reveal the tight causative relationship between biological form and function.

More recently, Hoppeler shifted his attention to focus on factors that influence human muscle structure – including endurance and strength training, space flight, the effects of hypoxia, immobilization and nutrition. ‘For me, humans were always a special case of comparative physiology; namely a bilegged animal that was easy to convince to do what you wanted, which was sometimes difficult in animals’, he chuckles. He adds, ‘We belong to the category of relatively sedentary animals and we are constructed in a special way in that we only use our legs for locomotion, so I could borrow a lot from my comparative research and use it in exercise physiology.’

Hoppeler admits that he has greatly enjoyed working with his friends and colleagues, which was reflected in the symposium speaker list with talks from long-standing collaborators including Pietro di Prampero, Kevin Conley, Jean-Michel Weber and Stan Linstedt. Considering his collaboration with Hoppeler on fuel use in muscle, Weber calls Hoppeler ‘a pioneer in integrative biology’, saying, ‘He was one of the first people that I met that showed me how to do things and really insisted on having a dialogue between specialists in different areas. A lot of what he was doing was whole-animal, whole-organism, whole-human physiology. Then he ventured into the molecular part; as molecular biology became more developed, he immediately saw that the molecular tools were really helpful in trying to solve problems at the whole-animal level.’

Another motivating factor in Hoppeler’s life has been the shear pleasure of tackling challenges. ‘For me it was just fun to do research, to attack paradigms, attack dogmas, to go after mechanistic questions with the tools that were at my disposal. I thoroughly enjoyed my life in science and if something happened to come out of it I am pleased’, he laughs. In addition, he has devoted significant time and energy to societies and organisations outside the university, including leading the Swiss Federal Institute of Sport, presiding over the European College of Sports Science and guiding *The Journal of Experimental Biology* as the Editor-in-Chief for the last 10 years.

So what next after almost four decades in the same department? ‘I am currently working on a book on eccentric exercise, I will continue to teach, and I have a student who is exploring both fundamental aspects of eccentric work and its application in rehabilitation’, says Hoppeler, who is certainly not slowing down. And then he smiles, adding, ‘And I hope to spend more time doing what I like best, and what I like doing best is caring for *The Journal* [*of Experimental Biology*] and skiing with my family.’

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Reference

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