

# Exercise Physiology 1949 – 2019

## Sportphysiologie 1949 – 2019

**O**ne of the main topics in the German Journal of Sports Medicine is sports physiology. Practically all body functions and organ systems are influenced during muscular exercise whether one-time (acute) or systematically repeated (chronic). Types of exercise vary between short (e. g. a jump or a blow) and extreme duration (e. g. running 1000 km) in all ages. Most investigations consider muscle functions, metabolism, transport systems (respiration and circulation) and the relevant nervous and hormonal regulations.

Sports Physiology is largely also a synoptic science: It uses knowledge of anatomy (e. g. obtained by muscle biopsies), biochemistry, biomechanics, genetics etc. to explain body functions during and after exercise.

### Die erste Jahre seit 1949

In the era when the journal was founded, much was already known about aerobic and anaerobic metabolism as result of investigations especially by American (e. g. D. Van Slyke, D. B. Dill, B. Balke), British (e. g. J. S. Haldane, C. G. Douglas), Scandinavian (e. g. A. Krogh, Ch. Bohr, P. O. Astrand, E. H. Christensen, B. Saltin), Italian (e. g. R. Margaria) and German (e. g. M. Rubner, N. Zuntz, O. H. Warburg, E. A. Müller, H. W. Knipping) scientists. Ergometric methods (various ergometers, gas analysis of expired samples collected in Douglas bags) had been established. In the fifties, two revolutionary steps were taken: 1) The description of the physiological causes of excitation after measurements of the membrane potential in squid giant axons and the correlation to electrolyte shifts (8). 2) The sliding filament theory of muscle contraction (10) not included in textbooks until 1956. During the following decades, numerous methodological innovations were achieved: e. g. continuous measurements of expiratory gas concentrations, determination of gases, lactate, COHb and electrolytes in ear lobe blood, histochemical methods in muscle biopsies introduced by Bergström and Hultman (glycogen content, fibre types, capillary network, (1)), finally the explosion of genetic analyses. In the present year investigators who detected the regulation of erythropoietin secretion and thus hemoglobin mass by hypoxia-inducible factors, were awarded the Nobel prize for physiology. Field measurements of heart rate and respiratory gases were performed with portable small devices. Now "wearables" ga-

ther data about physical exercise without ergometers as well as about body functions and external conditions (13).

These advances are mirrored in articles in our journal. It is impossible to consider the total content. In Germany there have been chairs for sport physiologists in Kiel, Hannover, Bochum, Köln, Bonn, Bayreuth, Ulm, but physiologic aspects have also been considered in other institutes (e. g. (9)). All German groups of investigators in sports medicine have published regularly in our journal.

Unfortunately the first volumes are difficult to analyze. Libraries at the institutes have been closed, the oldest articles are stored only in some central libraries. Articles by later very well-known scientists were already frequently published in the initial years. As an example, Harald Mellerowicz from Berlin wrote "The capillary function during exercise" in 1951 (11). Klepzig, Reindell and Weyland discussed the athlete's heart, a topic of internal medicine as well as of physiology, already in 1952.

### Die Entwicklung seit 1999

I have checked the latest volumes between 1999 and 2019. Of approximately 1000 articles, 222 treat topics of basic sciences. Many publications were written by renowned foreign investigators (e. g. Switzerland: H. Hoppeler, M. Flück, Belgium: R. Meeusen, K. de Meirleir, France: M. Duclos, Italy: P. E. di Prampero, S. Cinti, Denmark: C. Juel, M. Kjaer, USA: C. Foster, P. D. Wagner, J. A. Dempsey, G. Brooks, South Africa: T. D. Noakes). Mostly they have reviewed the state of the art in their speciality, e. g. Brooks et al. about lactate metabolism (4), Dempsey et al. about respiration (5). P. D. Wagner described the limiting factors of power (14). Of course there are also articles written jointly by authors from different countries, e. g. (6).

My team, too, initially in Cologne, then in Hannover and Berlin and collaborating with scientists in Colombia, has published several times in the German Journal of Sports Medicine. Our topics are metabolism and electrolytes, gas transport and blood volume as influenced by acute exercise, physical training, altitude and sex. Recently we published reviews about exercise efficiency and physical properties of highlanders living on different continents. A method especially useful for the latter topic is the determination of hemoglobin mass. We have cooperated in the development of the method since the eighties. It has been optimized by W. Schmidt and N. Prohammer (12) and is being applied more and more >

## EDITORIAL

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in theoretical and clinical medicine. A remarkable resonance, however, was elicited by a small article about delayed muscle soreness in which we evaluated the scarce sources on the topic and speculated a bit (Wietoska and Böning 1979, expanded in 2000 (3)). We reasoned that subtle damages within the muscle fibers were the cause rather than large concentrations of lactic acid. This was confirmed histologically by Friden et al. two years later (7).

## Anregungen

In my opinion, the critical reaction to publications in letters to the editor and editorials is also important but too rarely used. Hereby important new findings as well as mistakes may be pointed out. As an example I may mention my editorial "Fat in spite of exercise? An alleged paradigm change results from calculation mistakes" (2). Allegedly ground-breaking findings were that regular muscular exercise increases the energy turnover only slightly. But it had been neglected to relate energy turnover to body mass. Dainty Africans frequently moving as hunters were compared to well-nourished car-driving American citizens.

Inevitable for the international resonance of the journal is the use of the English language. This has been accepted in physiology since 1970. But I believe that it is appropriate to use German in science, too. A language becomes impoverished when retreating from important topics. Therefore the expanded German abstracts in the printed version are valuable. But in my opinion a complete bilingual version as in the journal *Deutsches Ärzteblatt* (German Medical journal, [www.aerzteblatt.de](http://www.aerzteblatt.de)) would be the best solution. ■

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