

EDITORIAL

The spirit of sport at the beginning of the Millennium Spiritul sportiv la început de mileniu

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The changes of olympic and international regulations, as well as the appearance of new sporting disciplines, may involve the reconsideration of some concepts related to the spirit of sport. There is no doubt that competitive sport involves particular physical and intellectual stress. The effort of Pheidippides who ran almost 240 km including the marathon is notable. He paid with his death, but this is an edifying example for the future of the spirit of sport. It is not known whether he used stimulants or he had just an extremely good physical condition and biochemical status. However, we know that such performance involves serious training and a Spartan selection for that time (even if Pheidippides was Athenian). Recent biomedical, pharmaceutical, biomechanical and psychological research sheds a completely new light on the sacrifice of the Greek athlete. In this context, a brief analysis of the main characteristics that currently define the spirit of sport is attempted.

The athlete's health must be perfect, because risk factors during the competition are obviously different from those found in ordinary situations. A rigorous analysis of the London marathon in the period 1981-2004 correlated with the number of runners (32,000) shows that there were 8 deaths. One was due to a cerebrovascular accident (subarachnoid hemorrhage), 2 were due to hypertrophic cardiomyopathy, and 5 to coronary heart disease (Tunstall Pedoe, 2004). Death occurred during the race, right after its finish, or within 24 hours from the race. The same author, through a normalized calculation including time and distance in relation to the number of participants, reports the risk of death in the London marathon, compared to the data provided by the European Council for the safety of travels over the period 2001-2002. Only the number of motorcycle accidents (18) is higher than that of accidents due to the marathon (12), compared to bicycle accidents (3), car accidents (1), aircraft accidents (0.67), and motor racing accidents (0.08) recorded during the same time period. Data are really surprising, although the study refers to athletes aged over 30 years.

The human organism is an automatic self-regulation system. Under physical and mental stress conditions, the information avalanche through the reaction pathway leads to the exceeding of critical reference values. The

mechanisms responsible for homeostasis no longer function optimally.

In the case of long distance runners, an intrinsic physiological damage from Na, K, Mg, Ca and Cl, an ion exchange disequilibrium in the cell membrane results. In the absence of intense physical exercise, ion concentrations remain practically at constant values through a yet unknown mechanism, which plays the role of a biological potentiostat. Initially, theoretical electrochemical studies published by Goldman (Goldman, 1943), Hodgkin and Katz (1949) showed that the rest potential of a biological membrane is determined by the different concentrations of the ions Na^+ , K^+ and Cl^- in the two aqueous solutions separated by the membrane. Planck's theory supposes a "constrained diffusion" through the liquid junction, by which the ion concentrations in each section of the junction layer remain constant in time (Sten-Knudsen, 2002).

Based on Planck's theory of diffusion potential across the membrane and using the integral Volterra equations, the contributions of the three ionic current densities in equilibrium were found (Bonciocat & Marian, 2005). The sum of these three contributions gives the expression of the rest potential and a comparison with the Goldman-Hodgkin-Katz formula is made, showing in what conditions they become identical formulas.

However, all theoretical models refer only to the first approximations in stationary conditions. The theoretical aspects of all ion contributions including radical species in the exchange mechanism across the cell membrane under non-equilibrium conditions in the presence of stimulants and the synergy or catalytic effects induced by oligoelements remain unsolved for the moment. This is actually the case of long distance runners.

Radical and non-radical species derived from oxygen and nitrogen, due to their chemical affinity for target molecules, are responsible for cell tissue damage as a result of protein changes, lipid peroxidation, and DNA chain breakage. During the cyclic strain of muscle tissues and tendons, the maximum effort interval is associated with ischemia; consequently, when normal tissue oxygenation is resumed, the production of radical species is stimulated (Bestwick & Maffulli, 2004). Hyperthermia provides radicals through the activation of combined charge transfer

and diffusion processes, probably at mitochondrial level. The individual biochemical mechanism of adaptability to the generation of radicals is yet unclear both in ordinary persons and high performance athletes.

The character and education of athletes play a key role in sports competitions. In spite of educational differences depending on the belonging to a certain group, in institutional settings, elementary hygiene and behavior rules are respected. On the other hand, religious tolerance is involved in the relations between officials and athletes. In other words, xenophobia and intolerance are completely excluded from sports competitions. Any athlete who aspires to a title should possess a strong character and accept defeat with fair play. Without *self-respect and respect for the other participants*, excellence cannot be attained.

Commitment is another desideratum for an athlete. A recent editorial (Bocu, 2014) draws attention to the phenomenon of addiction, emphasizing the fact that in the case of high performance sport, exercise should be monitored by specialized medical teams. This addiction phenomenon is even more harmful in athletes who have ceased their activity, but still participate in competitions (see the marathon). In the absence of completely computerized medical surveillance, the organizers cannot monitor the participants. The perpetuation of addiction has multiple causes, of which two stand out. Competition itself involves complex wireless bioelectrochemical monitoring and the cost of equipment is still prohibitive. However, elderly athletes are encouraged to participate in marathon competitions. The case of the old athlete Fauja Singh, aged 93, who finished the London marathon in 2004 in 6 hours and 7 minutes, is well known.

Does *solidarity* in hazard situations that sometimes have tragic consequences involve the cancellation of a competition? It is difficult to believe that after the death of a teammate, considering the *team spirit*, the other members of the team can mobilize themselves. Psychologists maintain that it is in these situations that courage manifests.

The courage to attack the limits of one's own and the competitors' capacities is another determining factor in promoting the spirit of sport.

We left for last some controversial aspects. Any high performance athlete who respects Olympism aspires to

excellence. In order to achieve this desideratum, are we (unfortunately) subject to cheating, Săvulescu et al., 2004 (Oxford University) wondered in an essay on *ethics, fair play and honesty*. The analysis refers to the forbiddance or the control of the administration of chemical, synthesis, natural chemical compounds (e.g. erythropoietin EPO stimulates the production of erythrocytes) and of hypoxic devices that develop biochemical reaction mechanisms specific for the individual. The conclusion allows to see the possibility of legalizing the consumption of chemical compounds under strict control, for the protection of athletes.

Finally, several questions are asked. We created the Paralympic Games. Do we separate the human species according to criteria related to genetics, accidents or bioengineering? What will be the performance of the living being assisted by bioservomechanisms, when such a biomechanical structure is controlled by the human brain? Will the far future require other separations? Another certainty is that new laws will be issued. The *respect for rules and laws* remains. This completes the spirit of sport.

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