

Athletic Stars shine at Night

Late hours of the day prove more conducive to the attainment of optimal performances

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An important discovery made in the course of the research surveys of the Olympic Games in Helsinki in 1952, in Melbourne in 1956, and in Rome in 1960 was that maximal athletic performances are most likely to be attained in the evening.

The Japanese Gymnastic Team lost the gold medal in Australia because it had to perform the compulsory apparatus exercises during the morning hours while their Soviet opponents were called to do likewise in the evening. The final gymnastic display after the conclusion of the contest left no doubt that the Japanese possessed a slight but definite margin of superiority.

The chance element of timing the two teams' appearances had been the decisive factor. Four years later in Rome, the Japanese won the gymnastic team competition against their Soviet opponents. Empirical experiences to the effect that the late hours of the day are most conducive to the attainment of optimal athletic performance standards have been made not only in respect of gymnastics but also of track and field, swimming, wrestling, fencing and soccer. A broad physiological principle seemed to underlie the phenomenon under reference and although the magnitude of its effectiveness is not necessarily overwhelming, the evolution of athletic performances has gone so far that consideration of finer points becomes increasingly more appropriate.

Remarkable Improvements. For example, the remarkable improvements during the past years of middle and long distance running records in this country have certainly been facilitated by the growing trend to hold competitions in the evening. Though it is true that the avoidance of the midday heat has contributed to the performance advancements under reference, the latter are not thus explained in their entirety. Comparable improvements have occurred in sports which, unlike long distance running, do not benefit especially from low environmental temperatures.

The exceptional popularity of typical evening sports, such as basketball and indoor track and field meetings, is due largely to the instinctive knowledge on the part of the spectators that 'athletic life begins after 7.30 p.m.'. In the same way as physical performance capacity reaches its climax in the evening, the emotional receptivity of the spectators also attains its greatest height late in the day.

Like every other branch of the medical sciences, sports-medicine rests upon the interplay of observation and experiment. Though physiological and clinical laboratory studies have undoubtedly added to our understanding of the theory of athletics the conditions under which athletic competitions are conducted cannot be rendered fully amenable to laboratory analyses. For this reason, many scientific studies on athletics lack relevance.

Tops In Field. The number of investigators who possess genuine insight into sport is very small, much smaller than that which qualifies contenders for top level work in other disciplines or research. It is certainly no coincidence that, among the few who have conceptualized thinking on athletics, are several outstanding athletes who following their college years have pursued a research career. Among these are the British Philip Noel-Baken (1), Sir Adolphe Abrahams (2), Dr. Roger Bannister (3), and Prof. A. V. Hill (4); in France, Mr. Jean Borotra (5); in Germany, Drs. A. Mallwitz (6) and H. Mellerowicz (7); and in this country Sid Robinson (8) and Kenneth Doherty (9). In my own research I have found the experiences of many years of competitive athletics of decisive value.

100 years ago, the great French physiologist Claude Bernard drew attention to the fact the human organism is endowed with a self-regulatory system through which a variety of functional entities are maintained at fixed levels; e.g. at rest, pulse rate is about 70 per min.; body temperature 37° C.; systolic blood pressure 110 mm/Hg; and sugar content of the blood 100 mg/%. The late Boston physiologist, Walter Cannon, referred to the underlying principle as homeostasis. During exercise the component elements of the homeostatic balance are widely deployed: pulse rate may rise to 180; body temperature to 39°; systolic blood pressure to 160; and blood sugar to 175.

I have described this deployment under the name of heterostasis. Homeostasis and heterostasis characterize two different conditions of the body's internal milieu; the former at rest, the latter during activity. The study of the difference between homeostasis and heterostasis has revealed a great deal about the nature of the physiological adjustments that occur during exercise upon which the co-ordinative efficiency of the muscular system very much depends.

Hemeostasis as well as heterostasis of highly trained athletes differ specifically from those of untrained subjects. Thus, outstanding long distance runners, skiers, swimmers, cyclists and mountaineers show functional characteristics that distinguish them from those which are present in weight lifters, shot putters and wrestlers ; and in fencers, pistol shots and horse riders.

However, all highly trained athletes have in common an enhanced capacity to deploy their *autonomic* front precisely in accordance with the physiological requirements of the desired motor task. This capacity is mediated through the nervous system which ranks uppermost in the hierarchy of bodily mechanisms that determine the quality of the athletic performance.

Opposite Principals. As to the control of blood circulation, respiration, heat production, metabolism, muscle tone and — to varying extent — of all other physiological systems, two correspondingly opposite principles have been identified ; the one is called sympathetic, and the other para-sympathetic.

The sympathetic principle plays the decisive role in the selective activation of the organism's resources during exercise : while the influence of para-sympathetic principle prevails during recovery. However, both exert their influence at rest as well as during exercise and recovery ; and the athletic performance largely depends upon the effectiveness of their balance which undergoes typical changes with training : the highly trained athlete is distinguished by a conspicuous preponderance of parasympathetic influences.

His superior performance capacity is very much contingent upon this preponderance which manifests itself even at rest, e.g. through a slow pulse rate, differences in muscular tone and through a number of metabolic criteria which have recently been demonstrated by Dr. W. Raab of the University of Vermont who sneaks of the heart of the untrained as *loafer's heart* and quite rightly holds that only the trained athlete's heart is in the strictest sense normal.

The full significance of the para-sympathetic preponderance in trained athletes shows itself during exercise ; viz. through a superior capacity to deploy the homeostatic balance and maintain the heterostatic distribution of the various functional units in an appropriate manner in anticipation of and during exercise. During performances of sub-maximal intensity athletes never fully mobilize their reserves ; though untrained individuals may well do so.

Soviet research has acquainted us with evidence to the effect that the para-sympathetic influence is subject to a 24-hour rhythm and that this influence reaches its greatest intensity in the evening. These observations have lately been corroborated by Dr. E.J. Klaus in Muenster, Germany. The rhythmic periodicities under review

which are of major importance for the medical theory of athletics represent the scientific basis for the empirical observation that athletes are most likely to attain their best performances in the evening.

(1) *Olympic silver medal winner in the 1500 m. in Antwerp in 1920; recipient of Nobel Peace Prize in 1959; President of UNESCO's International Council of Sport and Physical Education.* (2) *One of four famous athlete-brothers, all of whom represented England at Olympic Games. Sir Adolphe was Dean of the Westminster Medical School in London.* (3) *First to run the mile in under 4 min. Outstanding neuro-psychiatrist.* (4) *Well-known all round athlete; recipient of the Nobel Prize in Physiology in 1923.* (5) *Member of French Davis Cup Tennis Team that dominated the Courts during the late 20's; Vice-President of UNESCO's International Council of Sport and Physical Education.* (6) *Outstanding decathlon man; pioneer in medical rehabilitation.* (7) *Sprinting champion of Germany; Director of Institute of Sportmedicine in Berlin, Germany.* (8) *One of the U.S., greatest mile runners before World War II; Professor of Physiology at Indiana University.* (9) *Third in decathlon at the Olympic Games in Amsterdam in 1928; leading expert on science of track and field.*