RUNNING RECORDS

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CONSIDERABLE popular interest has developed in running records especially as a result of the recent visit to this country of the Swedish runner, Gunder Haegg, with his seven world's records. There seems to be inadequate means of correlation of records with distance; or more specifically to determine which of two records at different distances is the better. According to newspaper reports the runner himself can not choose among his own records.

It is obvious that a runner can maintain a higher speed for a short run than for a longer distance, but the relation between these speeds and distances is complex. The proper correlation is by a curve through a few of the best records, the others all falling more or less below it, since no record could be better than perfect.

A logical plot is that of average speed in meters per second against the logarithm of the distance as in Fig. 1. The use of the logarithm permits plotting of a wide range of distances without undue crowding at the left end. The curve drawn, with dotted portions at each end, is the plot of the equation,

$$(\log D - 1.5)(V - 3.2) = 6.081$$

which is a hyperbola with a vertical asymptote at 1.5 and a horizontal one at 3.2m/sec. The former is simply equivalent to using a unit of 31.6m in measuring the distance. The latter has a real physical significance, being for a "perfect runner" the "dog trot" velocity. This can be defined as the speed which he could maintain indefinitely without tiring (if it were not for lack of sleep, nourishment, etc.). He can maintain a slightly higher average speed for a finite long distance, or a considerably higher speed for a short distance, either effort producing temporarily complete exhaustion.

The records for less than 400 meters fall below the hyperbolic curve because other factors prevent a runner from attaining such a speed which would exhaust him in those distances. A tangent to the curve is drawn through the record for 220 yards. The records beyond one hour fall below the dotted curve because such races are seldom run under ideal conditions of course and weather; and because other forms of tiring, such as lack of nourishment, enter in. A straight line is drawn through the points for one hour and the marathon. The normal tiring for the large mid-portion of the plot is probably mostly a function of the oxygen concentration in the blood.

The scale of Fig. 1 is too small to permit accurate comparison of different records. This is accomplished in Fig. 2 in which the ordinate is the left-hand side of the equation.

The record for 5,000 meters is clearly superior to most of the other records. In fact, if it were five seconds slower, the straight dotted line, which nearly passes through seven other points, would correlate the best records nicely. By readjusting the constants of the equation the 400-meter record (which has been run twice) and either the 800-meter record or that for one hour (but not both) could be placed in a horizontal line with the 5,000-meter point, all other records being

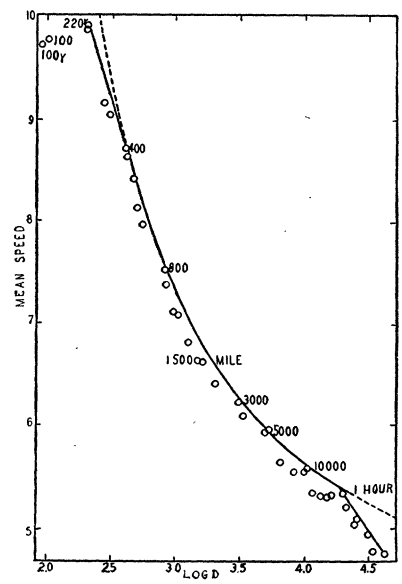

FIG. 1

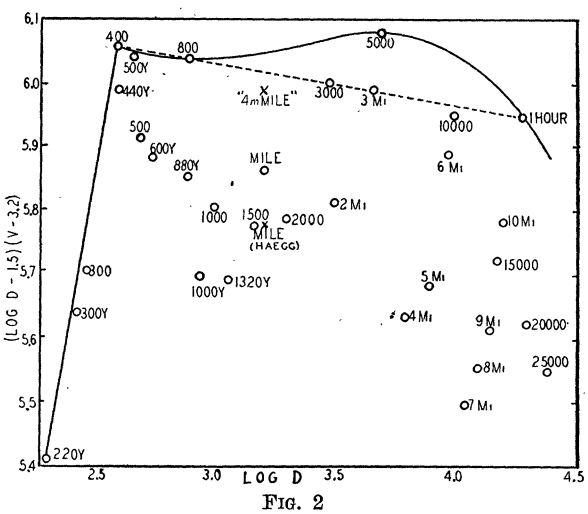

FIG. 2

inferior. This is not done, however, because the choice between the 800 meter and one hour would be arbitrary; and because any new record above the line would require a recalculation with distortion of the whole plot. It is believed that the plot as shown gives a fair comparison between the records. Tentatively a smooth S curve is drawn through the four records mentioned, and is considered to represent the present limit of human speed.

The plot shows that four of Haegg's seven records, the 1,500 and 2,000 meters, his one mile and the two mile, are practically equivalent. The 3,000 meters and three mile are much better, but inferior to his 5,000-meter record. The new mile record by Arne Andersson in Sweden of 4: 02.6 is closer to the curve; but even the hypothetical "four minute mile" falls short, and is therefore an imminent possibility.

A straight line is drawn between the 400-meter point and that for 220 yards, showing that those for 300 yards and 300 meters are inferior. The break at 400 meters is of course too sharp, but the abrupt drop is due to the fact that races shorter than 400 meters are not completely exhausting.

The records used in the calculations are those given in the New York World Almanac for 1943, whether officially accepted as world's records or not. Two other records are included, the new mile record made on July 1, 1943, and the 500-yard record of 54.4s. by Borican on June 13, 1940. Table I gives the records for the more usual distances with the products plotted in Fig. 2, and the calculated records corresponding to the curve of Fig. 2. Calculated times for other distances can be found readily by interpolation. Any actual time for a race can be compared with the calculated world's record on a percentage basis, either time for the same distance or, what is more sound theoretically but less convenient, relative distance in the same time; since that represents the relative accomplishment of an inferior runner as compared with that of a "perfect" runner in the same time.

TABLE I

WORLD'S BEST RUNNING RECORDS

Distance	Product*	Time computed	Time actual	Per cent.
100 yd	....	....	9.4s	
100 m	....	....	10.2s	
200 m	5.33	20.16s	20.3s	99.3
220 yd	5.39	20.3s	20.3s	100.0
400 m	6.057	46.0s	46.0s	100.0
440 yd	6.043	46.34s	46.4s	99.87
800 m	6.041	1m 46.6s	1m 46.6s	100.0
880 yd	5.860	1m 47.33s	1m 49.2s	98.26
1,000 yd	5.697	2m 4.7s	2m 8.8s	96.82
1,500 m	5.771	3m 40.4s	3m 45.8s‡	97.61
1 mile	5.860	3m 58.7s	4m 2.6s	98.19
2,000 m	5.788	5m 4.8s	5m 11.8s	97.66
3,000 m	6.000	7m 58.6s	8m 1.2s	99.46
2 miles	5.815	8m 37.2s	8m 47.8s	98.00
3 miles	5.993	13m 26.6s	13m 32.2s	99.31
5,000 m	6.081	13m 58.2s	13m 58.2s	100.0
5 miles	5.687	23m 26.5s	24m 6.2s	97.25
10,000 m	5.950	29m 39.8s	29m 52.3s	99.30
10 miles	5.784	49m 35.0s	50m 15.0s	98.67
19,210 m	5.946	One hour	One hour	100.0

* $(\log D - 1.5)(V - 3.2)$ D in meters, V in meters/sec.
‡ Since this paper was written, Andersson has run 1,500m in 3m 45s.

OBITUARY

LEWELLYS F. BARKER

DR. LEWELLYS F. BARKER, emeritus professor of medicine of the Johns Hopkins University and visiting physician to the Johns Hopkins Hospital, died on July 13 at the age of 75 in his home at 208 Stratford Road, Baltimore. His death brought to a close a long and active career in which he had attained great eminence as a physician and teacher.

Dr. Barker was born in Norwich, Ontario, Canada, on September 16, 1867. His father, James F. Barker, and his mother, Sarah Jane Taylor Barker, were members of the Society of Friends and thus Dr. Barker was brought up as a Quaker. He attended Pickering College from 1881 to 1884 and in 1890 received the degree of bachelor of medicine from the University of Toronto. After graduation he served as an interne in the Toronto General Hospital, and having determined that the Johns Hopkins Hospital was the institution in which he wished to continue his medical studies, he came to Baltimore, and was appointed assistant resident physician by Dr. Osler. This marked the beginning of Dr. Barker's distinguished services to the Johns Hopkins University and Hospital.

During these early and busy years he worked in close association with Osler, Welch and Mall, and it was not long before it was realized that this young assistant possessed a mind of unusual quality and capacity. Dr. Franklin P. Mall, the professor of anatomy, was one of the first to give expression to this feeling and in 1894 selected Dr. Barker to fill the position of associate in his department; and in 1897, at the age of 30, Dr. Barker was made associate professor of anatomy. Under Mall's influence, Dr. Barker became absorbed in a study of the nervous system. This resulted in his first important and extensive contribution to medicine which took the form of a book entitled "The Nervous System and its Constituent Neurones."

A trip abroad to work in Germany with von Fry, Flechsig and His was soon followed by a noteworthy distinction, for in 1900 he was invited to take the chair of anatomy at the University of Chicago. Pre-