It is remembered that Dr. Roger BANNISTER was the first athlete in the world to run the mile in under four minutes. At the same time continuing brilliant medical studies and his sports career, he is now at St. Mary's Hospital, London.

The prediction of the ultimate limits of athletic performance depends on the understanding of the physiological limiting factors when a man runs at different speeds.

In sprinting, the mechanism of energy liberation is anaerobic, because there is insufficient time for the transport of oxygen from the lungs to the muscles.

In longer races an increasing proportion of the energy for running comes from the aerobic mechanism of energy liberation. Aerobic mechanisms contribute just over half the total energy required in running a mile but more than three-quarters of the energy required in running three miles. In the presence of adequate supplies of oxygen, pyruvic acid is not converted to lactic acid but itself undergoes oxidative reactions. Since the anaerobic reactions are a relatively inefficient source of energy, the
speed of running depends on two factors:

1) Efficiency in transporting oxygen to the muscles so that as much energy as possible is provided by the aerobic mechanism.

2) The runner's skill, that is, his ability to perform the running movements with a minimal energy expenditure and hence reduce his oxygen consumption.

The ultimate limiting factor in running very long distances is the rate of absorption of glucose, the substrate for oxidative breakdown to provide energy. If adequate supplies of glucose are available, nervous fatigue is the ultimate factor. Three dangers are apparent in marathon racing: hypoglycaemia, salt depletion and dehydration and the failure to control body temperature.

In the past few years we have learnt much more about the kind of physique which is necessary for each athletic event. SHELDON introduced the technique of somatotyping in 1940. By a series of photographic estimates he classified the degrees of thinness (ectomorphy), muscularity (mesomorphy) and fatness (endomorphy) in a sample of the general population. Recently TANNER studied 137 men competing in the 1960 Olympic Games at Rome. All the track athletes had a low score for endomorphy, as one might expect, but it was possible to distinguish between sprinters and distance runners with considerable precision. There are however many exceptions to the ideal physique and many athletes by willpower, overcome apparent disadvantages.

The difference between athletes lies not entirely in differences of physique, cardiac output or diffusion capacity: it lies rather, I suspect, in their capacity for mental excitement, which brings with it an ability to overcome or ignore the discomfort - even pain - in muscles and the brain which is probably caused by ischaemia and the consequent changes of blood lactate concentration and pH. Though physiology may indicate respiratory and circulatory limits to muscular effort, psychological and other factors beyond the ken of physiology set the razor's edge of defeat or victory and determine how closely an athlete approaches the absolute limits of performance.

There are of course some wider medical aspects of
competitive sport. There is no section of any community that cannot benefit, except perhaps the most socially impoverished, and even then the prospects of international competition may act as a spur of enlightenment and progress.

Physical deformity need not be a barrier, as Sir Ludwig GUTTMANN has shown by his Olympic Games for paraplegics, giving the Games the name of "Para Olympics". Competitive sport is a part of education but it is also a vital part of maturity too. THOREAU once commented: "The majority of men lead lives of quiet desperation". Sociologists tell us that all of us still seek instinctively for some of the freedom our far-off ancestors knew.

The need for adventure may at first have been satisfied by the struggle for survival. But now that natural dangers have been mainly conquered, we seek further trials. Unless men find them in the sphere of sport, is it not possible that some of them may rebel with some further form of violence? May not a drift towards crime be the result of the thwarting of these impulses? Through sport a man can still feel that his body has a skill and energy of its own. I believe that a collective restlessness, even violence, can be safely extinguished in the sports we play. Competitive sport therefore provides an outlet for this craving for freedom and will become even more important the more restricted, artificial and mechanised our society becomes.