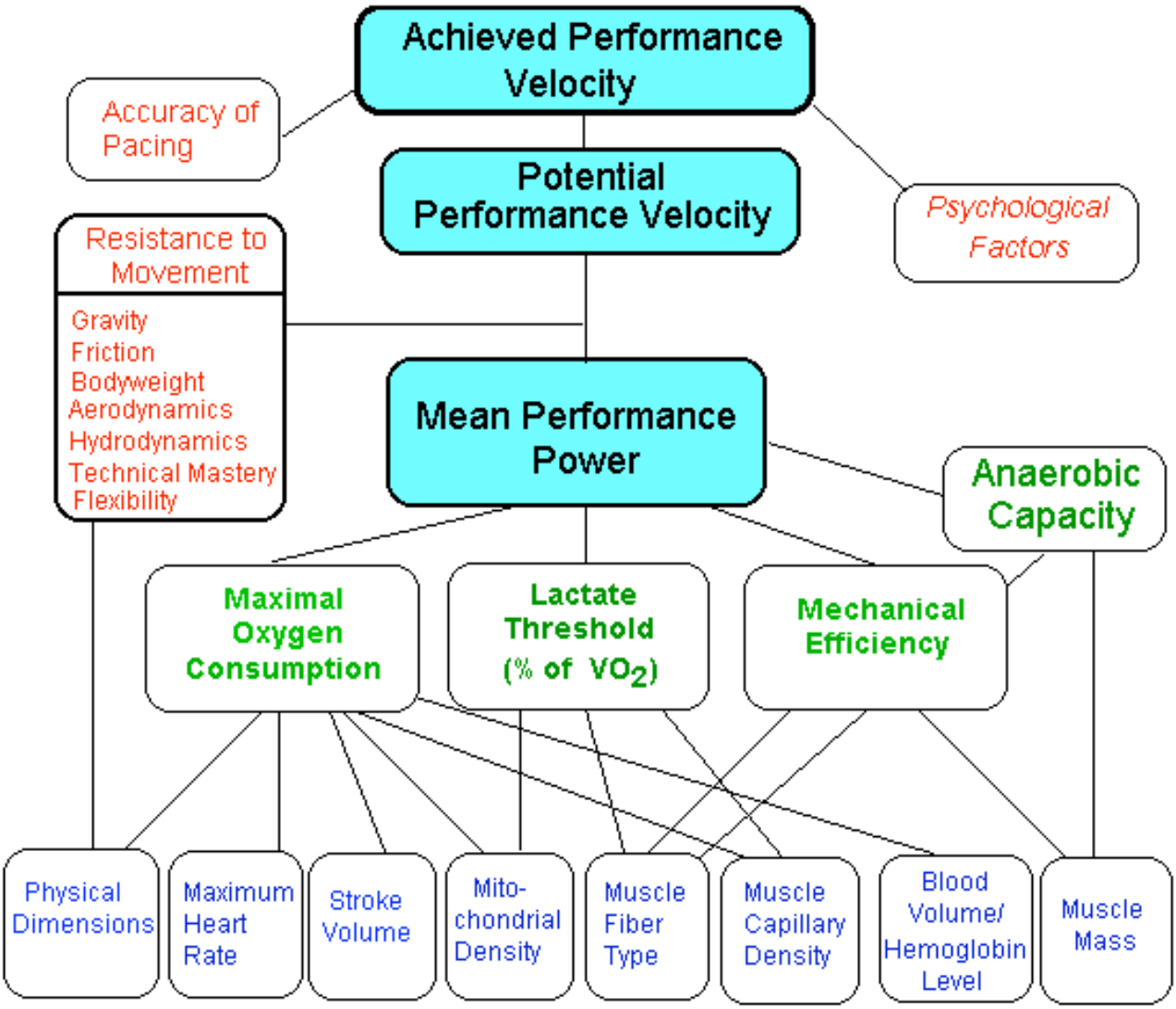
THE ENDURANCE PERFORMANCE MODEL

Whether you run, row, ski or cycle, the goal is always the same; you are attempting to maximize your ACHIEVED PERFORMANCE VELOCITY. All endurance sports demand some combination of three components: 1) High oxygen transport capacity, 2) High fatigue resistance in working muscles, and 3) High efficiency of transfer of physiological work to mechanical movement. Every endurance athlete brings to the starting line some combination of Performance Power (1 and 2). The third variable, Efficiency of Power Transfer (3) links the engine to the specific movement task. These variables combine to determine Potential Performance Velocity. Finally, on a given race day, performance potential is influenced by psychological factors and the accuracy of pacing. The end product is ACHIEVED PERFORMANCE VELOCITY, a personal best, a Masters record etc.

Conservatively, we can list dozens of factors that impact endurance performance. To make things more complex (and interesting), these factors are not independent, but influence each other. Finally, each particular sport discipline puts specific demands and constraints on the system through both the specific resistance to movement that must be overcome, and the race distance or duration.

Given all of this complexity, it is helpful to have a unifying model. So, I am presenting one here for you that you can refer back to when you read other articles. This model summarizes the currently accepted understanding of the physiological limitations to endurance performance. In other words, it is the current paradigm. Perhaps time will show that other factors should be included, or some of these deemphasized. For now, this model seems to fit the data well.

The concept of the figure or this discussion is certainly not original. It summarizes the findings of nearly 100 years of physiological and performance research. An excellent article on this subject based on research he has directed or assisted, and a fairly similar figure, were produced by Edward Coyle PhD (Exercise and Sport Science Reviews, vol.23, p25, 1995. Williams and Wilkens, Publishers.) Michael Joyner M.D. also wrote some excellent synthesizing material on the issue of physiological limitations on performance (running). Journal of Applied Physiology 70:683-687, 1991.



Now, as complicated as the figure above may appear, it is still a simplification. Underneath the physical and anatomical components we could add: 1) genotype, 2) genetically determined responsiveness to training, 3) nutrition, 4) immunological resistance to stress, 5) testosterone level, 6) intensity of training stimulus, 7) frequency of training, 8) years of training load, etc. It is a fantastic puzzle to explore, but remember, the solution is different for each person. Good Luck.