SPECIFICITY OF ENDURANCE TRAINING

Noakes, T. (1986). *Lore of running*. Cape Town, South Africa: Oxford University Press.

In aerobic endurance training, mitochondrial adaptations occur only in muscles stimulated by activity. The response is further limited to those fibers which are activated in the activity. Thus, white fibers are very unlikely to be stimulated to produce a training response in work that is consistently at or below anaerobic threshold. These adaptations are only specific and do not generalize to other forms of activity that may use the muscle, and therefore muscle fibers, differently. For example, endurance gained from flat-track running does not generalize or facilitate hill running.

Different training intensities use different physiological mechanisms and therefore, produce different training effects. These are what might be expected in running.

- Sprinters aim to increase the rates of the creatine kinase reaction and of glycolysis,
- middle-distance runners attempt to adapt the muscle so that they become progressively more resistant to low pH levels, and
- marathoners attempt to shift the lactate turnpoint (AnThreshold) to a higher speed, increase the capacity for fat oxidation so that carbohydrates can be "spared" or "saved", maximize the ability to store liver and muscle glycogen before exercise, and increase the capacity to absorb carbohydrate during competitive performances.

Response systems are also dependent upon the mechanical function doing the work. For effective training at least the appropriate biomechanical actions (technique and its constituent neuromuscular pathways) must be maintained and repeated while the appropriate energy system is fatigued. Irrespective of the development level of an athlete's technique, when in a non-fatigued state, an athlete usually works as efficiently as possible, even though the technique might include some "errors." With the onset of fatigue caused by a training stimulus, muscle fiber and then muscle recruitment occurs, eventually resulting in a degradation of movement efficiency no matter what the standard of technique that originally existed. In the very early stages of fatigue, a loss of efficiency can be stalled by the athlete consciously striving to maintain essential technique elements, a compensatory activity that lasts only for a short time. Physical fatigue gradually becomes more general and reduces movement efficiency. Consequently, it is not worthwhile to persist with excessive fatigue that causes technical inefficiency when attempting to get the optimum benefit from a practice activity.

Once the activity's biomechanics are degraded, further physiological overload is not warranted because the body will be learning to energize an inappropriate and, very likely, counterproductive action. Thus, for specific training to be beneficial it has to include both the biomechanics and energizing system of the intended competitive performance.

Implication. When a program mixes training stimuli, it is likely that the body's response will be general and diminished over that which could be achieved through blocked, repetitive stimuli. A response system can only be stimulated optimally when it is exposed to repetitive work that requires skill technique maintenance in the face of increasing fatigue. Mixed work does not achieve that because both techniques and energizing capacities are varied, none being stimulated optimally, and so responses are not maximal. For effective coaching it is essential that "types" of work are programmed to provide optimal stimulation through the preservation of exact techniques with appropriate physiological overload.

There comes a time in a training segment where further work is counterproductive. That point is where performance and technique have deteriorated despite increased effort by the athlete. Coaches have to be "brave" enough to terminate training at that point rather than completing the segment as programmed.