

Fatigue – muscles or mind?

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When we place sustained physical demand on our bodies, the by-products of the processes that generate the energy to meet this demand accumulate in the muscles, reduce our capacity to maintain speed and cause the muscles to send a signal to the brain that we feel as fatigue. That sounds reasonable, but is it correct? Studies that have been done recently support a theory that has been around for some time that the brain has a subconscious function that causes us to feel fatigued (and hence to reduce our effort) well before muscle and other tissue is in any danger of damage from sustained exertion. This is like having a “governor” that keeps things in the comfort zone.

Studies reported in *Running Research News* (v21:01, Jan-Feb 2006) indicate that loss of pace in a distance race is due more to a reduction in stimulation of muscle fibres than to changes within the fibres themselves. If the nervous system is a key factor in maintaining pace then this suggests that training to condition the nervous system to maintain a higher level of muscle stimulation should assist in improving race performances. A feature of this type of training is running at goal race paces to lock those paces into the neuromuscular system memory. High intensity training stimulates the neuromuscular system to recruit more muscle fibres and to better coordinate the groups of fibres that power and control movement. It also conditions a runner to tolerate sustained demand. Whenever you try to learn a new movement (whether it is learning a new dance step or a more efficient running style), you first have to think about each step in the process before you do it – you have to train your nervous system to control groups of muscle fibres in a coordinated way. You also tend to tire quickly at first. With practice, the process becomes automatic, done without conscious effort. If running fast for a period of time is a new “trick” for you it is something that can also be improved with practice. Running long distances slowly will not make you better at running fast.

Two South African researchers (St Claire Gibson and Noakes) provide evidence that the sensation of fatigue is generated by the brain in response to integration of stimuli from the complex set of systems that are involved in sustained physical exertion. Many variables in multiple physiological systems interact to bring about change in skeletal muscle power output. This set of systems includes the muscles and the brain. The SA researchers claim that a “governor” region of the brain calculates a pacing strategy that results in exercise intensities that are homeostatically (body systems in a steady state) acceptable. The distance to be run is the key variable in determining pace. In simple terms, how fast we run depends on a subconscious determination of how far we have to run and what it will take to do that comfortably. Improving performance then comes down to changing the upper limit of the governor and specific training challenges that maximise the capacity of the physiological systems involved to act together to maintain a high level of power output for the required duration of that performance. Breaking a race up into shorter segments (think of a 5000m race as five 1000m segments), dismissing each as it is completed and focussing on the next segment is a race strategy that can be used to increase overall pace.

Racing or demanding training sessions lead to various levels of discomfort. We don't like discomfort and our bodies will subconsciously act to move us to a more comfortable state, a

reasonable response in most situations. It takes a conscious effort to maintain a fast pace throughout a race, but this is something that training can prepare you to do.

The physical challenge is only part of a race. For some people, being passed by another runner is interpreted as a challenge, something that motivates an increase in pace. For others, the same thing causes a feeling of defeat, no increase in pace (sometimes even a drop in pace), an acceptance of a decrease in finish position. You can usually think yourself into feeling more or less fatigued. Taking the positive path is something that you can develop by concentrating on it during training. Practice visualising yourself running smoothly and fast, running a race or training session in your head before the actual event. Work through responses to various race situations before you face them. Other people may not conform to your game plan, but at least you will have a response to challenges in your memory. Think “tired” and you will be. Think about going faster and you probably will.

(A St Claire Gibson & T D Noakes, 2004, Evidence for a complex system integration and dynamic neural regulation of skeletal muscle recruitment during exercise in humans, Br J Sports Med; 38:797-806)