

## IS IT ALL IN THE MUSCLE?

I have written a number of short articles most of which are condensed versions of the works of various experts in the field of exercise science and biomechanics. Although there is no scientific data to decide the best method of training, in many of my articles I have quoted credible opinions and physiological reasons for recommending race-pace training in preference to long over-distance training; especially for events of 50m to 200m: a total of 12 Olympic events. I don't want to hammer this concept into the ground but would like to consider the reasons for all types of training and look at present thinking about certain aspects of training.

As the muscles play such a vital role in athletic performance, an article in 'Science Daily' about the genetically altered performance of mice was of great interest. The article explains how by the addition of a single enzyme PEPCK-C<sub>muscle</sub> in the muscle turned the mice into 'super mice' far more powerful than the control mice, and they had extraordinary athletic ability. Another article on the same subject was headed 'Building muscles without exercise' This article stated that the mice developed muscles the same as muscles developed by intense exercise and increased their ability to perform physical tasks way above untreated mice. (Apparently the method used to transform mice is not suitable for humans, long term effects have not been determined) I found the articles interesting because of the vital role that muscles play in athletic performance. When discussing the pros and cons of various methods of training the term 'aerobic base' usually comes into the picture. It is not clear what this really means in terms of muscle function. It is established that we have red slow-type 1 fibres, and white fast-type 2 fibres. And there are five sub-types of the white fast-type 2 fibres. Some of these fibres the white fast-type 2 fibres are uncommitted fibres; these can develop into either slow or fast type fibres depending on the training intensity.

Long over-distance will develop slow type fibres and race-pace swimming will develop fast-fibres. However, it is not quite so simple; some people have slow-type fibres that approach the fast-type fibres of other people. And it must be remembered that white fast-type C (X) fibres can be adapted to endurance training and these are particularly powerful fibres. So 'aerobic base' is a bit confusing, it suggests that you can build a base that will stay intact while you perform other type training. In fact, the muscle will always respond through fibre changes to whatever intensity you are training. If you train both types at different intensities you will end up somewhere between the two, leaning towards the predominant stimulus of your training.

Another often discussed subject is oxygen; the actual role of oxygen in physical exercise is a subject of intense debate involving some exercise scientists; that is all I know of the matter and have no comment, but we could have a look at some of the ways we set intervals in training to manipulate oxygen consumption and what is actually happening. Back to the 'super mice'; the researchers found that the control mice could only run for 19 minutes, while the 'super mice' could run at a fast pace for 30 minutes, and use mostly fatty acids as fuel. The muscle could alternate fatty acid and carbohydrate metabolism and had a low lactate level. The 'super mice' must have used oxygen very efficiently and their outstanding athletic ability is due the added enzyme in the muscle. Does the muscle access the oxygen?

The practise of limiting the recovery time in long over-distance short rest interval training uses oxygen on a 'pay as you go' basis and is aimed at developing a high lactate threshold; this limits the speed of the swimmer and it is not possible to use the muscle at race-pace and faster than race-pace. The interval has to be long enough for the swimmer to be able to continue the training at race pace or faster, this would train the muscle to access the substrates used by the muscle at the pace of the race for the duration of the distance swum. Race pace for long events is not as difficult to control as the shorter distances and coaches would have a wider choice of interval distances in exercising their talents for developing their programmes.

A friend of Prof Tim Noakes in the USA who has written a book based on the **Central Governor\*** hypothesis, has suggested that since the central governor theory predicts that there is always a reserve, the idea is not to try to adapt the physiology about which we know little but to try to access that reserve and the only way to do that is to make sure that you train at the pace that you want to achieve in competition. The danger in all swimming programmes is over-training; testing not properly followed and swimmers become tired and performance suffers. From correspondence with Prof Noakes the following extract seems relevant: "We are also finding that the brain reduces its muscle recruitment progressively during exercise as well – reasons unknown – and that this also causes the fatigue of prolonged exercise." Also " I am beginning to think that fatigue is perceived in the brain and is a learned response – that is - we programme ourselves to fatigue at a certain time during exercise. This is another reason why high speed training is so important, it trains the brain as much as anything else".

Coaches are influenced by programmes used by successful coaches who have trained world class swimmers. This is good but it should be born in mind that exceptional talent and faith in the programme would succeed on a variety of training methods. Records of the past and present records confirm that swimming is getting faster almost every year. To find the difference from qualifier to the final heat, coaches will have to experiment to find the speed they need, the answer is there.

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Very Condensed version by H.G.Lynn, of Central Governor headed '*What's New*' Available free [gorlynn@vodamail.co.za](mailto:gorlynn@vodamail.co.za)

The Integrated Neuromuscular Recruitment Model of Exercise Physiology and Athletic Performance(*Central Governor Model*) is a chapter in *The Lore Of Running 4<sup>th</sup> edition* By Prof Noakes MBChB, MD, DSc, FACSM.