A GUIDE TO ANAEROBIC TRAINING

'GLOSSARY'

SPEED

Speed has many different definitions in different sporting contexts. In sprint swimming 'speed' usually means maximal swimming velocity over a short distance. When defined this way, speed requires a combination of strength, speed of movement, application of power, anaerobic capacity, coordination and appropriate sprint technique.

SPEED DEVELOPMENT

As 'speed' has so many different components, speed development training must address all of these components. Speed development can be divided into the **foundation work** to develop strength, speed, power, stability, coordination, and technique required to swim fast, and **specific speed development work,** consisting of short- maximal swimming repetitions.

FRONT-END-SPEED (FES)

'Front-End Speed' or **FES** is used to refer to the speed of the 1st 50m of a 100m race.

BACK-END-PACE (BEP)

'Back-End Speed' or **BEP** refers to the speed of the 2nd 50m of a 100m race.

200m PACE (200p)

200m pace or **200p** refers to the pace of the middle of a 200m race. As the 2nd and 3rd 50's of a 200m race should be very similar in pace, the pace can be expressed either as a 50m time or 100m time. The 200m *SpeedCharts* can be used to determine specific 200p times over a range of other distance. Similarly 400p, 800p and 1500p can be used to refer to the pace of the middle stages of races over each of the corresponding distances.

LACTIC ACID ENERGY SYSTEM / ANAEROBIC GLYCOLYSIS

The lactic acid energy system, also referred to as *anaerobic glycolysis*, is the main anaerobic energy system, responsible for contributing a substantial amount of energy for sprint swimming. The lactic acid energy system uses glycogen as a fuel to rapidly deliver energy to working muscles

GLYCOGEN

Glycogen is the form in which carbohydrate is stored in the body. Muscle glycogen is the primary fuel source for anaerobic exercise (anaerobic glycolysis), including sprint swimming. When muscle glycogen is depleted, performance in anaerobic activities is compromised. **Complete** replenishment of muscle glycogen stores, when heavily depleted, takes around 48 hours.

LACTATE PRODUCTION

The term 'Lactate Production' is usually used to describe a **maximal rate of lactate production,** or a **maximal rate of energy production through anaerobic glycolysis**. Lactate Production Training therefore aims to increase the capacity of this system to delivery energy for exercise.

For more information on Lactate Production Training, see the 'Lactate Production' Information Sheet.

LACTATE TOLERANCE / TOLERANCE

'Lactate Tolerance' Training (or simply 'Tolerance' training) aims to develop the ability to maintain fast swimming under extreme fatigue (similar to final stages of a 100m or 200m race) through a combination of 1) maintaining a high physiological power output and 2) maintaining good, efficient technique. *Tolerance* training therefore focuses on technique (particularly avoiding technical break-down) under fatigue, as well as effort.

For more information on Tolerance training, see the 'Lactate Tolerance' Information Sheet.

LACTATE REMOVAL

Lactate Removal is a term used to describe the process by which the fatigue resulting from anaerobic metabolism can be minimised. Minimisation of the negative impacts of highly anaerobic glycolytic work (e.g. lactate production/tolerance) occurs in a number of ways. The hydrogen ions, which are the acidic component of the lactic acid, can be 'buffered' or neutralised. Bicarbonate is the major buffering system within the body, but other substances such as phosphate and haemoglobin all play a role in buffering hydrogen ions produced by anaerobic metabolism. The lactate component of lactic acid is shuttled to inactive muscle fibres where it can be converted back to pyruvate and used as an aerobic energy source, or removed by the liver and kidneys. Any lactate or hydrogen ions that are not 'removed' will result in an increase in muscle and blood lactate concentration, and a decrease in pH.

Lactate Removal Training is training that attempts to improve the bodies capacity to remove the bi-products of anaerobic metabolism – primarily lactic acid – and therefore postpone the onset of fatigue. Lactate removal training usually involves alternating between race-speed specific swimming (often BEP or 200p), which will produce lactic acid, and moderate (but not slow) swimming that will challenge the removal of the acid.

AEROBIC

Although all intensities of exercise have a substantial aerobic component, **aerobic** training is usually considered as intensities that are predominantly aerobic, with little or no anaerobic component (ie, below anaerobic threshold). It is however important to make the distinction between low-level aerobic training, which uses mainly fat as a fuel source, and high intensity aerobic training, which uses glycogen for fuel at a greater rate. High intensity aerobic training can significantly deplete muscle glycogen stores, and therefore can impact on subsequent anaerobic sessions.

VO2 MAX

VO_2max is the term used to describe the maximal rate at which the body utilises oxygen to produce ATP (for a specific activity). VO_2max is expressed in litres per minute, or milliliters per minute per kilogram of body weight.

Many factors affect VO_2max, involving many systems in the body – the ventilatory system to extract oxygen from the air to the blood stream; the cardiovascular system to bind the oxygen in the blood stream and transport it to the working muscles, and the muscles which extract the oxygen and use it to create ATP from stored carbohydrate and fat. Therefore many types of training contribute to improving VO_2max. For example, extensive low-level aerobic training can improve the capiliarisation of muscle fibres so that oxygen can be more readily extracted from the blood, thus improving oxygen utilisation by the muscles and therefore VO_2.

VO_2max training usually refers to training at intensities that are at or near VO_2max. As VO_2max occurs very near maximum heart-rate, this type of training stresses the cardiopulmonary system (delivery of oxygen from the environment to the working muscles through the bloodstream), as well as challenging the maximal rate of extraction and utilisation of oxygen at the muscle. As VO_2max occurs above anaerobic threshold, there is a considerable anaerobic component to exercise at this intensity, as well as a maximal aerobic component.