JIM JAYES

EVERY SECOND COUNTS

PHYSICAL PREPARATION FOR CANOE SLALOM

FOREWORD: IAN WILEY PRE-OLYMPIC CHAMPION

Acknowledgements

Photography by Chris Worrall
Photographs on Cover and Introduction by Tony Tickle Introduction by Ian Wiley
Diagrams courtesy of The National Coaching Foundation Graphic Design by Richard Pope
Printed by Colchester Institute

Contents

Foreword

I was honoured to be asked by Jim to review this book.
One of the main points stated in the book, comes in the first line, that the requirement for a high level of Slalom specific skill is essential. I cannot emphasize this point enough, as the development of skill and its maintenance throughout physical preparation plays a major part in success or failure.

I am sure this book will be of great value to Slalom Athletes of all levels.

Ian Wiley
Pre-Olympic Champion

Introduction

Once a good level of specific slalom skill has been developed, to gain further progress within the sport detailed attention to the physical aspects of the preparation becomes necessary. As physical development takes place it will also be possible to enhance technique with regard to speed and consistency, especially in the latter stages of performance. With added power new possibilities in technique will arise. Also with a higher level of fitness and less fatigue for a given pace, the athlete will find it easier to concentrate during race and training performances.

Training Environment

A major factor in athletic performance is the effect on training and racing of the athlete's overall life style and environment. Factors such as: where they live, climate, water and air pollution, finance, diet, study, work, parents, other people and other interests all play an important part in the make up of the athlete.

Young athlete's have very little control of their initial circumstances, with possibly the exception of effective management of time. As the athlete progresses the choices of each individual are greater and considerations of how training and racing will fit into the athlete's life as a whole will need to be made. These choices are the responsibility of the adult athlete, who may or may not wish to consult with others. Ultimately these decisions represent a very complex and individual mix of circumstances. For the young highly ambitious and talented athlete, these choices should be thought about to some degree early on in their sporting career, in order that they can start to plan ahead.

For Canoe Slalom training, the location of your training facilities in relation to your home is a major consideration of both time and finance. Facilities not only include a slalom training site, which may possibly need to be floodlit, but also other considerations such as coaching, training partners and other paddlers, gym, canoe club, swimming pool etc. The requirements of a good training programme are many and varied. Few locations, if any one, have all the answers· the world being full of "particular slalom site" experts who are often unable to perform to the same standards on other courses. For major events the athlete has little choice as to which courses to race, therefore variety of training venue is an important consideration which will require transport.

At current world standards the commitment of many of the top athletes is almost and sometimes total, with individuals trying to cope with the demands of not only performing, but also financing the training and competition in various ways.

A very difficult period for many athletes, is the period from deciding to go for the top, to the time (if it arrives) that someone, organisation, company or grant giving body realises their potential.

This is usually a very hap-hazard process with many pit falls. It requires good fortune as well as keeping one's eyes wide open for opportunities, a bit like real life. Putting to a good use the athlete's personal publicity can enhance many of these chances. Possible ways of coping initially that have been used with varying degrees of success by many top athlete's have been:

I. getting good very early on and finding a sponsor or receiving major grants;

2. staying in full or part time education financed by grants;

3. splitting a full time educational course, taking alternate years out;

4. become unemployed;

Many of the above usually require a frugal existence. With pressure on finance if not time;

5. having a full time job in a good training environment, with very good management of personal time;

6. obtaining a part time or full time job with a sympathetic employer;

7. having the financial support of parents or relatives.

Much of this personal organisation of time and finance is not a matter of being able to train eight hours a day, but being in a g0od overall environment to take full advantage of the training opportunities.
There are many possible combinations of the above. Only the individual with all the necessary information can make the required decisions, based ultimately on their personal level of commitment to achieving their ambitions and fulfilling their overall personal potential.

Designing the Programme

First identify what is required for optimum performance at the current level and future desired levels of competition. As the sport progresses, the performance levels of today's winners, both in training and competition, may not be good enough in the future; an important point for the young aspiring champion. Look towards what would be the ideal and not just at what already exists. Assess the current and future physical demands of the race run as well as the demands of the training. Often athletes need to train in order to be able to train better later on.

Determine the athlete's current condition by use of competition and training results, looking at them both from the individual point of view and in comparison with others; use of time trials both 9n and off the gates and of various lengths; comparisons with others during gym sessions weights and circuits etc., and the use of the slalom performance test (explained on page 36). From these results it should be possible to start to identify strengths and weaknesses. The aim is to strengthen weaknesses whilst maintaining strengths and then progressing as a whole, taking into account the desired level of performance required both in the long and short term.

Analysing the Physical Demands of a Slalom Run

A study of video from a wide range of race performances at world class level reveals the following:

average stroke rates during competition;

Mens KI: 80 per minute in the gates and maximum 130 per minute at the start and finish of the event on the straight;

Ladies K 1: 70 per minute in the gates and maximum of 80 at the start and finish on the straight. It also appears that the LKI class also tend to hold onto each stroke for a longer time. Probably due to a comparative lack of power;

CI: 60 per minute in the gates and a maximum of 78 at the start and finish on the straight.

Course lengths vary from 110 seconds to 180 seconds for the Mens KI and longer for other classes. This means a gate every 4.4 - 7.2 seconds.

These stroke rate observations are an important point when designing strength/power and circuit type training sessions, as movements made during these types of session need to be made at or above the speed required in order to gain the maximum training effect.

Further observation shows that very little straight forward paddling takes place, with most forward momentum being performed by paddling in arcs and with the boat on edge to some degree. This has great significance to those who train mainly on flat water.

Much of the controlling strokework takes place at very extreme ranges of movement so good flexibility, strength and power are required in almost all directions.

About three backward strokes take place per minute with bow rudders occurring often as part of the forward paddling control.

The anaerobic lactic system is used to a great extent, with lactate accumulation measurements found in slalomists amongst the highest recorded in any sport. This is of great significance, especially considering the high degree of skill and coordination required. This shows that as well as being a very technical sport it is also a very physically demanding one.

A minimum of 20 and a maximum of 25 gates.

A minimum of 6 up streams, sometimes as many as ten, with at least one in four gates upstream.

Standard minimum weights of boats.

This and other specific individual information such as training time available, commitment and environment, will help in the development of a programme with correct proportions of various types of training for each individual.

When evaluating an individual, take into account several performances to ensure reliability.

The Physiological Considerations

When time, commitment and environment allow for more training, some major mistakes are all too often made. Foremost amongst these are the over use of high intensity training sessions thereby not allowing sufficient recovery of both muscle tissues and energy stores, along with the insufficient development of the aerobic system, which in tum leads to the athlete being unable to fulfil their anaerobic potential.

With many of the athletes we are coaching, a main theme of their training is the use of alternate days of aerobic and anaerobic work, thus providing a balanced programme which allows good recovery from each type of training session; this is extremely important to avoid over training and consequent deterioration in performance. Many of the paddlers using this pattern of training have gained exceptional results, comparatively quickly.

Aerobic - Anaerobic Performance

(See glossary for details of abbreviations and terms.)

A basic knowledge of physiology is beneficial to the understanding of the relationship between the fuel energy systems, exercise intensity and nutrition. These concepts aid training specificity and are explained in sports nutrition texts (*2).

The simple currency of energy is a chemical fuel within cells producing muscular contraction called adenosine triphosphate (ATP). The breakdown of ATP is a reaction which releases muscular energy.

ATP = ADP+ energy

The amount of ATP available within the cells is limited and in order to prevent depletion of ATP the processes by which ATP is regenerated are especially important. There are three principle ways in which this ATP can be resynthesised and these systems are:

Aerobic performance requires the sufficient intake of oxygen for the oxidation or burning up of food stuffs, mainly carbohydrates and fats. Carbohydrates (CHO) are oxidised much more rapidly than fats. In Canoe Slalom, where the high intensity and short duration are characteristic, the principle fuel utilization is carbohydrate. This most important foodstuff, being CHO is digested into glucose and stored as glycogen. Fatigue in the aerobic systems is a result of either a restriction in the oxygen or glycogen supply.

Anaerobic exercise occurs without utilising oxygen as the oxidation of carbohydrate or fat is not sufficiently immediate. In the initial few seconds of exercise a decrease in ATP is not observed as a consequence of immediate regeneration through the breakdown of creatine phosphate (CP). This rapid resynthesis of ATP by CP is also limited as the quantity of stored CP is very small. Where the exercise duration continues at intensities at which the rate of aerobic energy production is inadequate, known as the anaerobic threshold, ATP is resynthesised directly from glucose, whilst lactic acid is produced as an intermediate product. At light exercise intensities, this lactic acid is continuously removed into the circulation, before being reconverted to produce yet more ATP, elsewhere in the body.

glucose+ ADP= lactic acid+ ATP

lactic+ oxygen+ ADP= carbon dioxide+ ATP+ water

Lactate is thus not an end product but reconverted through simultaneous aerobic energy production. However, when the exertion is such that the lactic acid cannot be removed from the muscle vicinity, lactic acid then accumulates. The athlete first experiences this as an ever increasing stiffness in the muscles along with a corresponding loss of coordination.

It is important to understand that there is no sudden switch between aerobic and anaerobic energy systems. In fact, the two processes coexist and the dominating ATP resynthesis system is dependent upon principle factors; intensity, duration and type of exercise, the training condition of the individual, maturity and preceding diet.

In summary, the three energy systems involved in the regeneration of ATP as the stores become depleted are;

1) aerobic oxidation of principally carbohydrate derivatives;

2) anaerobic alactic, the ATP-CP system;

3) anaerobic lactic acid glycolysis system.

Diagram 1

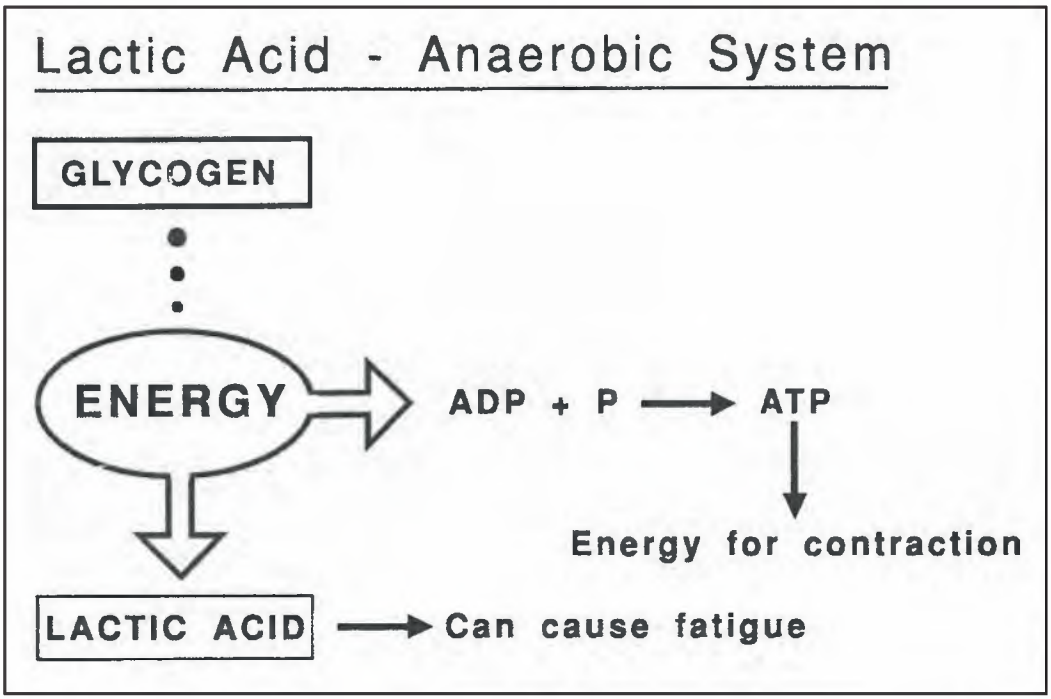


Diagram 2

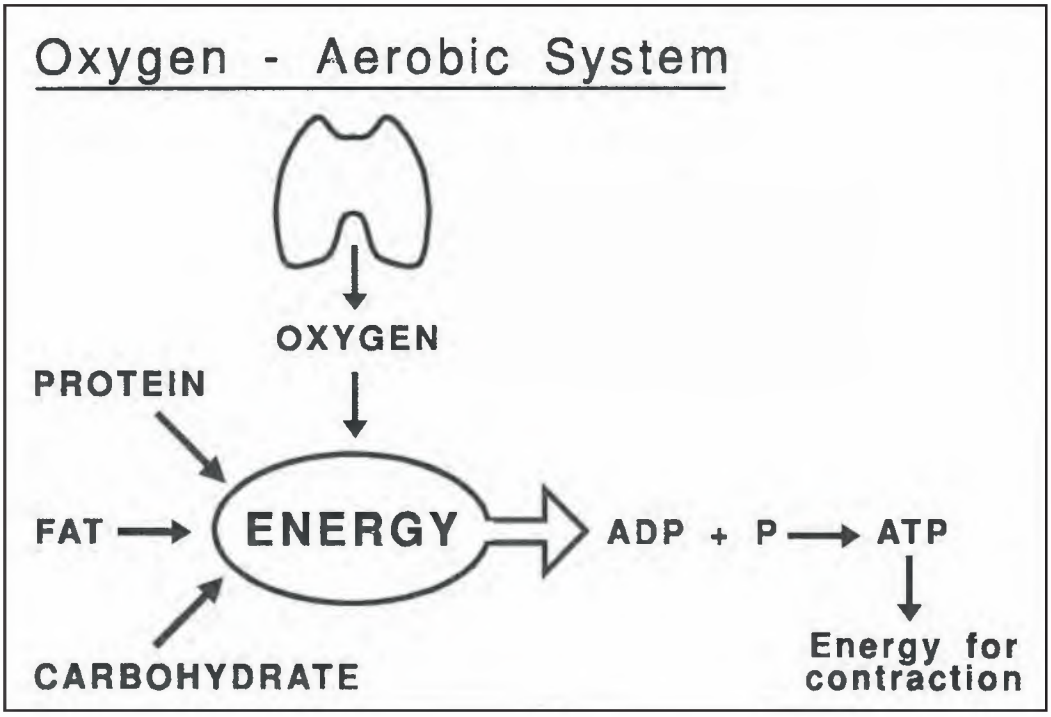


Diagram 3

The Three Energy Systems

Anaerobic System - *Starter* system - needs no oxygen and produces no waste

Anaerobic System - *Fast-twitch* system - needs no oxygen but produces harmful waste (lactic acid)

Aerobic System - *Slow-twitch* system - needs oxygen but produces no harmful waste

All supply energy simultaneously in varying proportions

Aerobic Training

A good aerobic capacity will help the athlete achieve a high anaerobic capacity by aiding the recovery in the mainly anaerobic sessions. This allows the well conditioned aerobic athlete to achieve more in the anaerobic training sessions. This is due to the development of the heart, lungs and circulation system that takes place during aerobic work, which in tum aids the removal of lactic acid during the anaerobic sessions. For this reason it is advisable to develop the aerobic system first in the training build up.

On the aerobic days the athlete can do sessions at or below their anaerobic threshold level. These sessions being guided by pulse rate, with the anaerobic threshold level being established by the use of the Conconi test. These sessions are about 30 - 40 minutes duration, either done continuously or the work being divided up into lengths of anything from 3 min to 40 min with only 1 - 2 min rests between reps. during the session.

Once the anaerobic level is established it is useful for the paddler to do some sessions with a pulse meter to get the feel of the intensity required. However the anaerobic threshold level may change and further testing is needed at regular intervals.

Aerobic Progression of Training Sessions

Figure 1 is a guide for progression and overload of sessions.

Use a very gradual progression and overload from session to session for best results. Start to highlight this work about 5 - 6 months before major events easing off in the final few weeks before racing, as other training takes priority. Maintain a very gradual progression unless the athlete encounters problems of fatigue. If this happens take a rest and drop back a few sessions in progression. It will often be necessary to take a short active rest before it is possible to move onto a higher level. Use a mix of the following and other sessions for variety using the volume of work, and to a lesser extent intensity, as your main guide to progression and overload. Once training at anaerobic threshold level on a regular basis, maintain it for most sessions as this is probably how most progress will be made.

Figure 1

4	* 6 min	* 1	pulse	15	beats	under	Anaerobic	Threshold.	
5	* 5 min	* 1	"	15	"	"	"	"	
4	* 6 min	* 1	"	10	"	"	"	"	
1	* 20 min		"	15	"	"	"	"	
4	* 6 min	* 1	"	5	"	"	"	"	
5	* 5 min	* 1	"	10	"	"	"	"	
4	* 7 min	* 1	"	10	"	"	"	"	
1	* 25 min		"	15	"	"	"	"	
5	* 6 min	* 1	"	5	"	"	"	"	
6	* 5 min	* 45 sec	"	10	"	"	"	"	
5	* 7 min	* 1	"	10	"	"	"	"	
1	* 25 min		"	10	"	"	"	"	
6	* 5 min	* 30 sec	"	10	"	"	"	"	
7	* 4 min	* 1 min	"	Anaerobic	Threshold	Level.			
4	* 8 min	* 30 sec	"	10	beats	under	Anaerobic	Threshold.	
1	* 25 min		"	5	"	"	"	"	
7	* 4 min	* 45 sec	"	Anaerobic	Threshold	Level.			
5	* 7 min	* 1 min	"	10	beats	under	Anaerobic	Threshold.	
10	* 3 min	* 45 sec	"	Anaerobic	Threshold	Level.			
3	* 9 min	* 1 min	"	Anaerobic	Threshold	Level.			
1	* 30 min		"	5	beats	under	Anaerobic	Threshold.	
7	* 4 min	* 30 sec	"	5	"	"	"	"	
6	* 5 min	* 1 min	"	Anaerobic	Threshold	Level.			
10	* 3 min	* 30 sec	"	Anaerobic	Threshold	Level.			
5	* 8 min	* 1 min	"	5	beats	under	Anaerobic	Threshold.	
8	* 4 min	* 30 sec	"	Anaerobic	Threshold	Level.			
6	* 6 min	* 1 min	"	Anaerobic	Threshold	Level.			
1	* 35 min		"	5	beats	under	Anaerobic	Threshold.	
6	* 5 min	* 1 min	"	Anaerobic	Threshold	Level.			
1	* 30 min		"	5	beats	under	Anaerobic	Threshold.	
9	* 3.30	* 30 sec	"	Anaerobic	Threshold	Level.			
7	* 5 min	* 1 min	"	Anaerobic	Threshold	Level.			
1	* 30 min		"	Anaerobic	Threshold	Level.			
2	* 20 min	* 2 min	"	Anaerobic	Threshold	Level.			

To add variety to aerobic training the options are endless and may include many other sports as well as other forms of paddling both structured and recreational.

Anaerobic Lactic Training

Anaerobic sessions can take many forms, including full runs during and leading up to the season and other high intensity work with varied rest periods. It is not advisable to attempt to stress this system before puberty. Children are said to be aerobic, that is to say they do not rely heavily upon their anaerobic undeveloped system. Due to the fact that young children can perform high intensity exercise aerobically, an athletic youngster is equally good at sprint as endurance activities. During these anaerobic days it is possible to do more than one anaerobic session in the day, to ensure sufficient overload for development. Because there would not be sufficient time for a full recovery from the first session, these sessions should be evenly balanced from a fatigue point of view. It is the equivalent of doing two half sessions within the same day. It is also probably best to do the peak lactic sessions when fresh and the tolerance sessions last. Recovery from these anaerobic sessions can take anything from 24 to 96 hours. If sufficient recovery is not allowed, then progress will not be made. For a good recovery these days should be followed by days where the sessions are of lower intensity and so lactic free. Furthermore, high lactate accumulation is detrimental as it increases the likelihood of injury through muscular micro-ruptures. The situation of injury can be avoided by adequate rest sessions and by suitable training programmes based upon variety.

Anaerobic Progression of Sessions for Peak and Lactic Tolerance

Figure 2 is a guide for progression and overload of sessions.

For Peak Lactic sessions use runs of up to 120 seconds, longer runs will not increase the peak load on the anaerobic system. Use a full and active recovery to maintain muscle blood flow from all reps and sets. These kind of sessions will simulate closely the lactic levels experienced during racing. It must be remembered that although the total volume of a session gives an indication to overload it is not the only factor involved. i.e.. It would be found that if performing a peak lactic session of:

6 * 100 seconds * 200 second rests

it would be found to be a more demanding session than:

10 * 60 second * 120 second rests

even though the volume of both work and rest in both sessions is the same.

For Lactic Tolerance sessions some longer durations of work can also be included at various intensities, and it is also possible to use a variety of rests to determine progression and overload. Use active rests to aid recovery of between 2 * work down to ½ or even a ¼ on some of the shorter repetitions.

Start to highlight anaerobic work about 16 weeks before major events easing off in the final peak. A certain amount of maintenance work is advisable all year . Maintain progression unless the athlete encounters problems of fatigue. If this happens take a rest and drop back a little in progression, when re-starting training. It will often be necessary to take a short active rest before moving onto a higher level. It is possible to use a mix of the following sessions for variety. Use a very gradual progression and overload from session to session for the best results. It is very likely during this type of training that the athlete will reach a level where further overload will not produce a higher level of performance, but often the reverse if over-used. To make further progress at this point may take months or years and will often need further development of the aerobic system for the reasons mentioned earlier.

Figure 2

Sets.	Reps.	Length.	Volume in seconds.
a.	1 * 5 *	25 sec	125
b.	2 * 4 *	25 sec	200
c.	2 * 4 *	30 sec	240
d.	2 * 4 *	35 sec	280
e.	3 * 3 *	40 sec	360
f.	3 * 3 *	50 sec	450
g.	2 * 4 *	50 sec	400
h.	3 * 4 *	40 sec	480
i.	2 * 3 *	80 sec	480
j.	4 * 3 *	45 sec	540
k.	2 * 3 *	90 sec	540
l.	2 * 4 *	70 sec	560
m.	3 * 4 *	50 sec	600
n.	2 * 5 *	60 sec	600
o.	2 * 3 *	100 sec	600
p.	3 * 3 *	70 sec	630
q.	4 * 4 *	40 sec	640
r.	2 * 3 *	110 sec	660
s.	3 * 4 *	60 sec	720
t.	2 * 3 *	120 sec	720
u.	3 * 3 *	90 sec	810

Comb. of sessions.	Volume.
a. + g.	525
a. + o.	725

ATP-CP Alactic Training

Other sessions on these non-lactic days are stressing the ATP-CP system working from 5 - 15 seconds work with long rests of 1-2 ruins. Pay special attention to warm up at the start of the session and staying warm during rest periods . If the sessions are performed on gates, make the courses very easy so it is possible to work at 100%. Vary the start of each run from standing to running start so that it is possible to reach maximum speed within a few seconds. Doing this will allow the athlete to use these sessions as major speed development sessions.

Highlight this type of training about three weeks before major competitions, with a small amount of maintenance work done all year.

Figure 3 is a guide for progression and overload of sessions, the total volume of a session gives a good indication of progression as all repetitions in this type of training should be performed at maximum intensity with long rests.

Figure 3

Sets.		Reps.		Length.	Volume sec.
3	*	10	*	7 sec	210
3	*	10	*	10 sec	300
4	*	10	*	8 sec	320
3	*	10	*	12 sec	360
4	*	10	*	10 sec	400
5	*	10	*	8 sec	400
3	*	10	*	15 sec	450
5	*	10	*	10 sec	500

Recovery and Training

To obtain the optimum training effect at any given time, the link between training and recovery must not be underestimated. To train an energy system too often when it has not sufficiently recovered from a previous session will not lead to progress but to a decline in performance. The aim should be to train each system when it has recovered from the previous session and before it starts to decline. This way it is possible to build performance rather than continuously break it down. This cycle should be considered not only on a session by session basis but within the programme structure as a whole.

As well as the aerobic and anaerobic sessions broken into alternate days to allow recovery, a rest day each week is necessary for a more complete recovery. This is probably best taken the day after an anaerobic day and the day before the usual race day. This helps to form a pattern for both the paddlers mind and body leading up to race day. Thus providing a mini peak each week, from which the paddler can do some high quality work. (Usually a race simulation session or other high quality speed work). When training on heavy white water, the amounts of training and the rest between sessions may need to be re-accessed, due to the increased physical demands.

If performance levels are low due to continual tiredness, (this is often shown by a rise in resting as well as a lowering in the maximum attainable pulse rate, it is also often shown by changes in mood with high levels of depression, anger and general feeling of fatigue) it is far better to rest or do low intensity sessions and allow sufficient recovery, than to push until the athlete breaks down. Even with the great attention to progression, overload, intensity, recovery, diet and general health it is all too easy for the highly motivated athlete or coach to push too hard. During these low periods the athlete often has very low resistance to illness making this a situation to be avoided.

Flexibility

Flexibility is an important component of fitness. It is a form of conditioning designed to increase the range of movement possible around a specific joint. During appropriate flexibility training the connective tissues of the muscle extend. Fine muscle control is gained by accompanying strength and flexibility training. The benefits highlighted following good flexibility are:
reduced potential for injury,
improved movement efficiency,
increased amplitude of movement.

Warm-up

Warm-up increases the cardiovascular respiratory function and enhances skeletal muscle capacity. The latter is associated with increase in: muscle/ligament/tendon elasticity, muscle temperature and blood flow, and supply of synovial fluids to the joints. In addition warm-up aids mental focusing and race concentration.

Warm-up prior to exercise may be classified as passive, general or specific. Passive warm-up is external and associated with factors such as ambient temperature. The warm-up structure, optimum 15 minutes, should follow a pattern comprising:
general body warm-up,
static stretching,
specific movements with gradual increase to performance levels.

Stretching and Massage

Stretching and Massage as well as helping to prevent injury and prepare for training and competition, can also play an important part in the recovery process. Furthermore, the potential of warming down must not be underestimated. It prevents dizziness and nausea. It removes lactates and forms the principle of a working recovery. Post exercise muscle soreness may be avoided.

"the athlete who has a restricted range of motion of body parts important for his or her activity will probably realise a decrease in performance capabilities" (Hardy, 1985).

Link Between Nutrition and Performance

Muscle glycogen can be manipulated by a change of philosophy towards importance of nutrition in training. Low glycogen stores are always a disadvantage.

Foods can be divided into nutritional groups principally carbohydrate (CHO), fat and protein. Muscles mainly derive energy from stores of CHO in muscle and liver (as glycogen) and also from fat, thus using a mixture of fuels. Even at low exercise levels the rate of energy derived from fats is insufficient but CHO is synthesised very much quicker. All three constituents are required in a balanced diet. In general we consume a higher proportion of fat than recommended for a healthy diet. Athletes, therefore, should reduce their fat intake (whilst not eliminating) and increase CHO, to ensure adequate glycogen stores. A healthy diet will be the consumption of a wide variety of foods in balanced proportion.

CHO has two classifications, complex and simple. The natural complex 'starchy' CHOs are best such as found in bread, potatoes, pasta, rice, cereal, vegetables, and fruit. Simple CHOs, found in confectionery, cakes, fizzy drinks and of course sugar itself, contain little in the way of nutrients like vitamins and minerals. These foods are also often associated with fat.

Fat consists of fatty acids which occur as either saturated or unsaturated fatty acids. The main sources of saturated fats in our diet are butter, full cream milk and fatty meat whereas unsaturated fats come mainly from vegetable oils and oily fish. In principle we should eat equal proportions of both but usually in practise we eat three times as much saturated fat. Reducing meat consumption automatically restricts the saturated fat intake. Whilst vegans refrain from any animal produce , many athletes take a lacto-ovovegetarian diet. This includes dairy produce and provides a varied and balanced diet. However it is fatty meat that should be substituted, lean red meat is an excellent source of well absorbed iron and many other vitamins and minerals.

The protein contribution made by the non animal sources such as cereals, legumes and pulses should not be underestimated. Considering a typical meal of meat, potato, pasta or rice and vegetables.

The components will supply a varied diet in addition to minerals and vitamins; from the potato and vegetables: CHO, fibre and protein and from the meat: fat and protein. The meal would be improved by reducing the quantity or altering the type of meat, to those more lean: chicken or fish, whilst increasing sing the amount of potato and other vegetables.

Athletes do not require additional nutrients supplemented beyond a balanced diet. If nutrient depletion were identified, then diet should be reviewed. Multi-vitamins are general remedies and of questionable monetary value but provide an insurance policy. Female athletes with a high menstrual flow, especially if they are not eating red meat (reduced iron intake), should consult a GP for a blood test, who may then prescribe vitamin C / iron supplementation. A fruit juice containing vitamin C accompanying a main meal will increase iron absorption. Iron dictates blood formation and haemoglobin oxygen transport capacity .

For efficient metabolism and circulation the body must be fully hydrated. Lethargy between training sessions is likely to be caused by dehydration. The body's need for water is not matched by your thirst, when you become thirsty, you are already dehydrated. The difference between carbonated and still isotonic drinks absorption is a matter of preference. Where hydration is a crucial factor for performance and training, isotonic sports drinks have the edge on water. TI1e minimal glucose and electrolyte concentrations cause the maximum rate of absorption. If not sufficiently dilute, absorption is inhibited and dehydration is accelerated. Fluid should be consumed prior to a session and then little and often during training. Alcohol is a diuretier drug, - it increases the body water loss, which is harmful to athletes. Muscles cannot derive energy from alcohol and thus it is impossible to run off a hangover. This does not infer that athletes should not drink alcohol. A suitable sensible solution is plain drink initially and alcohol later.

The misnomer of cramp as a result of insufficient salt through sweating is unfounded. Sweat, is dilute in salt which infers that the remaining body fluids are more concentrated in salt. Additions of salt to meals is not advised. Cases of cramp can often be attributed to changes in equipment or fittings.

Glycogen enzymes are very active on completion of exercise and in this period of less than 2 hours post-exercise, the body is most receptive to CHO refuelling. Refuelling must be integrated into training sessions. This may mean taking food to the river-bank for consumption directly after training, together with a drinking bottle. Sufficient energy consumption to meet demands of training and to maintain stores requires regular eating. Low carbohydrate in hard training depletes glycogen stores and training with low stores is harder still, causing an extended recovery time, and increasing the likelihood of injury due to muscle fatigue. Meal arrangement towards smaller, more frequent meals; five is ideal - consisting of 3 main meals and 2 snacks, with around 25% eaten at breakfast time. If you are training in the evening, eat a snack late afternoon and your main meal following training. Adrenalin (like alcohol) reduces the rate of digestions so it becomes vital; to allow sufficient time prior to competition, greater than 2 hours. Food eaten too close or during competition will merely be retained in the stomach, except in ultra endurance activities.

Furthermore, a rest day from training once a week is essential. It allows the body to properly refuel from depleted glycogen levels and to repair, providing renewed freshness and better motivation. CHO loading/taper training is a regime of combined building up the glycogen stores by increased carbohydrate dominated meals whilst reducing the amount of training usually over a period of a week prior to completion. This reviewed principle is characterised by rest instead of last minute training in the day(s) prior to peak performance. Days of rest within training phases has been identified as being valuable elsewhere in this book.

A systematic method of motivation towards a continued alteration in diet is to keep a log of food consumed. A healthy diet will improve the ability of the body to perform, with the greatest contribution by supporting consistent and intensive training and in recovery. Any machine no matter how efficient cannot perform optimally if incorrectly fuelled. (*3).

Is this Sports Nutrition or Just Healthy Eating?

Developing the Programme

As training and assessment of the programmes takes place, the athlete and coach should become aware of the individuals strengths, weaknesses and responses to certain types of training. This assessment needs to be an on-going process. A main aim is to personalise the training programme for maximum effect for the individual. Two people following the same training programme will often get two different responses. It must be remembered that each athlete will be starting with a different genetic make up, level of fitness and skill, therefore each will respond in separate ways and have different requirements. With this in mind a basic structure is set out. It has been arranged to try and avoid over training, allow for muscle re-generation and recovery of energy stores. Each training session is usually a very gradual progression upon the previous work, either in intensity, length or number of repetitions, except during periods of active recovery and in the final peak before competition.

Within this structure there is a great deal of choice as to what sessions to use, often with quite different sessions achieving the same results.

It must be stressed that the quantity of sessions shown are for a high level performer, who has usually built up to these amounts over a period of months or years. Often skill and strength/power development or maintenance work would be added onto this programme as extra sessions or done in replacement to others.

To incorporate this programme for the use of lower level athletes it would be wise to omit or replace some of the anaerobic sessions with skill development type work throughout the season, as that is initially where the greatest gains will be made.

These sessions are based on the athlete training once or twice a day six days a week and refer mainly to the type of work that can take place at various times. The exact amount of training time is an individual matter, but as more training takes place the importance of structure and variety within the programme should become a major priority. This work can take place in the boat or other forms of training can be undertaken.

Long Term Planning of the Programme

As well as having a weekly plan the physical preparation should also be organised on a long term basis in order to get maximum effectiveness from the training. Taking into account the various lengths of time to develop the bodies energy systems to peak levels, as well as development taking place over a period of years, a rough guide to the effectiveness of concentrated periods of training of these systems would be:

Four to six months for the aerobic system.

Eight to sixteen weeks for the anaerobic system.

Three weeks for the ATP-CP system.

During Initial Pre-Season Preparation the following structure can be used as a general guide, with the balance of aerobic/anaerobic work biased more towards the aerobic training. A small amount of maintenance anaerobic work is done intentionally during the off season, with some anaerobic A TP-CP work occurring almost unintentionally as a result of the necessity to practice techniques at or above race pace.

The main anaerobic work is usually introduced between eight to sixteen weeks before major competitions. The exact timing of this will depend on the previous training effects and the need to peak for major events during the season. This may mean that some of the early season events are contested with the athlete having done very little anaerobic development work.

Within the programme there are times when various types of work are either stressed for development or performed as maintenance sessions while other systems are developed. For development, progression and overloads are required. For maintenance just repeat current levels of work. Make reference to the progression charts when designing individual programmes.

Strength Training

The inclusion of Strength Training and the exact placing within the schedule to allow for adequate recovery, will to a great extent depend on the loadings, intensity and repetitions used. These sessions will be mainly anaerobic and either lactic or alactic. They will both require at least 24 hours recovery between each session.

There are many options available for the development of strength/ power. These session can either take place in the boat making use of extra resistance of current, shallow water or drag from an object · being attached to the boat. These sessions can be very specific and are of great use especially for maintenance during the season. Other options on land are the use of various different kinds of gym equipment, weights, isokinetic and paddling machines.

The development of general all-over strength should be a main objective during the initial stages of a strength training programme. Make use of a wide range of exercises in order to prepare the body for a specific programme for canoe slalom. The requirements of such, being a great degree of strength with speed (power), the speed at which the exercise is performed is vitally important and should be as fast or faster than the movements made during paddling. (Refer to page 6 for stroke rates.)

The movements of each muscle group to be strengthened, should simulate closely the movements made during paddling. On a practical level this often means breaking the stroke down into its various components. When it is difficult to mimic these movements exactly, try to simulate the strokes in a number of different ways, so that the overall strength developed for any particular stroke, will come from a combination of exercises.

It is characteristic of good technique that there is positive control of the balance or stability of the boat. This is achieved by equal development of muscle groups in the lower half of the body. In addition these large muscle groups are responsible for the breakdown of lactic acid and aid improved recovery time. Consequently strength training should not isolate only development of upper body muscles.

On white water it is very rare that any two strokes are identical, even forward paddling. So in order to be specific use a variety of angles of resistance, concentrating on the ranges of movement most commonly repeated. Also consider that some new techniques may require development of specific strength and flexibility in areas and ranges not previously experienced.

Strength sessions using weights are fairly easy to quantify for the purposes of overload and progression. Isokinetic machines, while being easy to use and fairly specific, are less easy to quantify. A combination of the two is often a good compromise.

Two Sessions a Day Programme

Initial Preparation

A typical weekly programme during initial preparation period 5/6 months before peak performance showing a large amount of aerobic and technical development work, with some maintenance of anaerobic work. This is also a good time to start strength and power development.

Day 1. Rest day or very light session.
Day 2. 1. High quality. 2. Aerobic development.
Day 3. 1. Tech. development. 2. Anaerobic maintenance.
Day 4. 1. Aerobic/recovery. 2. Aerobic development.
Day 5. 1. Tech. development. 2. Anaerobic maintenance.
Day 6. 1. Aerobic/recovery. 2. Aerobic development.
Day 7. 1. Tech. development. 2. ATP/CP maintenance.

Second Phase

Possible weekly programme during preparation period 3/4 months before peak performance showing the introduction of anaerobic development work. During this period a general increase in the overall volume of work is appropriate.

Day I. Rest day or very light session.
Day 2. 1. High quality . 2. Aerobic development.
Day 3. 1. Tech. development. 2. Anaerobic development.
Day 4. 1. Aerobic/recovery. 2. Aerobic development.
Day 5. I. Tech. development. 2. Anaerobic maintenance.
Day 6. I. Aerobic/recovery. 2. Aerobic development.
Day 7. 1. ATP/CP maintenance. 2. Anaerobic development.

Third Phase

Possible weekly programme 2/3 months prior to peak performance, that can also continue to be used for a length of time during the season. A general increase in quality is desired during this period, with many of the gate sessions becoming specific to race performance. i.e.. Clear full runs with long rests.

Day 1. Rest day or very light session.
Day 2. 1. *a. High quality. 2. Aerobic development.
Day 3. 1. *b. Anaerobic peak. 2. Anaerobic tolerance.
Day 4. 1. *c. Aerobic/recovery. 2. ATP-CP + aerobic M.
Day 5. 1. Anaerobic peak. 2. Anaerobic tolerance.
Day 6. 1. Aerobic/recovery. 2. ATP-CP + aerobic M.
Day 7. 1. Anaerobic peak. 2. Anaerobic tolerance.

*a. High quality sessions. To produce high quality race performance, race simulation session or other high speed session.

*b. Session 1 on day 3 may need to be a recovery session or rest depending on the severity of the high quality session on day 2.

*c. Aerobic/Recovery: A session performed below aerobic threshold level. ie. very low intensity.

M. = Maintenance.

The ATP-CP sessions are increased three weeks prior to major competitions.

Final Preparation

Possible weekly programme 16 days prior to peak performance, that can also continue to be used for a very short length of time during the season. The length of time that peak performance can be sustained will depend to a large extent on the length of the basic preparation period. The longer and more extensive the preparation, the longer the peak will be sustained. A main feature of this final preparation is rest, which allows for some high quality peak lactic sessions, which are mainly used for competition simulation training. The volume of work during the sessions is also decreased and possibly spread out over a few more sessions.

This programme assumes a race day being in place of the usual weekly peak performance session in the second week.

Day 1. Rest day or very light session.
Day 2. 1. High quality. 2. ATP/CP.
Day 3. 1. Anaerobic peak. 2. Rest or light session.
Day 4. 1. Tech. maintenance. 2. ATP-CP + aerobic M.
Day 5. 1. Anaerobic peak. 2. Anaerobic tolerance.
Day 6. 1. Rest or light session. 2. ATP-CP + aerobic M.
Day 7. 1. Anaerobic peak. 2. Anaerobic tolerance.
Day 1. Rest day or very light session.
Day 2. 1. High quality. 2. ATP/CP.
Day 3. 1. Anaerobic peak. 2. Aerobic/recovery.
Day4. 1. Aerobic maintenance. 2. Rest.
Day 5. 1. ATP/CP. 2. Aerobic/recovery.
Day 6. 1. Race simulation. 2. Rest.
Day 7. Rest day or very light session.
Day 1. Rest day or very light session.
Day 2. 1. High quality RACE PERFORMANCE.

One Session a Day Programme

Initial Preparation

A possible weekly programme during initial preparation 5/6 months before peak performance, showing aerobic and technical development work, with some maintenance of anaerobic work. This is also a good time to start strength and power development. With a limited amount of time many of the sessions are simply combined so all the requirements are taken into consideration. Great care must be taken to maintain quality.

Day I. Rest day or very light session.
Day 2. *a. High quality.
Day 3. Tech. development+ ATP/CP.
Day 4. Aerobic development.
Day 5. Tech. development + anaerobic maintenance.
Day 6. Aerobic development.
Day 7. Aerobic development.

*a. High quality sessions. To produce high quality race performance, race simulation or other high speed work with full recovery .

Second Phase

A possible weekly programme during preparation period 3/4 months before peak performance showing the introduction of anaerobic development work. During this period a general increase in the overall volume of work is appropriate.

Day 1. Rest day or very light session.
Day 2. *a. High quality.
Day 3. Tech. development ATP/CP.
Day 4. Aerobic development.
Day 5. Tech. development + anaerobic development.
Day 6. Aerobic development.
Day 7. Aerobic development.

Third Phase

A possible weekly programme 2/3 months prior to peak performance, that can also continue to be used for a length of time during the season. A general increase in quality is desired during this period, with many of the gate sessions becoming specific to race performance . ie. Clear full runs with long rests.

Day 1. Rest day or very light session.
Day 2. High quality.
Day 3. Anaerobic tolerance.
Day 4. Aerobic development+ ATP-CP.
Day 5. Tech. development + anaerobic peak.
Day 6. Aerobic development+ ATP-CP.
Day 7. Anaerobic peak followed by tolerance.

* On day 3 the session may need to be a recovery session or rest depending on the severity of the high quality session on day 2. The ATP-CP sessions are increased three weeks prior to major competitions so this kind of session is performed every other day.

Final Preparation
The volume of work during the sessions is decreased. This programme assumes a race day being in place of the usual weekly peak performance session of the second week.

Day 1. Rest day or very light session.
Day 2. 1. High quality race simulation+ ATP/CP.
Day 3. 1. Tech. maintenance + aerobic maintenance.
Day 4. 1. Anaerobic maintenance+ ATP/CP.
Day 5. 1. Aerobic/Recovery.
Day 6. 1. Full race simulation+ ATP/CP.
Day 7. Rest day or very light session.
Day 1. Rest day or very light session.
Day 2. 1. High quality RACE PERFORMANCE.

Peaking

At top level it is important to target only a few major events per year to be peak performances. It is all too easy to try and produce a peak for each and every event. If this is done, when looking back at the season as a whole it would be seen that major parts of the paddlers training time would be spent resting and easing up for non-important events, thus losing a lot of training time. Also the paddler may have done too much high intensity work without the aerobic work to back it up. The result of this strategy is usually mediocre results throughout the season. The main point is to have these systems developed to optimum levels in time for major events. This often means sacrificing some events and performances, which is hard to accept mentally but necessary from a physical point of view.

Approaching a major event the paddler gradually cuts down the amount of work starting from two weeks to a few days before the event depending on the paddlers overall condition, severity of the previous training and the importance of the event. Also the rest during the sessions is sometimes increased to enable the paddler to move at a faster rate and attain higher quality. Another option is to do slightly less amounts of work than before and to spread the work into more sessions within the day or week. These are excellent ways of producing quality.

The aim is to race when fully recovered from the training and make the optimum use of the bodies over-compensation of recovery from the effects of training with all the bodies systems developed to optimum level for the specific event. This often means a different emphasis on strength, power, endurance, skill and equipment for different courses and conditions.

Technique within this Structure

Every gate session should be a technique session to some extent. During repeated gate training sessions many of the techniques used in racing become almost totally automatic, often performing hundreds of moves and gates in one session. The main point is to be a thinking paddler, even in the most intense and pressured situations and make sure that the final grooving of techniques are performed correctly.

Due to the often very repetitive nature of much of the physical development work and bearing in mind that this is when the final touches in coordination and grooving of technique are put together, it is extremely important during these highly physical training sessions to either (1) pay attention to technique (2) make the courses very easy (3) do a non-gate session, in order to not undermine already good technique. Even with these precautions it may sometimes be necessary to terminate some of these sessions if technique deteriorates too far.

Technique development is best achieved when the paddler is fresh and able to concentrate. The paddler is usually ready for this after an aerobic day or rest day, when a more complete recovery has taken place. Much of this development work must be practised at or above race pace. With such a highly technical sport and the infinite number of moves required, this development work should be an on-going process, a point often overlooked by some highly ranked paddlers. A major feature of these development sessions is to allow time to look at and mentally rehearse/revise the course. The rest during these sessions should allow for a good recovery, so that the quality can be kept high.

Good technique is anything that is the fastest and can be consistently repeated on race day. A main aim of technique work is the development of conservation of momentum within each move and the run as a whole. Often quite different lines and techniques produce the same or very close times; these must then be looked at in terms of consistency and economy of effort.

By the time of the major events the paddler should have a very clear idea of what is possible, both technically and physically. This assessment needs to take place prior to each event as both physical and technical levels have usually changed from the previous event.

Monitoring and Testing

In order to carry out and create a training programme to suite individual needs it is important to have feedback to indicate progress or decline in the efficiency of the programme. It is necessary to have this information quickly, accurately and be specific to the performance required. It is also extremely important to have this information for motivation purposes. To achieve this result we have developed a slalom specific test.

The results of the test is probably of most relevance if taken the day after the rest day. This being the usual race day and peak performance for the week. It can easily be incorporated into the paddlers training routine with the minimum interference.

The test requires the athlete to negotiate two gates in a figure of eight pattern on a continuous loop basis on flat water. The gates are hung on a single line and set six metres apart (measuring from the two nearest poles on each gate). The pole heights being set at 15 cm above the water .

The athlete wears a recording pulse meter during the test which is translated into graph form for later analysis to assess the results of the test and training.

The athlete paddles at a pace dictated by an audio cassette tape emitting bleeps. The tape was originally developed as part of a running test. (*1).

Slalom Performance Test

Starting the Slalom Performance Test.

Start the cassette player. At the beginning of the tape, two bleeps indicate an accurately timed one-minute interval. Use this to check that the tape has not stretched, and that the speed of the cassette player is correct. Accuracy to within 0.5 second either way is sufficient.

The tape continues with a brief explanation of the test, leading into a four-second countdown to the start of the test itself. Thereafter the tape emits a single bleep at regular intervals. The athlete should aim to be at the opposite gate to the start by the time the first bleep sounds. They should then continue paddling at this speed, with the body being within the gate line of one gate or the other each time there is a bleep.

After each minute, the time interval between bleeps will decrease, so that the paddling speed will need to be increased. The first paddling speed is refereed to as 'Level 1 ', the second speed as 'Level 2', and so on. Each level lasts approximately one minute. The athlete should continue until they can no longer keep up with the pace of the bleeps.

Analysing the Results of the Test

The first result, which easily assess and compares, even without the use of the pulse meter, is a good measure of the athletes overall endurance capacity, is shown by the maximum level achieved at the end of the test. It usually represents a level at which the athlete for various reasons of fatigue, cannot continue to increase pace with the tape. We have usually seen a significant breakdown of technique during the final levels, often resulting in penalties and irrational attempts to change technique.

The second result is shown by the pulse rate graph, showing the level of exertion both aerobic and anaerobic at various levels during the test. These are especially interesting at high sub maximal levels of speed and exertion, as they relate well to slalom racing, as many race runs are performed at sub maximal pace due to the skill demand of the course. Also these sub maximal readings are of great value, as it is often difficult and not desirable for the athlete to perform at maximum intensity on a regular basis. It is also of value only to set a sub maximal level to be reached in order just to evaluate aerobic performance. This can be done on a more regular basis than the full test. A graph from a previous test is very easily compared with a present performance. Comparing pulse rates of different paddlers is a more complex process and will require more research. But of the people tested so far the lowest level pulse rates for various levels during the test have come from the current MKI world champion .

The third result is simply the number of penalties incurred during the test. It is also interesting to look at what level of exertion when the penalties are incurred. There is a point at which skill control deteriorates very quickly, due to fatigue of various kinds, including the build up of lactic acid. Knowing this fatigue level will help as a guide to future pacing of race runs. These penalties may also be due to concentration problems, also often related to fatigue. This occurs as a consequence of physiological factors related to the ratio of carbon dioxide to oxygen in the bloodstream.

The Influence of External Factors on the Test

Some of the tests carried out have been taken in a swimming pool to try and provide a consistent environment. Other tests have been done on open water in fairly warm and still conditions approximately 20C. Attention must also be taken of water depth, a standard warm up, wind conditions and air temperature, all of which have an effect on the results.

When changing boat design it is a good idea to do two tests, three or four days apart, one in each boat, to set the new standards and provide a comparison from old to new.

If the test is to be of value care must be taken to standardise all conditions .

References

(*1). Reference: Ledger, L.A. and Lambert, J., 1982 'A maximal multi-stage 20m shuttle run test to predict VO2 Max', Eur. J. Appl. Phsiol. 49, 1-5. Further developed by John Brewer, Roger Ramsbottom and Clyde Williams.

(*2). Wootton, S. 'Nutrition For Sport', Sports pages publishers.

(*3). A practical guide to Basic Sports Nutrition, BOA.
'Aspects of energy system physiology and flexibility' texts, adapted in consultation with John Gregory. In addition the section 'Link between Nutrition and Performance' supplied courtesy of John Gregory based upon an original article submitted to Canoe Slalom Magazine Vol 6 No. 3.

Diagrams courtesy of The National Coaching Foundation.

A cassette tape for the Slalom Performance Test, is available from the National Coaching Foundation G.B.:
4 College Close, Beckett Park, Leeds, LS6 3YR.

Heart Rate Monitors, are available from J.J. Coaching:
2 Jeffreys Terrace, Pontcysyllte, Nr. Llangollen LL20 7YR.

Glossary

Conconi test: A test used to establish the anaerobic threshold without taking blood samples .

Aerobic energy supply: Energy supply with sufficient oxygen. No lactate accumulation.

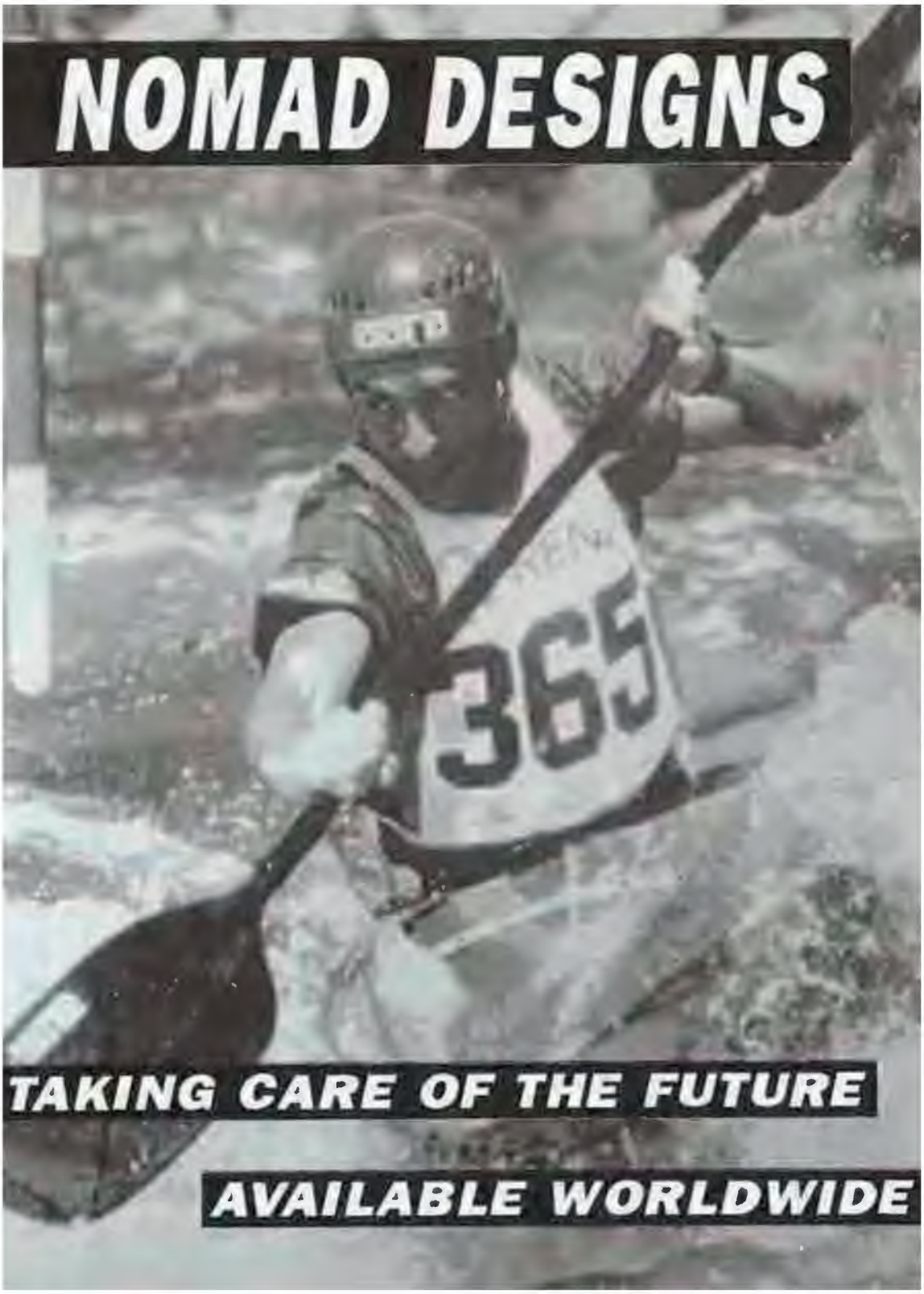
Anaerobic energy supply: Energy supply with insufficient oxygen. There is a accumulation of lactate.

Lactic acid: By-product of the oxidation of glucose with insufficient oxygen .

Anaerobic threshold: When performing above this level lactate accumulation takes place rapidly.

ATP: Adenosine triphosphate: High energy compound which transfers to adenosine diphosphate ADP. during muscular contractions.

CP: Creatine phosphate: high-energy phosphate present in muscle cells . Capable of re-forming ADP into ATP very fast.


NOMAD DESIGNS
365
TAKING CARE OF THE FUTURE
AVAILABLE WORLDWIDE