Indoor Rowing Training Guide, Version 2

The Indoor Rowing Training Guide, version 2, was written by Terry O'Neill and Alex Skelton.

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Preface

We are constantly being asked for training advice, be it for a 2,000m race, rehabilitation or general fitness. As every personal trainer or fitness expert will tell you, prescribing training is not that simple. Level of fitness, training background, maximum heart rate, history of illness, time available to train and your own expectations are just a few of the factors that need to be considered when starting any training programme.

We developed the original Indoor Rowing Training Guide to address all these issues, and ultimately make sure you make the right training decisions. The Indoor Rowing Training Guide, version 2 has built on the success of the first Guide and now includes sections on Nutrition and Diet, Psychological Preparation and has input from many top rowers and coaches. The Indoor Rowing Training Guide, version 2 will help you whether you are training for a race or simply would like to achieve a more healthy lifestyle.

Although we can't anticipate every individual's requirements we aim to provide information on the basic principles involved in designing training programmes and, by including many and varied examples, guide anyone in constructing an individual programme suited to their own personal needs.

The Concept 2 website is also of great benefit and includes some useful information about technique and training as well as information on competitions, distance award schemes and a message board so you can contact other indoor rowers. Concept 2 also has an electronic newsletter you can subscribe to on-line.

The Indoor Rower is an incredibly versatile and adaptable machine and this guide will help you plan your exercise with renewed confidence - knowing that you're doing what's best for you.

If you have any comments on this guide and if there's anything you think should be in any future editions, please contact us either by phone on 0115 945 5522 or email us at info@concept2.co.uk.

WARNING: The information provided within this guide is not intended to be a substitute for medical advice. Many of the programmes featured involve demanding physical exercise. We strongly recommend that you check with your doctor prior to commencing any of the programmes to ensure that you are physically able to undertake such exercise. Concept 2 Ltd accepts no responsibility for illness or injury resulting from the use of this guide.

Contributors

Terry O'Neill

Terry O'Neill has been involved in rowing for fifty years, thirty of which have been as a coach. He started in the sport as a coxswain and went on to row competitively before taking up coaching after being involved in a car accident. Since then he has been employed by the Inner London Education Authority as a fitness instructor, qualified as a weight lifting instructor and went on to qualify at the National College of Physical Education. He also holds the Gold, Silver and Bronze coaching awards from the Amateur Rowing Association (ARA).

Terry was appointed coach to the Great Britain men's lightweight squad in 1979, who went on to win the Lightweight Eight at the World Rowing Championship in 1980. By 1987 he had moved to coaching the men's heavyweight squad, specifically the Heavyweight Eight at the 1988 Olympics in Seoul. He continued coaching at an international level culminating in being the head coach for sculling for the Atlanta Olympics in 1996. He then moved into coach education as assistant director of the FISA International Coaches Course and was sent to Ecuador to run a coaching course for the Olympic Solidarity movement.

Terry lived in Spain between 1991 and 1994 where he coached at the Olympic Rowing Centre in Banyoles and served on the Barcelona Olympic Regatta Committee. More recently he has been a regional coach for the ARA based at the National Watersports Centre in Nottingham. He started working at Concept 2 in 1999 and continues to coach and advise on all aspects of rowing and indoor rowing.

Alex Skelton BSc(hons), PGCE

Alex Skelton was educated at Loughborough University where he completed his undergraduate degree in Sports Science and went on to complete a PGCE in Physical Education. He worked as a teacher specialising in the teaching of anatomy and physiology and exercise physiology for A-level until 2002. Alex has competed in and coached basketball at national level and also swam at a national level. He has been involved with rowing since 1996 and now rows at Notts County Rowing Association.

Celia and Keith Atkinson

Celia and Keith Atkinson MBE are founder members of the Concept 2 Education Team. Both are graduates of Durham University and retired teachers. Keith was Head of a Nottinghamshire comprehensive school and has a fifty-year association with rowing as competitor, ARA Gold Award Coach, FISA International Umpire and President of Nottingham Boat Club. Despite having MS, he has won two Bronze medals at the World Indoor Rowing Championships in Boston.

Celia and Keith have been involved in developing all aspects of the Concept 2 Education Programme since its inception.

Jurgen Grobler

After being approached at the World Indoor Rowing Championship in Boston in 1990 by Concept 2 Ltd's Managing Director Ian Wilson, Jurgen Grobler moved from his native GDR to Britain in 1991 to be head coach at Leander Club, Henley-on-Thames. He was appointed chief coach for men by the ARA after the 1992 Olympic Games and has held that position ever since.

Jurgen is arguably the most successful rowing coach of all time with numerous Olympic and world championship medals to his name. He was recognised by the international rowing federation (FISA) with the award of "Coach of the Year" 2000 and was elected to the FISA executive committee and competitive rowing commission.

Most notably he has coached Matthew Pinsent and Steve Redgrave to four world championship gold medals and two Olympic golds between 1991 and 1996. SInce then he has been a coach for the men's coxless four and has taken them to three world championship gold medals and Olympic glory at Sydney 2000. He now focuses his attention on the world champion coxless pair of Matthew Pinsent and James Cracknell in preparation for the Athens Olympics 2004.

Andy Darling

Andy Darling writes about sport and fitness for The Independent On Sunday, Running Fitness and Arena magazine, and about all manner of subjects for FHM and Bizarre magazines. He scripts and does the voiceover for ITV retro-music series, 'Forever'. He's an American College of Sports Medicine qualified Personal Trainer, has run a 2:41 marathon and learns kickboxing. Whilst juggling work, study for a Post Graduate Psychotherapy degree, and the demands of a wife and three children, he's clocked a 6:41 2,000m row, at the 2001 BIRC, and 5:14.7 for the Golden Mile in 2002.

Kurt Jensen, MSc.

Kurt Jensen, from Team Denmark Testcentre, Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, is the man responsible for the physiological testing of Denmark's elite athletes. As a result of these tests Kurt has a big input into the training programmes followed by Denmark's Olympic champion lightweight rowers.

Marjorie T Hagerman, MS, RD, LD

Marjorie Hagerman is an assistant professor in foods and nutrition at Ohio University in Athens, Ohio, where she is also the director of the didactic programme in dietetics and teaches in the Medical School.

A registered dietician of the American Dietetic Association (ADA) and a member of Sports, Cardiovascular and Wellness Nutritionists (SCAN), a dietetic practice group of the ADA, she is the author of *Home Plate Strategy*, a nutrition guide distributed annually to all minor league professional baseball players by the Professional Baseball Athletic Trainers Society. Marjorie is also a nutrition consultant to the US Rowing Association.

Frank Birch

Frank Birch is a long-time runner turned indoor rower. As a club runner he competed regularly on the track and at cross country. He planned to do a marathon when in his late twenties but decided he liked being a runner who hadn't done one when suddenly everyone started running them.

Frank discovered indoor rowing in November 1999 after a friend persuaded him to go and see the BIRC at Reading. He went, watched and knew he would be back to compete the following year - where he picked up a silver medal as a 45-49 lightweight male. Frank started preparing for a marathon on the Indoor Rower earlier this year. He is currently sidelined with a shoulder problem but still hopes to complete the event before the rest of the world catches on.

Chris Shambrook

Dr Shambrook is the co-author of *The Mental Game Plan: Getting Psyched for Sport* and runs HeadStart Performance Consultants. He has been the consultant psychologist for the Great Britain Rowing Team since 1997 and is a member of the British Olympic Association's Psychology Steering Group. His recent clients include Sunderland Football Club, Lancashire County Cricket Club, and the Cambridge University Boat Race Crews. At the Sydney Olympics, Chris provided support to the highly successful GB Rowing Team, and in particular the Olympic gold winning Men's Eight and the silver medal winning Women's Quad Scull.

Ade Roberts BSc (Hons), MCSP

Ade Roberts was educated at the Universities of Nottingham and Coventry where he qualified as a Physiotherapist in 2002, completing his dissertation in the abdominal imbalance of rowers specific to the core stabilisers. He has been involved in rowing since 1977 and is now a successful coach with crews winning Henley Women's Regatta; representing England at the Commonwealth Regatta in 1999 and 2002; Great Britain at the Under 23 World Championships in 1996, '97 and '98 and Senior World Championships in 2000.

Ade now works at the Queen's Medical Centre in Nottingham and coaches the Notts County Rowing Association women's squad.

Kareen Larkin BA Cantab, MSc, MBBS, MRCGP, MSc Sports Med.

Kareen Larkin (nee Marwick) was born in the Orkney Islands, is a part time GP and mother of two now working and living in Nottingham. She was educated at the Universities of Cambridge, Imperial College, and Nottingham where she recently completed her Masters in Sports Medicine, as well as Charing Cross & Westminster Medical School, London. Kareen started rowing at Cambridge University and went on to represent Great Britain between 1983 and 1995 including the Barcelona Olympics in 1992.

Harry Welsh

Former British and world champion indoor rower, and author of many technical articles for the Army, Harry has an extremely extensive background, not just in sporting achievements but in the field of rehabilitation. His abilities gained him honours in such diverse activities as rugby, fencing, athletics, canoe surfing, judo and biathlon to name but a few, all at either Army, county, national or international levels. He has also gained awards in coaching and officiating and, after leaving the services, a BEd (Hons) degree. Harry finished his teaching career as an acting head teacher, then took up indoor rowing at the youthful age of 67 years.

Contents

Section 1 :

Before and After Exercise

Exercise Guidelines

Before you start on your training programme it's important to understand, and abide by, the health and safety procedures involved in indoor rowing. Therefore please take time to read through this section carefully. That way you can avoid any unnecessary problems or injuries and get the most out of your programme, both in terms of performance and enjoyment.

Effective Exercise

The American College of Sports Medicine makes the following recommendations for the quality and quantity of training for developing and maintaining cardio-respiratory fitness in healthy adults:

- The activity should be one that uses large muscle groups, is maintained continuously and is rhythmical or aerobic in nature.
- The duration should be from 20 to 60 minutes, of continuous activity.
- Training should be regular; three to five times a week.
- The intensity of training should raise the heart rate to 60 to 85% of maximum heart rate (MHR).
- Strength training of moderate intensity should be added twice a week.

Safe Exercise

Indoor rowing is a safe and beneficial form of exercise. If you observe a few simple safety procedures, you can sustain an effective fitness programme with minimal risk. However, before you start, check through these routine precautions for your safety and comfort:

Personal Well-Being

- It's wise to have a health check before starting an exercise programme. **You should never exercise if unwell**.
- Always warm up, cool down and stretch thoroughly before and after each training session (see Warm Up, Cool Down, and Stretching in Section 1 : Before and After Exercise).
- It's important to warm up the muscles with some light rowing before you start stretching. If required wear a tracksuit (or equivalent) to help keep the muscles warm.
- Take time to develop good technique before increasing training intensity (see Section 2 : Technique on the Indoor Rower).
- When beginning an exercise programme don't overdo it; start slowly and build up gradually.
- Drink plenty of water during and after exercise. Don't wait until you are thirsty.
- Ensure you train at an appropriate intensity. We recommend you base your training intensity on your heart rate (see Training Intensity in Section 3 : Physiology).
- Keep a training log to help set realistic goals and targets and plan future programmes of work (see Training Log in Appendix).

Machine Protocol

- Check the handle, seat and monorail are clean.
- Adjust the damper setting to give the correct drag factor for your workout (see The Damper Lever and Drag Factor in Appendix for an explanation of how the damper works).
- Place the handle in the handle hook before securing your feet.
- Adjust the footrests. If you have long legs, you may need to lower the footrests. Fasten the straps securely.
- Sit slightly towards the back of the seat.
- Pull straight back with both hands. Do not row with one hand.
- Do not twist the chain, pull from side to side or let go of the handle whilst rowing.
- Keep clothing, hair and fingers away from the seat rollers.
- When you finish your exercise, place the handle in the handle hook, then, after releasing your feet, return the handle to rest against the chain guide/monitor support.
- Always ensure that the machine is properly maintained.

Warm Up

The aim of a warm up is to prepare the athlete both physically and mentally for exercise. When starting exercise, the body begins to release adrenalin, which increases the heart rate and causes dilation of the capillaries in the muscles. This has the dual function of increasing the temperature and elasticity of the muscles to help prevent injury and improve the speed at which oxygen can be transported around the body. The increased temperature allows the enzymes required for the muscular contraction to function more efficiently. Warm ups also make us more alert as the increased body temperature allows nerve impulses to travel more quickly, improving the reaction time. There are also psychological benefits of a warm up, especially if you are superstitious and perform the same routine every time you exercise or compete.

Training Warm Ups

The warm up necessary for training sessions will depend on the type of work involved in the session. The lower the intensity the less time required to warm up. This also applies to time taken in the cool down. This should be gentle rowing with heart rate at twice your resting heart rate.

Table 1.1

Warm-up/Cool Down Times for Training Sessions		
Type of Session	**Warm-up**	**Cool Down**
UT2	5-8 mins	5-8 mins
UT1	8-10 mins	8-10 mins
AT	10-12 mins	10-12 mins
TR	12-15 mins	12-15 mins
AN	15-20 mins	15-20 mins

Competition Warm Ups

Pre-competition warm ups should prepare you for maximum intensity exercise. For this reason they should start with a gentle warm up row until your heart rate is twice your resting rate. At this point you should stretch the muscles required in the competition. Once this is done, return to gently rowing until your heart rate has returned to twice your resting level. Once you have reached this point you should include a number of high intensity bursts; these should be no longer than ten strokes in length and you should do no more than four bursts in total. The time between bursts should be governed by the time it takes your heart rate to return to normal warm up level. Finally a 13 to 15 stroke start should conclude the work, then row gently until your heart rate has returned to warm up level.

Cool Down

The cool down, like the warm up, is a very important part of each training session and competition. The purpose of the cool down is maintaining light, continuous exercise to allow your body to pump oxygen around the fatigued muscles. This will help to remove the lactic acid that has built up in the muscles during exercise. A cool down reduces blood pooling in the muscles, which can lead to dizziness, and can also limit the soreness experienced in the muscles during the days after strenuous exercise. A good cool down should consist of five to 15 minutes of light continuous exercise followed by stretching.

Stretching

The stretching that you do in the warm up and cool down has different purposes. In the warm up stretching allows a slight increase in flexibility that will result in improved performance and reduce the likelihood of injury. In the cool down stretching has the purpose of helping the body to remove some of the build up of lactic acid in the muscles and to improve flexibility. For these reasons the stretching in the warm up and cool down are of different durations.

Stretching Guidelines

- Regular stretching is important in improving flexibility and should be continued regardless of what stage of a training programme you have reached.
- It takes time to make significant progress with stretching exercises. Start by selecting just a few simple exercises to begin stretching each muscle group. Then, very gradually, increase the number of stretches and condition the muscles to greater degrees of stretch.
- It's important to warm up the muscles with some light rowing before you start stretching. If required wear a tracksuit (or equivalent) to help keep the muscles warm.
- Stretching should be done slowly, with no jerking or bouncing movements. Move into the stretching position slowly, continuing until a good stretch on the muscles is felt. Never stretch to the point of pain.
- In the warm up, after reaching a good stretch position, hold it for eight to 15 seconds. In the cool down this can be increased to 45 to 60 seconds. After each stretch release the body slowly from the position.
- The muscle being stretched should be as relaxed as possible. Stretch both sides of the body equally.
- Stretching exercises are not meant to be competitive. Do not compare progress with others as over-stretching can lead to injury. Just as important, the overly flexible should be excluded from the stretching programme.
- Although the ageing process brings about stiffness and increasing lack of mobility, regular stretching programmes, especially yoga, can bring about great improvement.

Warm Up Stretching

During the warm up ten to 15 minutes should be found to stretch. These stretches should last eight to 15 seconds in duration and should be focussed on the muscles that will be used during exercise. This will lead to improved performance and reduce the likelihood of injury.

Cool Down Stretching

After the cool down exercise has been completed a stretching session should be undertaken. This is the best time to improve your flexibility as the muscles are warm. If necessary a tracksuit or other loose clothing should be worn to maintain the high body temperature. During the cool down the focus is on improving flexibility by holding the stretches for 45 to 60 seconds.

Flexibility Training

If you find that your flexibility is not as good as it should be then introducing an extra flexibility session will help you make good improvements. This session does not need to follow exercise and can be done anywhere. Ensure that the muscles are warm by either exercising lightly or having a hot bath then stretch, holding each position for 45 to 60 seconds and repeating each stretch three to five times. This can be done in front of the TV or whilst reading.

Recommended Reading

More information about stretching can be found in the following books, available from good book shops;

- **Bob Anderson, Jean Anderson (Illustrator) : *Stretching***
  Shelter Publications, 2000
  ISBN: 0936070226
- **Pavel Tsatsouline, *Relax into Stretch : Instant Flexibility Through Mastering Muscle Tension***
  Dragon Door Publications, 2001
  ISBN: 0938045288
- **Michael J Alter, *Sport Stretch***
  Human Kinetics Europe Ltd, 1998
  ISBN: 0880118237

Stretching Exercises

Warm up/pre-exercise stretches should be held for eight to 15 seconds and should be done two to three times.

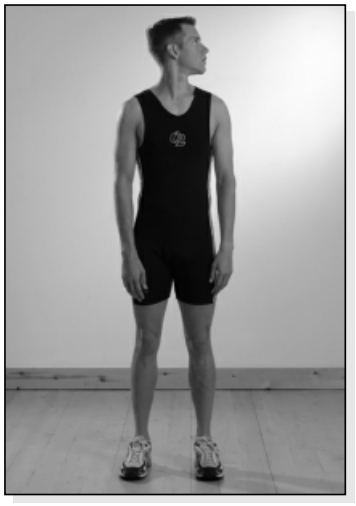
Cool down/post–exercise stretches should be held for 45 to 60 seconds and should be done two to three times.

In a flexibility session each stretch should be held for 45 to 60 seconds and should be repeated three to five times at least.

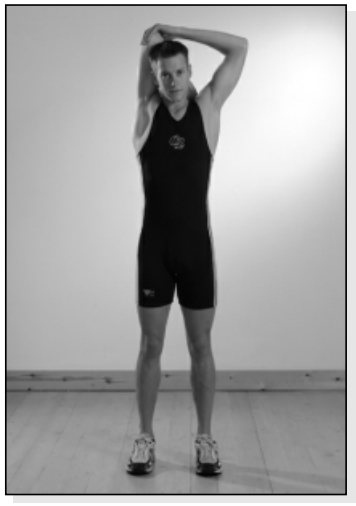
Where stretches can be done on both sides of the body only one side is shown. Ensure that you stretch both sides equally.

Neck extensors - flex the chin to the chest.

Scalenes - facing forwards, bring the ear towards the shoulder taking care not to lift the shoulder.



Upper Trapezius - turn the head to look over the shoulder, take care not to turn the body.



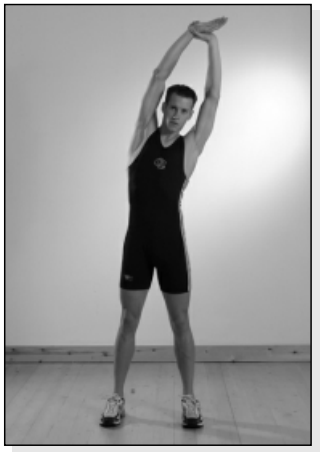
Triceps - place your right hand behind your neck. Use the left hand to apply pressure to the elbow, drawing the elbow behind the head. Ensure shoulders are relaxed.

Deltoids - reach across the front of the body, using the other arm to draw the arm across. Ensure that the shoulders are kept low.

Pectorals/Biceps - stretch both arms behind you, keeping the elbows straight and the thumbs pointing upwards. Ensure that you do not bend forwards.

Wrist flexors - with the elbow straight, use the left hand to apply the stretch by drawing the palm away from the floor, keeping the fingers straight.

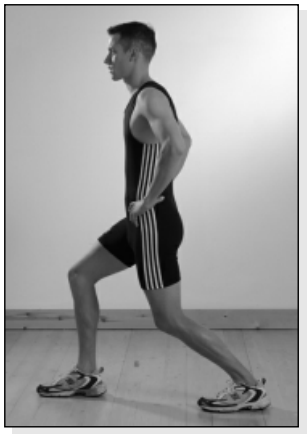
Wrist extensors - with the elbow straight, use the left hand to apply the stretch by bending the wrist, bringing the palm towards the floor, keeping the fingers straight.



Trunk stretch - standing with feet shoulder width apart, stretch right arm up towards the ceiling and over to the left, keeping the body in one plane.

Rhomboids - standing with feet shoulder width apart, hold your left hand with your right hand out in front of you, keeping your arms horizontal. Reach forwards, keeping the body upright, until you feel a stretch between your shoulder blades.

Gastrocnemius and Soleus - stand astride, stretch forward over the front leg, keeping the knee over the foot. Keep the back knee straight, keep both heels in contact with the floor.

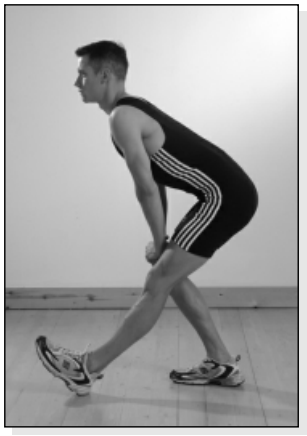


Achilles - as for the Gastrochnemius and Soleus but bend the back leg bringing the knee towards the floor, keeping the heels on the floor.

Hip flexors Psoas/Quadriceps - stand astride, stretch forwards, dropping the left knee towards the floor, allowing the heel to raise. Keep the body upright.

Abductors - stand astride, with feet parallel, keep the left leg straight, bend the right knee and stretch until the knee is over the right foot.

Quads - keeping your inner thighs and knees together push your left foot into your hand and push the hips forwards.



Hamstrings, Gastrochnemius (straight leg) **and Soleus** (bent leg) - stand astride with your front foot resting on your heel with your toes pointing upwards. Stretch forward over the front leg bending your back knee, keeping the heel in contact with the floor. Use your arms to support your weight on your bent knee. Keep your back flat and head up.

Hamstrings - sit on the floor, bend the left knee and slide heel towards the right inner thigh. Keep your back straight and flex from the hip, moving your torso towards the right thigh.

Hamstrings - lie flat on the floor, lift the left leg with the knee bent until the thigh is at a right angle to your body. Holding around the thigh, gently straighten the leg until you feel the stretch. The right leg should be bent with foot flat on the floor.

Hamstrings - keeping the back flat, reach over towards the right foot, feeling the stretch in the back of the right thigh.

Glutes/Piriformis – lie flat on your back with the right knee bent. Place the left heel on the right knee. Take hold around the right thigh and draw up towards your chest.

Rhomboids and Latissimus Dorsii - kneel on all fours, arms straight in front and spread slightly apart. Lower your chest to the floor, keeping the pelvis still.

Erector Spinae - lie on your back with knees bent; feet on the floor, grasp around your knees and pull your thighs towards your chest.

Pectorals, Obliques & Hamstrings - lie on your back with your arms out to the sides. Bend the right knee and move it to the left. Gently straighten the right knee until you reach the point of tension. Keep the head, shoulders and arms flat on the floor.

Pectorals, Obliques & Glutes - as previous stretch but grasp the right knee with the left hand and gently let it rotate across the body and onto the floor. Keep the head, shoulders and arms flat on the floor.

Rectus Abdominus - lie face down, place your hands under your shoulders, fingers pointing forwards. Straighten your arms gently until you feel resistance. Stretch your shoulders and chin forward.

Piriformis, Buttock & Lateral Torso - sit upright, place your left foot flat on the floor and place the right elbow behind the left knee. The left hand should provide support behind the body. Twist your upper body towards the left hand.

Section 2 :

Technique on the Indoor Rower

Technique

The definition of technique is "The skill required for the mastery of a task". Identifying the task is simple with indoor rowing because the task is to cover a given distance in the shortest time.

This doesn't mean that the people who produce the best times on the rowing machine have the best technique. Good technique has to account for efficiency measured by the performance when compared to the potential capacity of the athlete.

So good technique on the Indoor Rower is the ability to convert potential into performance. Developing good technique is carried out in three phases. The first phase is to develop the motor skills to master the sequence of movements, this is the cognitive phase of learning. Muscles respond to electrical impulses from the brain carried via the nervous system. Repeating a movement establishes a strong neurological pathway, which carries these tiny impulses. Breaking the rowing stroke down into its component parts and carrying out each segment slowly until it is mastered is the best method of establishing this pathway. This is followed by joining the segments together, gradually building up to the full stroke cycle.

During the development of motor skills there is no consideration to load; this comes next and is known as the functional stage. Here the muscles become familiar with the load, range and speed that they are required to work at and how it relates to other working muscles.

The final phase is the autonomous phase and here the muscles know their role with respect to the outcome task and movements become automatic.

Often, when people arrive at this stage, they think that this is all the work they need to do on technique. To some extent this is true in that, like riding a bike, once learned you never forget it. However, knowing how to ride a bike and winning the Tour de France are not the quite the same thing. Technique and not just fitness must be continually developed in order to realise your full potential.

You now have to go back to the beginning where we said that technique was converting potential into performance. As you continue to train your capacity increases and so now the emphasis of technique is to carry this increase in physical capacity over into faster times. The focus has now changed from the body position to the output display on the monitor. If it is not what you think it should be then you may need to go back and look at the movement to find where power is being lost.

Technical development is one of three crucial and interdependent aspects of training that require equal attention, with the other two being physical and mental development. Failure to exploit any one of these areas will result in underperformance. The interdependence is that first you have to make the decision and commitment to train to improve your physical condition. This is the mental area and mental strength is needed when things get tough and it is easier to quit.

Physical development will require hours of training, sweat and pain. Through technique you produce a result bringing all three areas together and reward for the effort and commitment.

It is easy to get hung up on the aesthetics of technique. Unlike ice skating, indoor rowing has no prizes for artistic content. On the other hand, poor technique won't win any prizes either. If you're looking at technique, keep focussed on the important areas. At the beginning of the stroke the legs come on early and are driving the handle back. Make sure that the handle moves back at the same time as the seat so the legs are not just driving the rower back.

Check that the trunk is held firm so that the power developed on the footplate is transferred directly to the handle right through the Drive phase. Often rowers transfer stability from the trunk to the legs and use the trunk to supply power. This can go almost unnoticed at low intensity work but is very inefficient. Although the upper body is responsible for over 50% of the stroke length the legs are responsible for 70% of the total power. This is because the load is at its greatest at the beginning of the stroke and decays to the finish. Good technique matches up the most powerful muscle groups in the legs to the greatest load and the faster muscles in the arms to the lighter but faster Finish.

Because you cannot realise potential without sound technique you can use pace as a technique tool. In all the training bands set yourself a target pace and try to stick to the recommended stroke rate, which can only be achieved with good technique. If you can coincide pace, stroke rate and heart rate then you will be developing all three areas simultaneously: mental, physical and technical.

Recommended Reading

Concept 2, *Technique Handbook and Video*

Frequently Asked Questions on Technique

answered by Terry O'Neill

Why is it that pictures taken at the World Indoor Rowing Championship reveal rowing forms (i.e. technique) that my Concept 2 manuals and video would illustrate as being incorrect. Am I misinterpreting your guidelines?

The technique advocated by Concept 2 in our manuals and video is based on sound biomechanical principles. For the majority of rowers following this method will produce the best results. However, there will be variation for a number of reasons. There is one well-known rower who has won virtually every race he's been in but, if you look at his technique, there are many faults. He rows with bent arms and doesn't sit square on the seat. This was a result of an accident several years ago which resulted in a permanent bent arm which he physically cannot straighten. He has one leg shorter than the other and so he has adapted his technique to suit his body.

Scullers are used to rowing the oars in an arc and so when they get onto the Indoor Rower their elbows tend to go out at the finish. You would not teach this on the machine because there is no angular element to the stroke, however, if the user of the machine's main aim is to perform on the water you would not want to change this characteristic.

Finally, the pulling of the 'oar,' or handle, to the chin. This stems from the belief that the extra length will give better results and although this extra long pull may initially result in the split time coming down, there will be an extra energy cost to the rower making the stroke less efficient overall. It also puts more stress on the back increasing the likelihood of injury.

I've been sliding forward until my calves kiss the backs of my thighs and I've been bending forward far enough for the handle to finish up just about under the monitor. I thought I was achieving correct posture. I'm now told that I have been sliding too far forward, thus depriving myself of the power in my legs, and that I have been swinging forward too far. What is the disadvantage to sliding too far?

If you overcompress the legs at the catch you put yourself at a mechanical disadvantage. You should compress the legs until the shins are vertical and the angle of the body should be around 30° (this will be when the body touches the thighs). Don't let your knees splay out too far as it is more efficient to pass the load through the centre of the joint, so keep your legs as parallel as possible.

This is an 'ideal' technique but there will always be variation caused by different body builds and flexibility. For example, if someone has a very strong upper body and relatively weak legs that person may be better off using a long body swing and short leg drive to compensate.

I know that my legs are more powerful than my arms and form an important component of the drive, but I don't think that I'm getting all of the power and efficiency from my leg drive that I should. What can I do to improve this?

There are a couple of exercises you can try. As you come forward think about the weight shifting on the foot towards the toes and also the compression of the legs, like squeezing down a coil spring. When you come up onto your toes release the spring. This is to make sure you take the beginning of the stroke with the legs.

The other exercise is, from the beginning of the stroke, keep the arms straight and just push off of the footplate moving back a couple of inches but making sure that the handle moves the same distance as the seat. Gradually increase the leg drive keeping the arms straight all the time, using them as a connection to the handle only. Do not pull the handle into the body.

When using the Indoor Rower I take the catch with bent arms. This is due to my knees being in the way and having to reach around them. I have lowered my feet to the bottom setting but still have the problem. I am 6'4", which is not tall for a rower. I also have the habit of rowing slumped but, when I sit up I find I am not drawing the handle in a straight line as the height of the chain is below my finish point (just below the chest). How can I put this right?

Although you are right to say that 6'4" is not exceptionally tall for a rower, the key is the ratio of leg to trunk length, regardless of height. If your legs are really long then at the beginning of the stroke they will be right up under your chin, even at the bottom setting of the footplate. If you slump, this will further aggravate the situation. If your elbows are bent out rather than down, your knees can come up between your arms. Try this; as you come off the finish sit tall and think about lifting your chest and reaching over your knees. To achieve this straighten the arms, lean slightly forward and allow the knees to come up into the space between your arms until your chest touches your thighs, keeping the arms straight. Then push the legs down out of the space and use the upper body in the second half of the stroke.

I find that I am not tiring my legs at all during a row unless rowing above 90% maximum heart rate. Even at 60% however, I am getting some back problems, I assume because my pull uses too much back. What am I doing wrong?

At the Finish the contact is mainly on the heels and you will feel the foot straps on the upper side of the feet. As you swing your weight forward, the contact changes from the heels to the balls of the feet where you should feel the pressure building as you break your forward momentum, to the point where you drive your body back. During this period the back, arms and shoulders are used solely to connect the handle to the footplate where the force is being developed. They are held firm and still so that, as you change the

emphasis from slowing the forward movement down to driving back, the seat and the handle move exactly the same distance. As the hands pass the feet the back becomes dynamic and starts to swing back. As the handle passes the knees the legs should be almost flat and then the arms draw the handle into the body.

An exercise you can try is to sit at the beginning and just push the legs back one to two inches, holding the body and arms still so that the handle and seat are moving the same distance. By doing this you are isolating the legs at the beginning of the stroke and you will feel the loading on the legs.

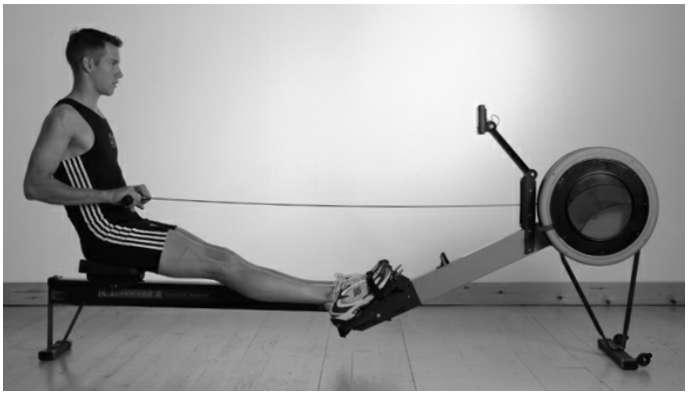
I'm experiencing a slight aching in the wrists. Is this to do with technique, or fatigue?

The wrists are involved in feathering the oar when rowing on water but on the Indoor Rower they should remain flat.

If it is the rowing that is causing the ache it can only be because the wrists are being stressed. Check your technique and if this does not help then there are some exercises you can do that will strengthen the wrists, giving them greater support.

You will need a round piece of wood, like a broom handle. Tie a piece of string, about one metre long, to the middle. On the other end of the string tie a weight of about five kilogrammes. Turn the handle so that the string winds itself around, raising the weight off the floor, and then lower the handle with your palms facing downwards.

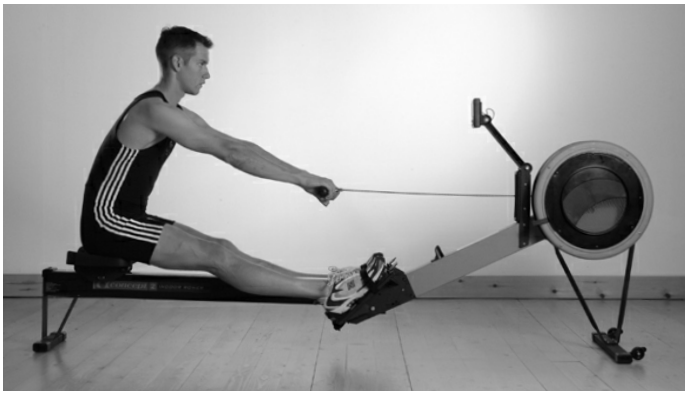
Another exercise is with a tennis ball held in the hands, palms facing each other. Turn the ball clockwise with the left hand and anticlockwise with the right as if you were opening a jar. Then change direction as if you were closing the jar. These are simple exercises that can be done at any time and, along with rowing, will strengthen your wrists which should solve the problem. If it persists, consult your doctor.



THE FINISH

Lean back slightly, legs flat, handle drawn to the body.

Forearms horizontal.



Arms extend, body rocks forward.

The arms are relaxed and extended fully.

The body rocks forward from the hips.

The Slide

AFTER the arms have fully extended and the body rocked forward, slide forward maintaining arm and body position.

THE DRIVE

Full Slide - The Beginning

Shins vertical with body pressed up to the legs.
The arms are straight and relaxed.

The position should feel comfortable.

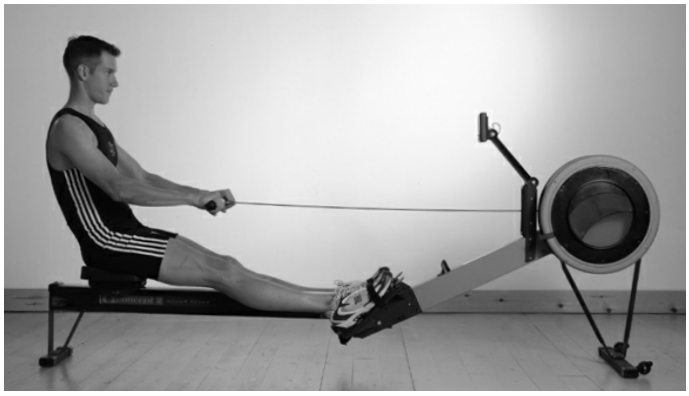
The Start of the Drive

The legs push down and the body begins to lever back.

The Drive continued

The legs continue to push as the body levers back.

The arms remain straight.

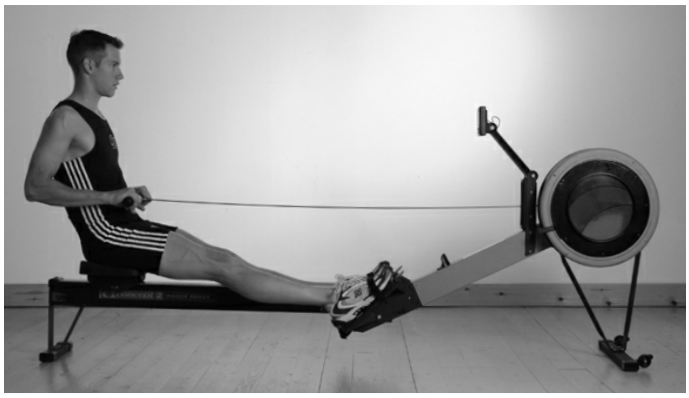


The body stops levering back

The arms draw the handle past the knees and then strongly to the body, returning to the Finish position.

Legs flat.

Forearms horizontal.



THE FINISH

Lean back slightly, legs flat, handle drawn to the body.

Forearms horizontal.

You are ready to take the next stroke.

Technical Faults and Solutions

Correct technique is essential for efficient rowing and to reduce the risk of injury. Here are some of the most common errors, with the reasons they are inefficient, and solutions to help you prevent or correct any problems.

Fault

Solution

1. Rowing with bent arms

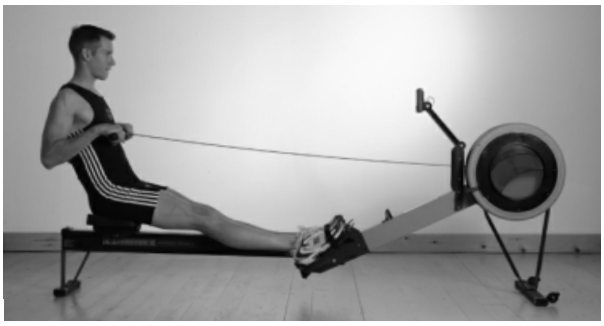
When the arm supports a load in one position the muscle remains contracted. Contraction expels blood from the muscles reducing the oxygen supply, increasing lactic acid build up and hastening fatigue.

The rower starts the Drive by pulling with the arms rather than pushing with the legs.

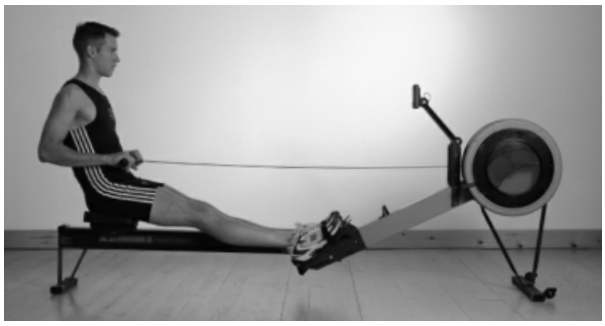
The Drive should start by pushing the legs and bracing the back with the arms fully extended and relaxed. The arms connect the legs and the back onto the handle.

2. Rowing with bent wrists

Work can be carried out more efficiently and the risk of injury reduced when the load passes through the centre of joints.



Rowing at various stages of the stroke with bent wrists.

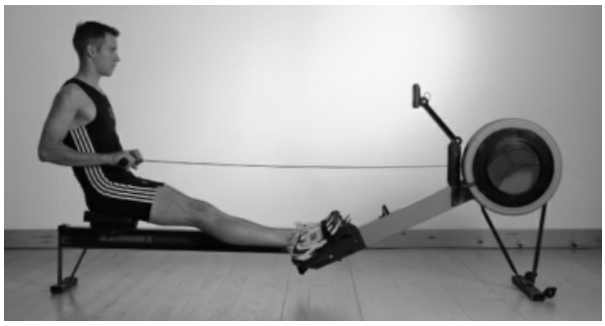


Always row with FLAT wrists. Check the hands at each stage of the Drive.

3. Pulling up too far and leaning back too much

Leaning back too far requires a great deal of energy to swing the body back through the upright position. The energy costs are greater than any gains through rowing a longer stroke.

At the Finish of the stroke, the rower pulls the handle up too high and leans back too far.



Draw the handle into the body. The wrists should be flat with elbows drawn past the body, forearms horizontal.

Fault

Solution

4. Slide shooting

The legs are the most powerful muscles in the body and are used to start the acceleration of the flywheel, which represents the greatest load. Any movement of the seat should result in a corresponding movement of the handle or the legs are not being used to the greatest effect.

The legs push away too early, the back is not braced and so the power is not transferred onto the handle.

The legs begin the drive and the body moves back with straight arms transferring the leg power onto the handle.

5. Using the back too early

Using the back too early means that the weaker muscles are taking on the greater load and the stronger muscles are used when the load has decreased.

The rower starts the Drive by swinging the body back rather than pushing the legs. This results in a weak movement.

The legs begin the drive and the body levers back with the arms fully extended and relaxed.

6. Knees up too early

At the beginning of the stroke you need to be balanced and in control in order to develop maximum power. If the recovery sequence of hands, body then slide is not carried out correctly then this will mean a last minute adjustment at the beginning of the power phase, throwing you off balance and out of control.

On the Recovery the rower slides forward before the handle has extended past the knees. The hands either hit the knees or they are lifted up to clear the knees.

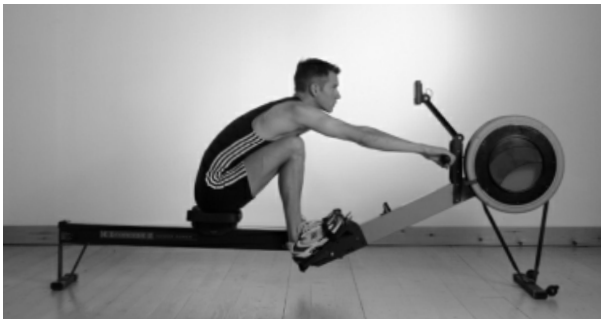
The Recovery sequence - hands, body, then slide. AFTER the arms have fully extended and the body has rocked forward, slide forward, maintaining the arm and body position.

Fault

Solution

7. Over reaching

Over reaching at the beginning of the stroke places the lower back at maximum flexion. If you then load it up there is a risk of tissue damage in this area.



The body stretches too far forward. The shins may be past the vertical. The head and shoulders tend to drop towards the feet. The body is in a weak position for the Drive.

The shins are vertical. The body is pressed up to the legs. The arms are fully extended and relaxed, body tilted slightly forward. This position should feel comfortable.

8. Body too tense. Grip on handle too tight

The only muscles that should be contracted are those directly involved in moving the flywheel. Any muscles in the shoulders and neck that are not directly involved will just drain energy if tensed.

Teeth are clenched, shoulders hunched and the rower is gripping the handle too tightly.

RELAX! Relax the shoulders down, unclench the teeth and relax the jaw. Keep a LIGHT hold on the handle.

9. Pulling the body to the handle

If you pull the body towards the handle there is an energy cost but it will not add anything towards moving the flywheel.

At the Finish, the rower, instead of pulling the handle to the body, pulls himself forward to the handle.

At the Finish the rower leans back slightly, holds the legs down and draws the handle to the body using the upper body as a firm platform.

Section 3 :

Physiology

The Need for Exercise

The need for exercise is quite simple and stems from the fact that changes in society take place at an incredible rate whereas the evolution of man is a much slower process. When compared to our predecessors, modern society requires less physical activity but we are subject to greater stress. Inactivity and stress form a lethal cocktail that is the major cause of heart disease, high blood pressure and certain forms of cancer which together account for the majority of deaths in Western society.

Stress is not all bad, we need a certain amount to stimulate us into action; too much stress is bad especially if the stress level cannot be relieved. Stress activates a mechanism in the body releasing chemicals that allow for a tremendous burst of energy. This is a vital survival mechanism know as "fight or flight", however, the stressors that trigger this mechanism in modern man often stem from frustration in traffic jams, train cancellations and computers crashing.

Unlike our predecessors we are unable to run freely or climb the nearest tree to restore the chemical balance of the body. We have to sit there whilst the chemicals released for action stagnate in our blood stream causing untold long-term damage.

The body is a truly magnificent machine with a capacity to correct a lot of these problems. Too often unaware of the consequences, we go until the situation becomes chronic. However, there are some indicators that all is not well and one of the more obvious signs is when we start to put on weight.

Recent surveys show that over 50% of the population of the UK are overweight and only the USA, with more than 60%, is in worse shape. Being overweight increases the risk of serious health problems and in most cases is unnecessary. Excessive weight gain will not happen overnight and a regular exercise routine along with a sensible diet will keep you in good shape.

In order to maintain a healthy lifestyle we must have an understanding of how our body works, how to train it to improve its efficiency and how to provide it with the nutrition that it requires.

If you want to know more about how your body works and how each energy system is trained, then read the rest of this section. If not, then you can go straight to the next section.

Your Body

Whatever you are doing, whether you are running a marathon or lying in bed you require energy. If you do nothing at all, then you only require a very small amount of energy to keep you alive. This is called the basal metabolic rate (BMR) and is the minimum amount of energy that your body can survive on. Anything that you do adds to your energy requirements. Any kind of exercise or movement requires energy so it follows that the body must be able to provide for these energy requirements. This section of the guide will explain how the systems that produce energy in the body work, the fuels that they require and the systems that supply those fuels and remove the waste products.

The Energy Systems

To produce movement the body must break down an energy store to release energy in a form that it can use. The energy store that the body requires to release this energy is called adenosine triphosphate (ATP). When the body breaks down the ATP the energy released is in a form that can be used to create movement.

The Anaerobic System

The anaerobic system has two energy pathways, the phosphocreatine, creatine phosphate or alactic system which provides very rapid release of ATP but only lasts for ten seconds, and the lactic acid system which is slightly less rapid but lasts for up to four minutes.

The alactic system relies on the substrate creatine phosphate that is stored in the muscles and because of its short duration is the main energy source used by 100m sprinters and weight lifters. After high intensity exercise your creatine phosphate levels will be depleted and can be resynthesised using energy from glycogen metabolism.

The lactic acid system breaks down glucose, or glycogen (stored sugar), to produce ATP. It comes into use immediately after the alactic system and can produce enough ATP for up to four minutes of high intensity exercise, but peaks at one minute. For this reason a 400m runner or 100m swimmer relies heavily on this system for their energy. Unlike the alactic system the lactic acid system leaves behind a by-product, lactic acid. Lactic acid causes the muscles to become more acidic, work less efficiently and causes the muscular pain that we associate with exercising hard. Therefore we try to minimise the production of lactic acid wherever possible.

The Aerobic System

The aerobic system is the slowest of the three systems to work but has the advantage of lasting indefinitely. This is the system that produces the energy required for the BMR and any non-sprinting movement that takes place throughout the day. Like the lactic acid system the aerobic system can use glucose or glycogen as its fuel but can also use fat, which produces much more ATP. The aerobic system is able to produce 19 times more ATP from each molecule of glucose than the lactic acid system can but has the disadvantage of requiring oxygen so takes as long to start as it takes the oxygen requirements of the cell to be catered for. For this reason the aerobic system does not take over from the lactic acid system for approximately three minutes. When fat is used as the fuel for the aerobic system it produces much more energy than glucose or glycogen but requires even more oxygen and so it can take between 20 and 40 minutes for fat to take over as the main fuel as it takes this long for the oxygen requirement to be met.

How Do the Fuels Get to the Muscles?

There are two body systems responsible for supplying the demand of fuels for the energy systems. These are the respiratory system and the circulatory or cardiovascular system.

The Respiratory System

The respiratory system consists of the lungs and respiratory muscles (the muscles of the chest wall, the abdomen and the diaphragm). The main job of the respiratory system is to inhale air, allowing the oxygen in the lungs to diffuse into the blood and the carbon dioxide in the blood to diffuse into the lungs to be exhaled. The oxygenated blood can then be transported around the body through the cardiovascular system.

The Cardiovascular System

The cardiovascular system consists of the heart and blood vessels. It is responsible for circulating the blood through two circuits. The first pumps the deoxygenated blood from the right side of the heart to the lungs where it becomes oxygenated as the oxygen bonds to the haemoglobin molecules in the red blood cells. The oxygenated blood then returns to the heart. The second circuit pumps the oxygenated blood from the left side of the heart around the body. Because the left side of the heart has to pump the blood further it is more muscular than the right side. The blood is pumped through the intestines and stomach where it collects nutrients and then to the muscles or organs. It then travels to the cells where it releases the nutrients and oxygen and collects the waste products and carbon dioxide and returns to the heart. The cycle then starts again.

During exercise the heart rate increases in response to demands for increased blood flow. This controls the body temperature and the supply of oxygen and nutrients to the working muscles. During heavy bouts of exercise the amount of blood flowing at any given time can increase by a factor of seven as a result of increased heart rate and stroke volume. Heart rate increase is initially linear and directly proportional to exercise intensity.

The blood plays a very important part in both supplying the fuels and removing the waste products of energy synthesis and in the maintenance of homeostasis (maintaining the body at balance). It is composed of 55% plasma of which 90% is water, 44% red blood cells (erythrocytes) and about 1% of white blood cells (leukocytes) and platelets (thrombocytes). The red blood cells have the haemoglobin molecules which bond with oxygen and allow the transportation of oxygen, the white blood cells fight infection, the platelets allow clotting in the case of a cut or abrasion and the plasma supplies water to the cells and helps to maintain the body temperature. If there is a shortage of any of the constituent parts of the blood the body is not able to function properly. If there is not enough haemoglobin or red blood cells the person may feel weak. This is called anaemia and is common both in pregnant women and in endurance athletes. It is caused by a lack of iron, the important part of the haemoglobin molecule, and can be easily cured with an iron supplement. If you think you might be anaemic then you should visit your doctor for professional advice.

VO_2 Max

When exercising the level that we can work at is normally limited not by the fuel stores in the muscle but by the maximum amount of oxygen that the body can take in and utilise in any one minute. This is called the VO_2 max. VO_2 max is limited by the amount of blood that can be pumped through the lungs and to the working muscles and by the efficiency of the lungs. The maximum value possible for a person's VO_2 max is capped by their genetic make up but the right training can help you achieve your potential. (A test to calculate your VO_2 max is given in Physiological Tools in Section 3 : Physiology).

The Effects of Training on the Body

The effects that training has on the body is dependent on whether the training undertaken is aerobic or anaerobic so these effects will be explained in two sections.

Aerobic Effects

By following an aerobic training programme for as little as 12 weeks you can make significant improvement in your VO_2 max. This is possible because you have made some physiological changes to the parts of the body that limit your VO_2 max. The heart responds to aerobic training like any muscle does to work: by getting bigger. This is called cardiac hypertrophy and results in an increase in the amount of blood that can be pumped out in each beat (the stroke volume) and hence an increase in the amount of blood that can be pumped in one minute (the cardiac output). This change to the heart means that the heart needs to beat fewer times to move the same amount of blood, therefore your resting heart rate will decrease. The lungs are also affected by aerobic training. They become more efficient and are able to take in more air per breath and take more breaths per minute. The final changes that occur due to aerobic training is that your blood volume increases due to an increase in blood plasma and red blood cell volume and the muscles become more efficient due to an increase in the ability to transport oxygen within the cell and to respire (resynthesise ATP).

Anaerobic Effects

The changes that take place in the body due to anaerobic training are limited in number compared to those that take place due to aerobic training. This is because many of the changes caused by aerobic training are an improvement in the ability to carry or utilise oxygen. In anaerobic training this system is not required so the adaptations are limited to four major points;

1. Muscle hypertrophy - the muscles used in high speed activities (the fast twitch muscle fibres) will increase in size.
2. Enzyme activity increases in the enzymes that are responsible for anaerobic energy production and recovery from anaerobic activity.
3. Energy stores of the anaerobic energy sources, ATP, phosphocreatine and glycogen increase in size.
4. Lactic tolerance - fast twitch muscle fibres become more tolerant to increased levels of lactic acid.

The changes outlined above show that it is very important to know what changes you wish to take place in the body before you start training so that you can ensure that you are doing the right sort of training to promote the improvements that you require.

Training Intensity

With improved knowledge of the energy systems that we use during exercise we can now move away from the "no pain, no gain" approach to training that has been prevalent, even recently, in some sports training. Exercise physiology has come a long way in the last fifty years and is now a much more exact science, capable of providing individuals with training programmes specific to their requirements. This section of the Training Guide aims to outline how varying the intensity of training can be used to bring about specific improvements in fitness with a much lower risk of illness or injury than the "no pain, no gain" philosophy. For all but the most experienced elite athletes the best way of monitoring training intensity is by ensuring that the heart rate is in the correct training zone. In order to do this we must have an understanding of resting heart rate, maximum heart rate and the difference between them - the heart rate range, the aerobic threshold and the anaerobic threshold, so that the correct training zones can be calculated.

Resting Heart Rate (RHR)

The heart, along with all of the other major organs in the body, is controlled directly by the autonomous nervous system; this means that we have limited conscious control over them. The heart responds directly to the demands placed upon it by the functions of the body. During rest the majority of blood flow is to the brain and major organs. To be able to identify the energy requirements of exercise and the correct training bands for heart rate we need to have a baseline; the resting heart rate. This can be measured by taking your heart rate as soon as you wake up, even before getting out of bed. Keeping a record of your resting heart rate can also help monitor your immune system thereby preventing over training and minimising the likelihood of getting ill. This is because your resting heart rate becomes elevated when your immune system is struggling to fight off infection. If you notice an unexplained rise in RHR of more than six to eight beats per minute then you should not train until it has returned to normal.

Maximum Heart Rate (MHR)

Maximum heart rate will vary depending on what you are doing to bring your heart rate up. Running will elicit a higher maximum heart rate than rowing which in turn will elicit a higher maximum than swimming. This is due in part to the fact that runners are upright and so the heart has to overcome the gravitational pull; rowers are seated and so the effects of gravity are reduced and swimmers are prone further reducing the gravitational pull. It is important to know what your maximum heart rate is as it enables you to calculate the correct training bands for heart rate. One method of calculating MHR is to use the equation MHR = 220 – age, but this can be very inaccurate, having an error of ±15/20 beats per minute (BPM). A more accurate method of finding your MHR is given in Physiological Tools in Section 3 : Physiology.

Heart Rate Range (HRR)

Heart rate range is determined by subtracting the resting heart rate from the maximum heart rate. When training bands are identified by percentages of heart rate, it is percentage of the HRR that is referred to. This value is then added to the RHR to give the training heart rate.

The Aerobic Threshold

Exercise brings about an increase in lactic acid in the blood, which at rest would be around 1mmol. The aerobic threshold is defined as a blood lactate concentration of 2mmols. This normally occurs at approximately 60% of maximum heart rate and is the lowest intensity that we regularly train at.

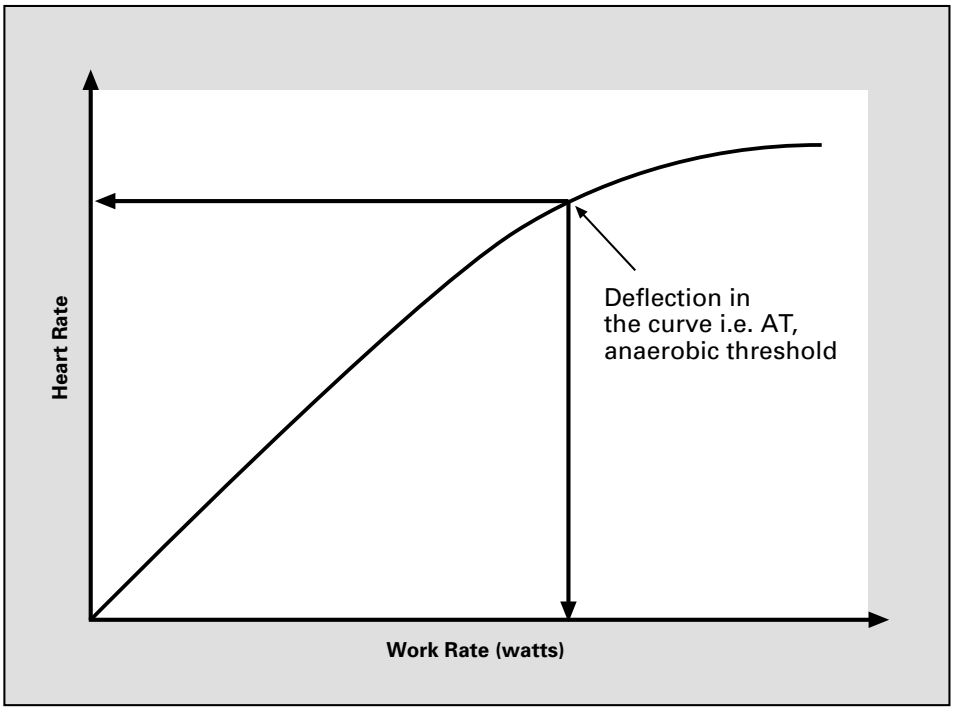
The Anaerobic Threshold (AT)

The anaerobic threshold is measured at 4mmols. At this point the lactic acid production is at the maximum level at which it can be metabolised and so it starts to accumulate in the working muscles, greatly reducing their efficiency. Anaerobic threshold is frequently measured as a percentage of aerobic capacity or VO_2 max and can be anywhere in the range of 50% to 85% of VO_2 max depending on fitness.

Because the heart has a limit on how fast it can beat there comes a stage where any further increase in demand for oxygen cannot be met. At this point there is a deflection in the heart rate/work rate graph (see below). The rate of increase slows down and eventually plateaus out at heart rate maximum. Many physiologists identify this point of deflection as the anaerobic threshold and exercise carried out above this level is anaerobic.

Training in this band has a greater effect on the development of the heart than training at a lower intensity. The development of muscular efficiency continues at a higher intensity but because training in this band is more physically demanding than aerobic training it cannot be sustained. Consequently although muscular efficiency is being trained at a higher rate it is for less overall time and therefore may not yield the same benefits.

For people with limited time to train, exercise within this band will have the greatest short-term effect.



Training Heart Rate

Training heart rates are divided into bands. These bands are determined by four key physiological points; resting heart rate, maximum heart rate, heart rate at aerobic threshold and heart rate at anaerobic threshold. In an unfit person the anaerobic threshold can occur as low as 50% of maximum heart rate but in a highly trained athlete this can be as high as 85% of maximum heart rate.

When starting out on a training regime, either from scratch or after several years of no regular exercise, then the simple method of determining your training heart rate can be used. This simply requires you to subtract your age from a nominal figure of 220, which represents maximum heart rate. You then apply the relevant percentage referred to in the training programmes to this figure. Any errors in this method will be on the safe side but as you get fitter you may want to use the heart rate range method.

If you have been exercising regularly you should calculate your maximum heart rate using the test in Physiological Tools in Section 3 : Physiology and then calculate your training bands accordingly.

Training Bands

Training heart rates are divided into five bands, determined by the RHR, MHR, aerobic threshold and anaerobic threshold. The five training bands can be divided into aerobic and anaerobic. The aerobic bands, utilisation training 2 (UT2) and utilisation training 1 (UT1), rely solely on the aerobic system and form the foundation of most training programmes. In these bands the main fuels are carbohydrate and fat, the percentage of each is dependant on the length of the exercise period. The anaerobic bands, anaerobic threshold (AT), oxygen transport (TR), and anaerobic (AN) combine the full output of the aerobic system with varying input from the anaerobic system. The fuel for these bands is carbohydrate.

The table below illustrates the relationship between the training bands and stroke rate. It describes how you may feel during the training and the training effect of working within each band.

Table 3.1

Training Bands

Band	Type of Work	% MHR	Rate (SPM)	What it is good for	How you feel
UT2	Utilisation 2. Light aerobic, low intensity work. Sustainable and fat burning.	55-70	18-20	General CV fitness.	Relaxed. Able to carry on a conversation.
UT1	Utilisation 1. Heavy aerobic work using more oxygen.	70-80	20-24	Higher level of CV fitness.	Working. Feel warmer. Heart rate and respiration up. May sweat.
AT	Anaerobic Threshold. Harder work. On the aerobic limit. Pushing into anaerobic area.	80-85	24-28	High level of CV fitness. Building mental and physical tolerance.	Hard work. Heart rate and respiration up. Carbon dioxide build up. Sweating. Breathing hard.
TR	Oxygen Transportation. Working hard. Unsustainable for long periods.	85-95	28-32	Developing oxygen transport to the muscles under stress. Increasing cardiac output.	Stressed. Panting. Sweating freely.
AN	Anaerobic (without oxygen). Short bursts of maximum effort. Unsustainable. Burning carbohydrate.	95-100	32+	Anaerobic work. Increasing speed. Accustoming the body to work without oxygen.	Very stressful. Gasping. Sweating heavily.

Notes

SPM = strokes per minute

%MHR = percentage of maximum heart rate

CV = cardiovascular

The different training bands use differing amounts of carbohydrates and fats as their primary source of fuel. Table 3.2 below gives a rough indication of the fuel usage at different intensities of exercise. Remember that this is only a rough guide as the percentage of fat versus carbohydrates used during exercise is dependant on duration and fitness as well as intensity.

Table 3.2

Relationship between Exercise Intensity and Energy Source

Exercise Intensity %MHR	Heart Rate (bpm)	% Carbohydrate	% Fat	Length of time at required intensity
65-70	130-140	40	60	60-90 mins
70-75	140-150	50	50	30-60 mins
75-80	150-160	65	35	15-30 mins
80-85	160-170	80	20	10-15 mins
85-90	170-180	90	10	4-6 mins
90-95	180-190	95	5	90 secs-4 mins
100	190-200	100	-	45-60 secs

Notes

Example 20 year old, MHR = 200

Physiological Tools

In order to achieve accurate results the same pre-test protocol should be carried out before the tests each time you undertake them. This should include:

- Being in good health.
- Being well rested with no heavy training sessions in the last 48 hours.
- No alcohol consumed within the last 24 hours.
- No strong coffee or tea in the previous three to four hours.

You will need a heart rate monitor and interface and where possible someone to record your results. The drag factor can be set to individual preference (see The Damper Lever and Drag Factor in Appendix).

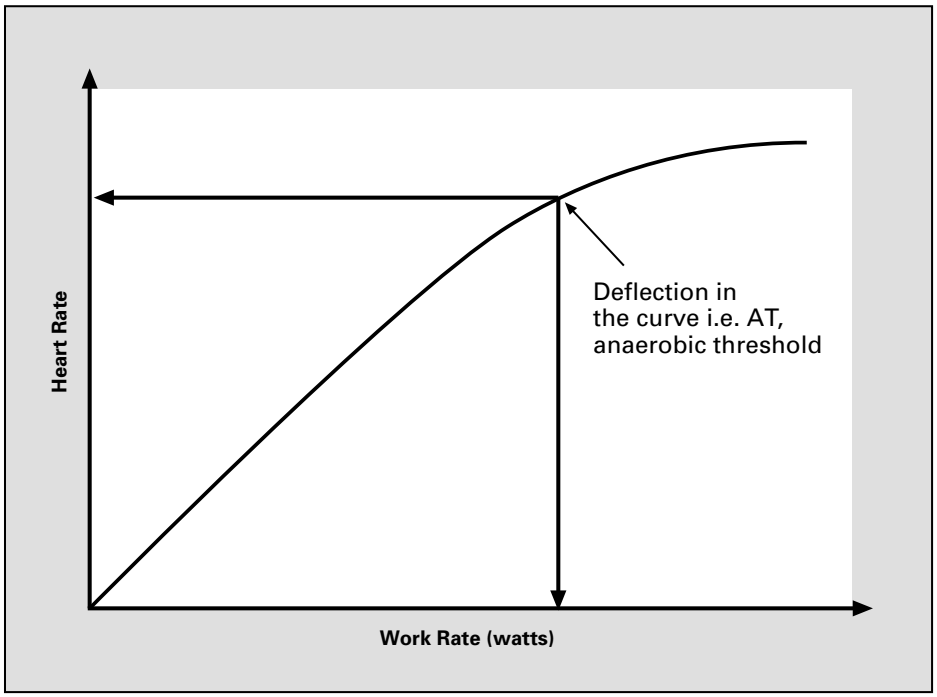
Row an eight to ten minute warm up followed by stretching as outlined in Stretching in Section 1 : Before and After Exercise. Then complete the warm up by rowing for five minutes with heart rate not exceeding 140 BPM and record the split time that corresponds to this heart rate.

Determining your MHR and Anaerobic Threshold

You will need someone to record your work rate and heart rate through this test.

Start the test by rowing at the split you recorded from the warm up. After every 90 seconds note the heart rate and increase the effort by 25 watts (see 500m Split Time to Watts Conversion in Appendix). Repeat this procedure until you reach exhaustion and record the maximum heart rate achieved.

In order to find your anaerobic threshold you will need to have someone to record your heart rate and work rate in watts every 15 seconds. This will enable you to plot a graph of your heart rate against work rate. You should then be able to find the point where there is a deflection in the curve. This corresponds to your anaerobic threshold. You can then find your heart rate and work rate at AT.



Finding an Estimate of Your Stroke Volume (ESV)

The following table gives an estimate of stroke volume based on a total blood volume of five litres.

Table 3.3

Estimated Stroke Volume in Millilitres					
Heart rate	**110 Watts**	**165 Watts**	**220 Watts**	**275 Watts**	**330 Watts**
110	162	188	233	258	303
105	155	179	221	245	288
110	148	170	211	234	275
115	141	163	202	224	263
120	131	156	196	215	252
125	130	150	186	206	242
130	125	144	179	198	233
135	120	139	172	191	224
140	116	134	166	184	216
145	112	129	160	178	209
150	108	125	155	172	202
155	105	121	150	166	195
160	102	117	145	161	189
165	98	114	141	156	183
170	96	110	137	151	178
175	93	107	133	147	173
180	90	104	129	143	168
185	88	101	126	139	164
190	86	99	122	136	159
195	83	96	119	132	155
200	81	94	116	129	151

To ascertain your estimated stroke volume from the above table, set the performance monitor to read watts and connect your heart rate interface. After a warm up, row at a constant watts setting as indicated in the boxes across the top of the table. Row at this intensity for four minutes.

After a while your heart rate will stabilise for a given workload. Using the column on the left hand side of the chart select the nearest heart rate to the one you observed in the test. Move across to the right until you arrive at the column that corresponds to your watts setting and read the stroke volume.

Example - A heart rate of 160 on a setting of 220 watts = ESV of 145ml/beat.

Estimation Your VO_2 max

The only precise way to determine your VO_2 max is through a laboratory test that involves measuring the difference in oxygen content between inspired and expired air.

However, as a result of gathering data over a number of years a formula has been developed by which you can approximate your VO_2 max. First you need to know your average power in watts for a 2,000m test. This figure is then multiplied by 14.4 and a constant of 65 added to give VO_2 max in millilitres.

For example, 2,000m time = 6:40 therefore, from the table in 500m Split Time to Watts Conversion in Appendix, the average watts are 350.

350 x 14.4 = 5,040

5,040 + 65 = 5,105 millilitres/min or 5.105 l/min.

This is an estimate within +/- 10%.

Frequently Asked Questions

answered by Terry O'Neill

I have been following the Concept 2 website advice for weight management. By taking 41 (my age) from 220 for my maximum heart rate I get 179 but recently achieved 185 bpm in my hill sprint training. My resting heart rate is 42 to 44.

Using the figure 179 I take 65% to get a work rate of 116 bpm. In order to achieve this I have to row at rate 28 to 30 instead of the 18 to 20 as recommended in the Training Guide. What am I doing wrong?

Your maximum heart rate will depend on what you are doing. Hill sprints will initiate a much higher maximum heart rate than indoor rowing. If you want to find your maximum heart rate on the Indoor Rower refer to the test in Physiological Tools in Section 3 : Physiology.

The percentage of heart rate that you should work at is with respect to your heart rate range. You determine this by subtracting your resting heart rate from your maximum heart rate. Multiply this by the percentage you require and add your resting heart rate on again. This will give you an accurate idea of the correct heart rate for that training zone.

You should not be too concerned about the stroke rate you use to achieve your training zones. This is a throwback to water rowing before heart rate monitors were common, when rowers controlled the intensity of training by using stroke rate. It is much more important to achieve the correct heart rate than the suggested stroke rate.

Why do we need to train in different training bands and why can't you just train as hard as you can for as long as you can?

When I first took up coaching the national team back in the late 70s we used three training bands. Then they were called steady state, tempo and interval training. For steady state read UT1, for tempo read anaerobic threshold. Interval training was based around a series of 500m pieces.

Following a programme based on these three bands the crew I coached in 1980 won the World Championships and set a world best time that stood for nine years. The athletes in the crew all had full time jobs and trained four evenings a week and twice on Saturday and Sunday.

It would be a brave coach that suggested turning back the clock to this type of programme to full time athletes that form the current national team. The nearest thing that I got to it was a couple of years ago when I helped a local club. The first thing I did was cut the number of sessions per week by removing all early morning weekday sessions. The reason was that these sessions were not focused because of the pressure to finish in time for work. The quality of the evening session was poor because the athletes were not getting enough sleep and arriving for training tired. When I suggested dropping the morning sessions I could see from the expression on their faces they were thinking "Who is this bloke?" However, they did as I asked and went on to win at Henley, which was their aim.

With full time athletes tiredness is not such an issue as they are able to rest between sessions. This is because they have more time to train so training fills up the time they have available. The rational used is that the training can be more specific and to achieve this the number of training bands are expanded to five or in some cases seven.

Identifying various bands isn't that different from training as hard as you can for as long as you can. Low intensity work is carried out over a longer period and if you went off too hard you would not be able to complete the session. But if you mean why don't you make each session flat out then the answer is you would only be training at one point on a continuum which ranges from low intensity aerobic work to high intensity anaerobic work.

The two extremes of training could also be called the endurance end and the strength end of the continuum. You will find that there will be some strength gains from endurance training and some endurance gains from strength training.

We identify bands by blood lactate levels and this is relevant to training programmes for rowing over 2,000m. Blood lactate levels may not be relevant to someone training for a marathon as marathon runners may not be able to create significant levels of lactate. It is relevant to rowers because there are two reasons why you will be unable to continue to exercise, one is you will run out of fuel and you can do this through aerobic work. This will happen to athletes involved in prolonged aerobic activities such as the ironman triathlon, if they fail to refuel as they go. The other reason is that through high intensity work you have an accumulation of lactate to a point where it changes the pH of blood from a normal alkaline 6.8 to an acidic 7.3. In this case calcium, which is the bonding agent in the actomyosin complex (part of the contractile unit of the muscle), is broken down and muscles can no longer function. This can be clearly seen in an event like the 400m hurdles where as the runners approach the finish line they appear to be running in treacle and stop immediately they cross the line. The total event lasts for less than a minute so there is no way the athlete has run out of fuel.

Lactate accumulation will also be the limiting factor in a 2,000m flat out row. The energy costs are about 400 calories, which in itself is not too high considering that a human has a capacity of around 10,000. However, this is the maximum consumption over a period of 24 hours and the rate of expenditure for a 2,000m piece is around ten times the sustainable rate which is why it is such a physical challenge.

The main objective of a training programme is to increase the amount of usable energy before the debilitating effects of lactate accumulation. Therefore you need to know at what training intensity this occurs (anaerobic threshold).

Because lactate is constantly present in the bloodstream, we also need to establish what amount is there as a result of the basal metabolism plus normal activity and what level we can expect from exercise that will bring about the desired training effect (aerobic threshold). These two points have been identified as 4 and 2mmols respectively. Then there are the training bands above the anaerobic threshold, the first at 6mmols and then above. We need to train in these bands to develop a tolerance to lactate and improve the metabolic resynthisis.

Recommended Reading

- **McKardle, Katch and Katch, *Exercise Physiology: Energy Nutrition and Human Performance***
  Lippincott Williams and Wilkins, 2001
  ISBN: 0781725445
- **Wilmore and Costill, *Physiology of Sport and Exercise***
  Human Kinetics Europe Ltd, 1999
  ISBN: 0736000844

Section 4 :

Creating a Bespoke Training Programme

This section of the training guide explains the basic principles of training and how to structure a training year. It provides all the information you need to create a bespoke training programme for you or your athletes, if you are a coach. When designing your own training programme you must decide your goal for the end of the programme and then, if possible, use one of the preset programmes in the next section of the guide to help you avoid missing anything out. Alternatively you can use the interactive programme to create a programme suitable as desired and then rearrange it to suit your own commitments.

Periodisation of Training

Most athletes, and elite athletes especially, start their preparation for a major event many months in advance (in the case of preparations for the Olympics this can be years in advance). Without breaking down the training into small manageable chunks they would very quickly become demotivated, and even if they did not, they would not easily be able to tell if they were improving or not. For this reason, training programmes are divided into small manageable sections called training cycles that can be varied in order to work different energy systems and to offset the problems of boredom.

There are three different types of training cycle. The macro-cycle is the longest of the cycles and can be up to a year in length. This is obviously too long a cycle to maintain concentration and improvement so this is broken down into four to eight week blocks called meso-cycles. This is becoming a more manageable size but is broken up to even smaller one to two week cycles called micro-cycles.

A stepped or wave approach to the meso-cycles has been found to be more efficient than a linear or continuous method of training. The wave principle requires that a training load increase is followed by a decrease to allow adaptation to take place in the body. An example is set out below:

If you have 18 weeks to the competition, then you have one 18 week macro-cycle that can be divided into 3 x 6 week meso-cycles. Your next step is to determine the training aim during each of the meso-cycles. Depending on your current level of fitness, you may decide to focus on general endurance during the first meso-cycle. This will mean that the majority of the training during this phase will be long intervals of 20 to 40 minutes low intensity work.

During the second meso-cycle the intensity should increase and the quantity decrease. This means the work intervals will become shorter, six to ten minutes, and the power output and heart rate will increase.

The third meso-cycle would be more specific race preparation. In the case of a 2,000m race the work intervals would be focused on part of the race e.g. 4 x 1,000m pieces or 12 x 250m. This meso-cycle concludes with a period of seven to ten days of tapering.

Structuring the Year

Serious competitors divide the year into four training periods; transition, preparation, pre-competition and competition. This enables them to be at their peak when required. The table below illustrates the training periods and their objectives for a twelve-month training programme.

Table 4.1

Training Periods & Objectives of a 12 month Training Programme				
Preparation (27 weeks)	**Pre-Competition (9 weeks)**	**Competition (12 weeks)**		**Transition (4 weeks)**
Development of general physical capacity, strength and cardiovascular (CV) fitness. Development of good technique. Mentally, athlete improves concentration to maximise technical improvement and build confidence for the coming competition.	Training becomes more specific. Athlete continues to work on good technique and mental preparation.	Intensity of training increases which, if unchecked, can lead to breakdown in technique. Identify weaknesses and work on them during low intensity sessions. This is the time to develop tactics and strategy for competition, as well as to stabilise competition performance.	**Taper Period** (the last seven to ten days of the Competition Period) Intensity and duration of training is dramatically reduced to allow the body to fully recover from the intense training of the Competition Period. Athlete focuses on race strategy and pre-race warm up, keeping the sessions short. This is also an opportunity to polish up technique.	Rest! This is the time for complete mental and physical relaxation and can include holidays. A minimal level of activity should be maintained using cross-training techniques. Time for evaluation, and to set objectives for the next year.
Stretching and psychological preparation are important components of all training periods				

Notes

i. Although the table reads left to right, to periodise your training you must work back from the date of your main competition.

ii. Transition period: four weeks after the main competition.

iii. Competition period: From the date of the competition you wish to peak at count back 12 weeks (4 x 3 week cycles). The last seven to ten days of this period will be a taper.

iv. Pre-competition period: Count back a further nine weeks (3 x 3 week cycles).

v. Preparation period: The remaining 27 weeks.

vi. To check how you are progressing, and the effectiveness of your training, you should keep a training log and do some baseline tests on a regular basis (see Baseline Tests in Section 12 : Tests).

The next table sets out how you should plan your training if you have six to 48 weeks before your major competition. The table is used by working out how many weeks you have till the competition, and then reads from the left hand column across. For example, if you have six weeks till competition this whole time should be spent in the period called competition and is all competition preparation. If you have 24 weeks until competition then you should do a three week preparation cycle followed by nine weeks of pre-competition and 12 weeks of competition.

Table 4.2

Training Periods (weeks)			
Weeks until Race	**Preparation**	**Pre-Competition**	**Competition**
6	-	-	6
7	1	-	6
8	2	-	6
9	3	-	6
10	3	1	6
11	3	2	6
12	3	3	6
13	3	4	6
14	3	5	6
15	3	6	6
16	3	4	9
17	3	5	9
18	3	6	9
19	3	4	12
20	3	5	12
21	3	6	12
22	3	7	12
23	3	8	12
24	3	9	12
25-48	3-27	9	12

Notes

The last seven to ten days of the competition period will be a taper, however, if you only have six weeks until competition a shorter taper of three to seven days would be adequate.

Tapering

For seven to ten days prior to an important competition you should taper off your training. Some people think that to reduce training doses at this time will lead to a loss of fitness but this is not true. Training is a combination of overload and super-compensation. This means that during exercise the body is brought to the point of exhaustion and, during the recovery period, the body recuperates to a point of greater capacity than before. The super-compensation period lasts for seven to ten days after the end of a training regime and so any fears of a loss of condition are groundless. The best use of this time is to focus on race strategy, getting the pre-race warm-up right, and polishing up technique. It is important to avoid the build up of lactic acid close to competition. The longest single piece of high intensity work should not exceed 90 seconds. A couple of these at the beginning of the final week should be okay, cutting back to bursts of 30 seconds in the days immediately preceding competition. If preparing for a 2,000m race, we recommend that the total number of hard strokes during the whole of the tapering period should not exceed 300.

An example of a week of tapering is shown below. This is the last week before a 2,000m race and assumes that you have trained conscientiously for the event. You should find that you are able to do much more work than is on the schedule. This is a good sign but do not give into the temptation to do too much. You are tapering and should be getting rested and ready for your race, not making yourself overtired.

Table 4.3

Tapering Based on Training Sessions per Week								
3 sessions or less	No Taper Needed							
4 sessions	1x3'TR	2x1.5'AN	3x4secsAN	RACE				
5 sessions	25'UT2	1x3'TR	3x1.5'AN	45secsAN	RACE			
6 sessions	30'UT2	1x3'TR	2x8'UT1	3x1.5'AN	45secsAN	RACE		
7 sessions	1x15'UT1	5'AT	1x3'TR	20'UT2	2x2'TR	3x45secsAN	RACE	
8 sessions	OFF	1x15'UT1	5'AT	1x3'TR	20'UT2	2x2'TR	3x45secsAN	RACE

Notes

i. 25'UT2 means row for 25 minutes at UT2 heart rate.

ii. 15'UT1 means row for 15 minutes at UT1 heart rate.

iii. 5'AT means row for five minutes at AT heart rate.

iv. 3'TR means row for three minutes at TR heart rate.

v. 2x1.5'AN means row for one and a half minutes at AN heart rate, then repeat once fully recovered.

Body Adaptation

Perhaps surprisingly, a training session itself does not actually bring about an improvement in performance. It is during periods of rest and recovery that the body adapts to demands made on it from exercising. As your physical performance improves, you can increase the training volume that in turn will change the type of training you do. People training four or five times a week will benefit from a high percentage of high intensity sessions, whilst those training twice a day may only complete 20 to 30% of their total training programme at high intensity. An individual's heart rate at different workloads will define the training intensity, therefore people training at the same workload could be training at different intensities. Training sessions that cause the heart rate to increase to near maximum are high intensity. Sessions that can be completed at moderate heart rate are low intensity.

To ensure the desired adaptation takes place a number of factors need to be considered:

- Training needs to be regular to stimulate adaptation in the body.
- There needs to be enough time between sessions for the adaptation to take place.
- The amount of training needs to be increased as adaptation takes place.
- The training programme needs to be specific to the needs of the individual.
- Training needs to be tailored to the specific physical demands of a particular sport.
- There must be a system for monitoring progress within the programme.

Recovery Time Between Intervals

Full recovery between intervals can be considered as taken place when the heart rate has fallen to warm up level (twice resting rate).

The intensity of interval-training can be increased by working to 90% or even 80% of full recovery.

Example - resting heart rate = 60bpm. Warm up rate = 120bpm

100% recovery = 120bpm, then repeat.

90% recovery = 132bpm, then repeat.

80% recovery = 145bpm, then repeat.

Reduced recovery is most effective at the beginning of an intensive interval-training period when intensity takes precedence over quality. Close to competition quality takes precedence over intensity and therefore full recovery is advisable.

Structuring the Programme

The number of training sessions per week you are prepared to commit to will have a profound impact on the mix of training you will do. In simple terms, if you are only training three or four times a week the intensity of your programme will be proportionally higher than if you are training seven or eight times a week.

To make some sense of this Table 4.4 outlines a suggested mix of training based on the number of training sessions per week, the training bands and the period of the year that you are training in. Table 4.5 illustrates the type of work, stroke rate and heart rate appropriate to each training band.

By referring to tables 4.1, 4.2, 4.4 and 4.5 and using the wave principle of training you will be able to start constructing your own programme.

The table overleaf shows how to divide the training sessions between the different training bands, depending on how many sessions you wish to train each week.

Table 4.4

Training Bands Mix (Based on Training Period & Training Sessions per Week)										
	Preparation		**Pre-Competition**			**Competition**				
No. of Sess.	**UT2**	**UT1**	**UT2**	**UT1**	**AT**	**UT2**	**UT1**	**AT**	**TR**	**AN**
3	-	3	-	1	2	-	-	-	2	1
4	-	4	-	2	2	-	-	1	2	1
5	1	4	1	2	2	-	1	1	2	1
6	2	4	1	2	3	-	1	1	2	2
7	3	4	1	3	3	-	1	2	2	2
8	4	4	2	3	3	1	1	2	2	2

Notes

Select the number of sessions you wish to train each week, taking note of the number of sessions required in each training band.

Table 4.5

Work in Each Training Band						
1	**2**	**3**	**4**	**5**	**6**	**7**
Band	**Time**	**Type of Work**	**Recovery**	**Example**	**% MHR**	**SPM**
UT2	60-90 mins	Long intervals 20-90 mins	10-20%	60 mins steady state	55-70	18-20
UT1	30-60 mins	Long intervals 10-30 mins	25-50%	3 x 10 mins: 5 mins rest	70-80	20-24
AT	18-24 mins	Medium intervals 6-10 mins	50%	3 x 6 mins: 3 mins rest	80-85	24-28
TR	12-18 mins	Short intervals 2-5 mins	100%	6 x 2 mins: 2 mins rest	85-90	28-32
AN	9-12 mins	Bursts 45-90 secs	100%	6 x 90 secs: 90 secs rest	90-100	Max

Notes

i. Band: the training band in which the athlete is working.
ii. Time the duration of training within each training band.
iii. Type of Work: the type of work for the training session.
iv. Recovery: the recovery time, expressed as a percentage of the work time.
v. Example: an example of the work.
vi. %MHR: the percentage of maximum heart rate appropriate for the type of work.
vii. SPM: strokes per minute.

Personalising Your Programme - the Danish Programme

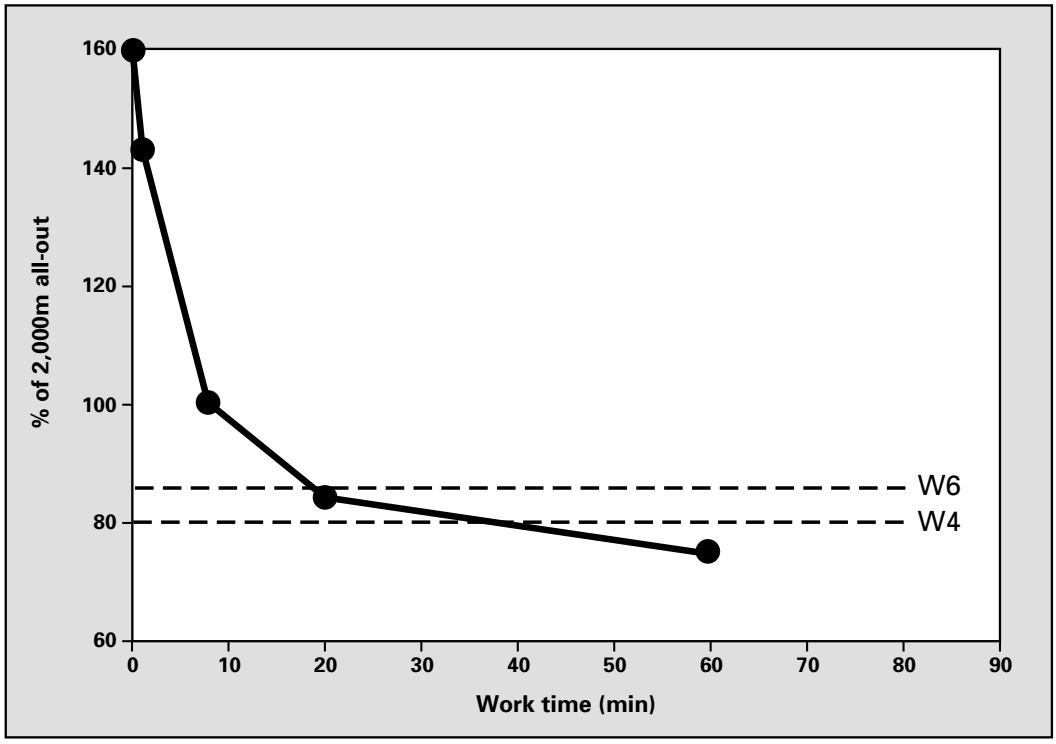
by Kurt Jensen

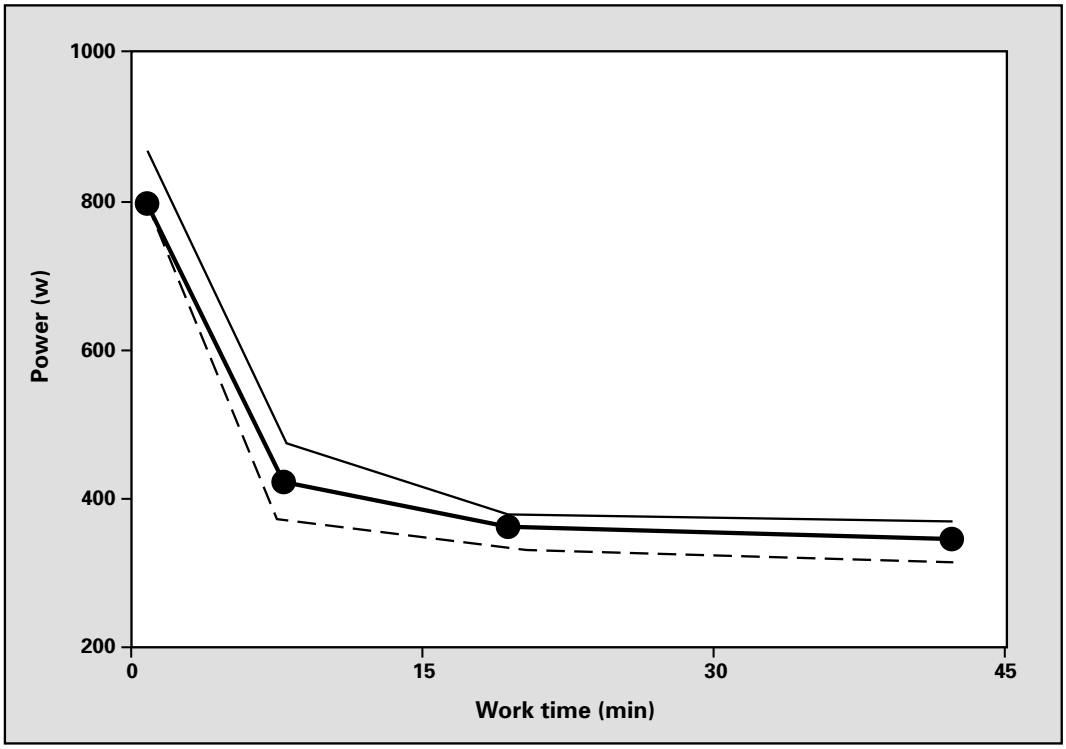
Denmark does not have many rowers and so it is vital that we provide a tailored training programme to meet their individual needs. This extends beyond physical training to encompass psychological and nutritional support.

One of the methods used to define individual training intensities is to produce a power/endurance curve on the Indoor Rower for each athlete. Five key points are established as a result of this test, which is carried out over one week:

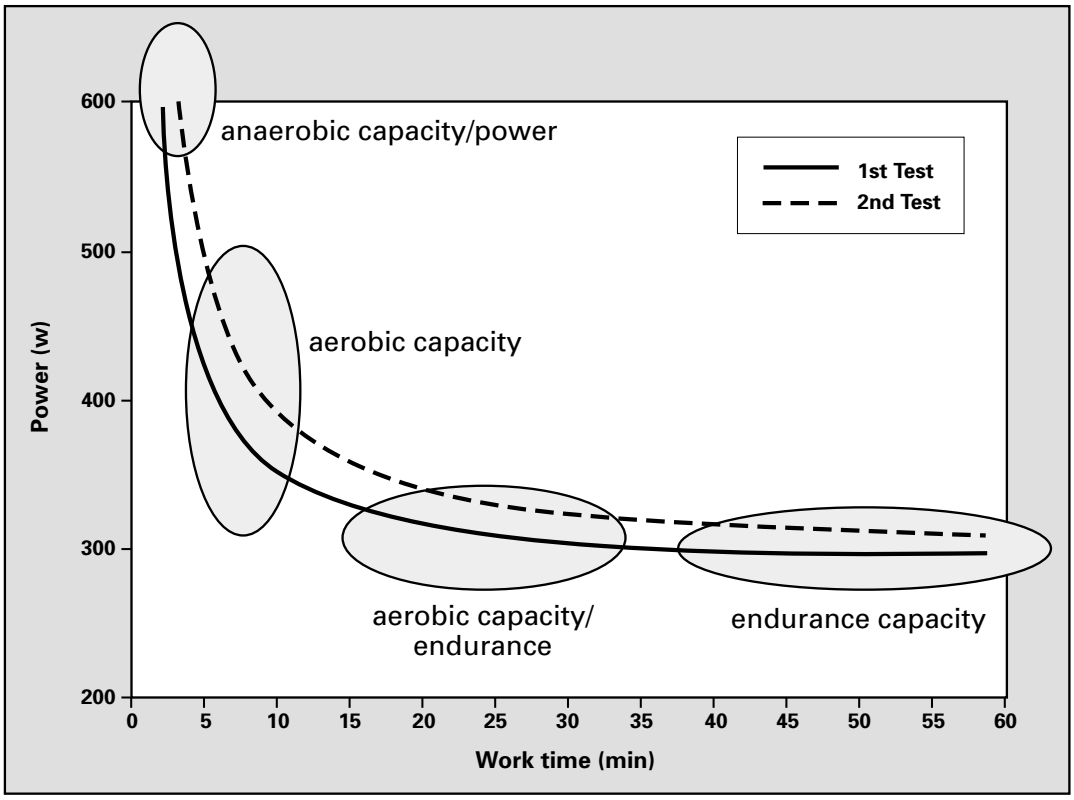
1. Maximum power output over ten seconds.
2. Anaerobic capacity over 60 seconds, stroke rate 36 to 46.
3. Race pace over 2,000m, stroke rate 30 to 34.
4. Aerobic capacity over 6,000m, stroke rate 26 to 28.
5. Endurance over 60 minutes, stroke rate 22 to 24.

A graph of power/time is then plotted and the individual's power output at blood lactate levels of four and six mmol/l are superimposed. We call these points W4 and W6 respectively. They would have been collected from a standard sub maximal step test. The work time at these two key points can then be read off directly from the graph. Below are two graphs, the first showing the results of an individual with the power represented as the percentage of power produced in the 2,000m test. The second is a graph of power against work time.





The average power is the thick line and the maximum and minimum values are also indicated. The graph below shows the four areas of anaerobic capacity/power, aerobic capacity and aerobic capacity/endurance and endurance capacity.



Training intensities were defined as follows:

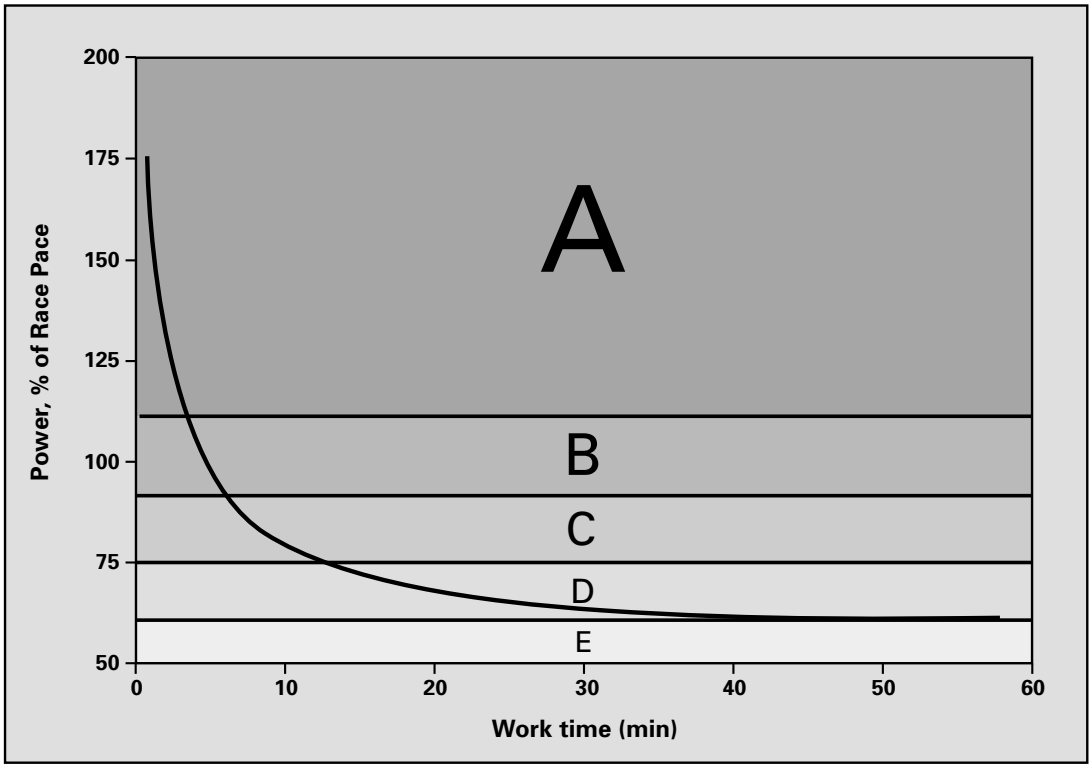
Table 4.6

Training Intensities					
Training Intensity	**Level**	**% of Max**	**Stroke Rate**	**Time in Range**	**Heart Rate**
Anaerobic Capacity/Power	A	110%+	36-46	3-5 mins. Short intervals	100%
Aerobic Capacity	B	90-100%	30-34	20-25 mins. Med intervals	95-100%
Aerobic Capacity/Endurance	C	70-78%	26-28	40-45 mins. Long intervals	80-90%
Endurance	D	60-70%	22-24	60 mins	65-75%
Recovery/Technical Improvement	E	<60%	-	-	<65%

Notes

Max refers to output for 2,000m piece.

The levels can be represented by a power graph. This shows the power output for each level. The training time in this level can then be read from the table above.



Traditionally, Danish rowers have not been able to train on the water in winter and so training is land based. Six to eight hours a week are spent on the Indoor Rower out of a total of eight to 12 hours. Training based around the rowing machine is far more efficient than training on the water. Some of the athletes measured are fitter in the winter than summer when the training becomes more water based. When the rowers move from the land to water the training time increases to 16 hours a week. This is less than the time spent training by British lightweights who tend to row right through the winter. An explanation for this is, because the Danes are fitter when they move onto the water, they are able to train at a higher intensity. However, not all the Danish rowers are able to transfer their fitness gains into boat speed and so specific onboard tests are being carried out to see exactly where this power is being lost.

In recent years climate change has meant it would be possible for the Danes to train on the water in winter but they don't see any advantage because far more time would be required to achieve the same fitness levels. When they do move onto the water, the volume of training increases and this increase plus the rise in ambient temperature, is all that is needed to bring down the weight of the rowers from a winter high of +6 kilos.

Lightweights should not reduce their food intake as this leads to negative energy levels where the athlete is unable to train at a high intensity. Positive energy levels are achieved by having enough fuel to cope with the demands of the training regime. When you enter negative energy your percentage body fat will actually increase as a result of reduced food intake. In some cases, additional nutritional advice is needed to help rowers meet their target weight. Young rowers, those under 21 years, should be actively discouraged from dieting to make the lightweight limit.

There is no reason why heavyweights and lightweights should not follow the same training regime. The only exception is in the area of weight training to develop strength. Here the heavyweight has the advantage of being able to increase muscle mass whereas the lightweight is limited by total body weight constraints. Beyond a certain strength level however, there is no evidence that more strength results in improved performance over 2,000m. A number of athletes were tested for strength by fixing the chain on the Concept 2 Indoor Rower and introducing a strain gauge to the handle. The strength difference in the athletes tested ranged from 160kg to 280kg, a difference of 80%. However, when they were then asked to row 2,000m, the rower with the lowest score was able to maintain a power output of 400 watts and was near to the top of the group.

Although a heavyweight rower has a higher VO_2 max in absolute terms, when body weight is taken into account there is no difference. Aerobic capacity is directly related to VO_2 max and so aerobically heavyweights and lightweights are equal. Rowing is not just an aerobic sport and where the heavyweight has the advantage is in anaerobic capacity. This means that on the rowing machine, when all other things are equal, the heavyweight will always beat the lightweight. This is not always the case on the water where under certain conditions the heavyweight's physical advantage is balanced by greater drag on the hull than that on a lightweight crew.

If asked why Denmark has been successful at lightweight level it would not be because of the training programme or because of the athletes. The key is to match the right training programme to the right athlete. This can be difficult for individuals rowing in a crew boat, but can be done during winter training on the rowing machine.

How is this Information Useful for Me?

The information presented above is collected and prepared by a professional sports physiologist. That does not mean that it is of no use to people who are not in national teams and do not have access to the testing facilities like those used by the Danes. All of the information used to create the graph, except the W6 point, can be easily found with no specialised equipment other than a Concept 2 Indoor Rower and a heart rate monitor as the following five points can be determined:

1. Maximum power output over ten seconds.
2. Anaerobic capacity over 60 seconds, stroke rate 36 to 46.
3. Race pace over 2,000m, stroke rate 30 to 34.
4. Aerobic capacity over 6,000m, stroke rate 26 to 28.
5. Endurance over 60 minutes, stroke rate 22 to 24.

We have already found that it is possible to find the anaerobic threshold (W4) - see Physiological Tools in Section 3 : Physiology. This power output at AT should then be added to the graph at 44 minutes. If your point for W4 lies above the line and not on it as in the graphs above, this shows that your endurance is not as good as it could be and should be a point to focus on.

Once you have created your graph you should use it to create a table, replacing the split, power and heart rates at the different levels with the values from your graph. This will then allow you to train at the correct intensity for any time stipulated by your training programme. It is however important that, as you get fitter and stronger, you adjust your graph so that you are always training at the correct level to maximise improvements.

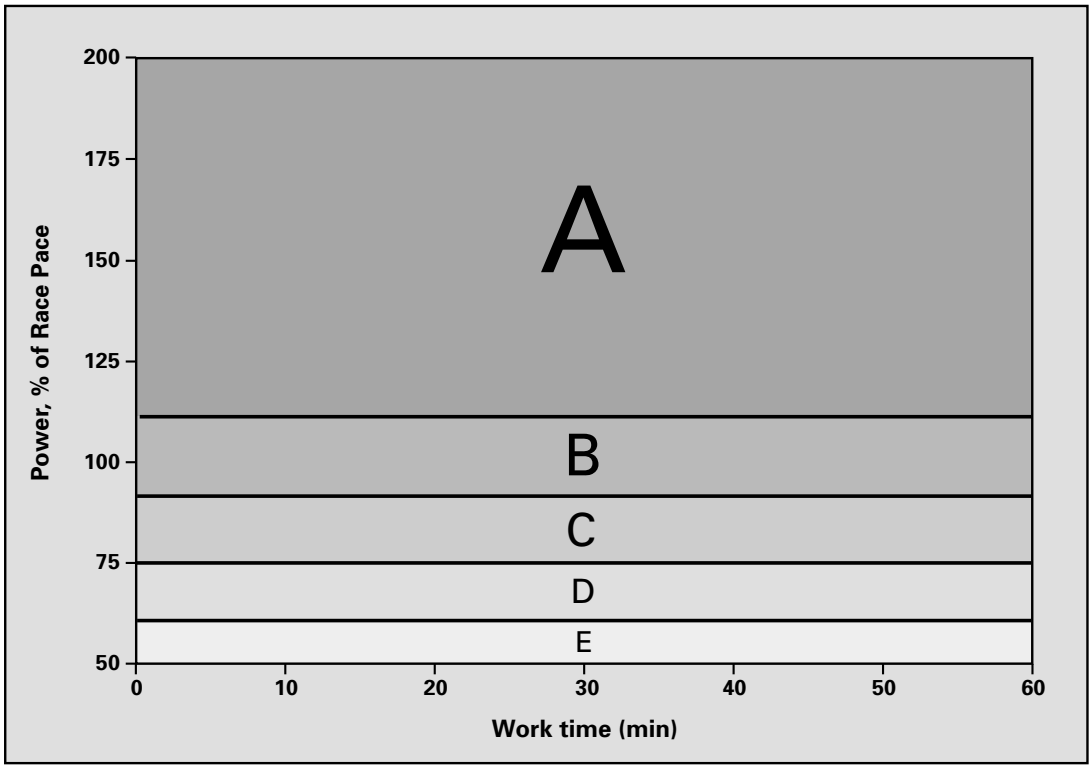


Table 4.7

Training Intensities				
Training Intensity	**Level**	**Split**	**Power (Watts)**	**Heart Rate**
Anaerobic Capacity/Power	A			
Aerobic Capacity	B			
Aerobic Capacity/Endurance	C			
Endurance	D			
Recovery/Technical Improvement	E			

Notes

Complete the table using the information from your graph.

Section 5 :

Preset Programmes

Programme Guidelines

The basic conditioning, 20 minute fitness and 40 minute fitness programmes are for those who achieving general health and fitness is their priority, whilst the 2,000m race training, marathon training and cross-training programmes are designed with a specific competition focus in mind. Each programme indicates a target group, but you must use your best judgement with regard to how you are coping and progressing. If you find that the work is hard, and you are having difficulties maintaining the programme, ease off and consider working at a gentler pace, perhaps on another programme. Equally, if you find that it's too easy, look at moving on to the next level.

Beginning Your Programme

Before embarking on any exercise programme remember the following:

- Ensure you are medically able to start exercising. Have a fitness assessment first.
- Always listen to your body and be prepared to take a rest if you are tired. Rest is a very important part of the training process as this is when your body adapts to training loads.
- Take care not to overdo it in the early stages and never train when you are ill.
- Work within the limits of your MHR (see Training Intensity in Section 3 : Physiology).
- Don't become a slave to the programme.
- Exercise safely (see Exercise Guidelines in Section 1 : Before and After Exercise).
- If you suffer from a bad back or experience back pain when using the rowing machine you should ensure that you are using the correct technique and limit yourself to doing 20 minutes continuous rowing at a time before taking a break to stretch. Make sure you include extension stretches like the Rectus Abdominus stretch shown in Stretching in Section 1 : Before and After Exercise. If your back pain persists consult your doctor or physiotherapist. If the session in longer than 20 minutes break it into 20 minute parts. This is not affecting your training as the effect is cumulative.
- All of the training set out in the guide refers to use of the Concept 2 Indoor Rower. This does not mean that all of the sessions should be completed on the rowing machine. In order to maintain some variety in your training programme we recommend replacing some of the UT2 and UT1 sessions with the same intensity work done either running, cycling, cross-training or swimming.

Basic Conditioning

by Celia and Keith Atkinson

Target Group: Age 40+, or younger people who are unfit and have done little or no exercise.

Dr Fritz Hagerman, Professor of Physiology at Ohio University, USA and Chairman of FISA's* Rowing Sports Medicine Commission has written the following exercise programme for the Indoor Rower following research into the effects of exercise on adults who had led a largely sedentary lifestyle and had not exercised in years. The results were amazing. Starting with five one minute rows, with rests in between, the group worked on a step-by-step basis, gradually building up to a level of fitness which enabled them to row continuously for 30 minutes.

The basic conditioning programme is designed to be a gentle introductory training programme, setting an upper training intensity limit of 75% maximum heart rate (MHR) or a level at which conversation can be maintained, whichever is lower.

The programme can be adapted to your needs. For example; you can double the rest time or vary the steps (i.e. go from one minute to one and half minutes and from two minutes to two and half minutes) if you wish. What is necessary though is regularity - establish a routine of one day's work followed by one day's rest in the early stages.

* Fédération Internationale des Sociétés d'Aviron (FISA) - the world governing body for the sport of rowing.

Table 5.1

Basic Conditioning Programme Framework					
Step	**Band**	**Row**	**Rest**	**Workload**	**Work Time**
1	UT1	1' @ 75% MHR	30 secs	5 reps, adding another rep each workout until you can do 8, then go to next step.	5-8'
2	UT1	2' @ 75% MHR	30 secs	Same as step 1	10-16'
3	UT1	3' @ 75% MHR	30 secs	Same as step 1	15-24'
4	UT1	4' @75% MHR	30-60 secs	4 reps, adding another rep each workout until you can do 7, then go to next step	16-28'
5	UT1	5' @ 75% MHR	30-60 secs	Same as step 4	20-35'
6	UT1	Progressing to continuous rowing	-	Once you are comfortable with step 5 increase the time period for rowing more rapidly. For example, to 7.5 mins x 4, then 10 mins x 3, then 15 mins x 2, until you are rowing continuously for 20 mins, then add 2 mins each day until you reach 30 mins.	20-30'

Notes

Step 1 means row for one minute at up to 75% of your maximum heart rate (MHR), then rest for 30 seconds. Repeat so that you complete five repetitions altogether. When you feel capable add another repetition until you can comfortably complete eight repetitions then move to Step 2, and so on. Step 1 represents between five and eight minutes of exercise.

Table 5.2

Basic Conditioning Programme				
Step	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**
1	5 x 1' UT1 20-24spm	6 x 1' UT1 20-24spm	7 x 1' UT1 20-24spm	8 x 1' UT1 20-24spm
2	5 x 2' UT1 20-24spm	6 x 2' UT1 20-24spm	7 x 2' UT1 20-24spm	8 x 2' UT1 20-24spm
3	5 x 3' UT1 20-24spm	6 x 3' UT1 20-24spm	7 x 3' UT1 20-24spm	8 x 3' UT1 20-24spm
4	4 x 4' UT1 20-24spm	5 x 4' UT1 20-24spm	6 x 4' UT1 20-24spm	7 x 4' UT1 20-24spm
5	4 x 5' UT1 20-24spm	5 x 5' UT1 20-24spm	6 x 5' UT1 20-24spm	7 x 5' UT1 20-24spm
6	4 x 7.5' UT1 20-24spm	3 x 10' UT1 20-24spm	2 x 15' UT1 20-24spm	20'UT1 20-24spm Keep adding 2' up to required total time

Notes

i. Move from one stage to the next only when you feel ready - there are no time restrictions.

ii. 5 x 1'UT1 20-24spm means row one minute at UT1 heart rate, at 20 to 24 strokes per minute, take 30 seconds rest then repeat till you have done it five times.

20 Minute and 40 Minute Fitness

by Celia and Keith Atkinson

In the 20 minute fitness and 40 minute fitness programmes the training periods have been defined as preparation, development and consolidation. The preparation period is the start up period, when you are getting used to a regular training regime; the development period should be started when you are happy that you've mastered technique and have established a regular exercise routine. You can then begin to work a little harder during each session. Provided progress is good you may wish to push on further into the consolidation period. The main changes are that the stroke ratings (strokes per minute or spm) will rise and the quality and intensity of the work will increase. In short, you will work harder and rate higher.

For those of you who become interested in competition, the preparation, development and consolidation periods can relate to the preparation, pre-competition and competition periods for 2,000m race training.

20 Minute Fitness

Target Group: People who have a limited amount of time for training.

The 20 minute fitness programme is based on the periodisation of training (see Periodisation of Training in Section 1 : Before and After Exercise), training heart rate (see Training Intensity in Section 3 : Physiology) and the training bands (see Training Bands in Section 3 : Physiology).

The session length, in terms of work, is up to 20 minutes but this does not include time for warm-up, cool down or stretching. Depending on the amount of rest you require, some sessions may overrun the allotted 20 minutes slightly.

This programme (Table 5.3) has been written for anybody who wishes to train from three to five times per week. If you train three times a week, follow the programme for sessions 1, 2 and 3. For four sessions add on Session 4, and for five sessions complete all sessions.

Notes for Table 5.3

i. 1 x 20' UT1 20spm means row for 20 minutes in your UT1 heart rate range at 20 strokes per minute.

ii. 2 x 8' UT1 20spm means row for eight minutes in your UT1 heart rate range at 20 strokes per minute, with a short rest of three to four minutes, then repeat.

iii. 6 x 1' AN 32spm means row one minute intervals in your AN heart rate range, with at least one to two minutes rest between each piece of work, repeat six times.

iv. 4 x 2'TR 30spm means row for two minutes in your TR heart rate at 30 strokes per minute with 30 to 90 seconds rest, repeat four times.

v. Sessions 1 to 3 are fairly hard workouts as they are designed for people only completing three training sessions each week. The less training you do each week the harder the individual sessions need to be so that cumulatively you are doing enough work for it to be beneficial. As you complete more sessions per week the training load of the extra sessions can be reduced. Therefore sessions 4 & 5 are lighter workouts. When completing more than three sessions a week we recommend you adjust the sequence of the sessions to give a more balanced mix of light and hard sessions throughout the week.

Table 5.3

20 Minute Fitness Programme, 3-5 Sessions per Week			
Session	**Light Week**	**Medium Week**	**Hard Week**
	PREPARATION PERIOD		
1	1 x 20′ UT1 20spm	1 x 20′ UT1 22spm	1 x 20′ UT1 24spm
2	2 x 8′ UT1 22spm	2 x 8′ UT1 23spm	2 x 8′ UT1 24spm
3	1 x 20′ UT1 20spm	1 x 20′ UT1 22spm	1 x 20′ UT1 24spm
4	2 x 8′ UT1 22spm	2 x 8′ UT1 23spm	1 x 20′ UT1 24spm
5	1 x 20′ UT2 18-20spm	1 x 20′ UT2 18-20spm	1 x 20′ UT218-20spm
	DEVELOPMENT PERIOD		
1	2 x 8′ AT 24spm	2 x 8′ AT 25spm	2 x 8′ AT 26spm
2	1 x 20′ UT1 20spm	1 x 20′ UT1 22spm	1 x 20′ UT1 24spm
3	3 x 5′ AT 26spm	3 x 5′ AT 27spm	3 x 5′ AT 28spm
4	1 x 20′ UT1 22spm	1 x 20′ UT1 23spm	1 x 20′ UT1 24spm
5	1 x 20′ UT2 18-20spm	1 x 20′ UT2 18-20spm	1 x 20′ UT2 18-20spm
	CONSOLIDATION PERIOD		
1	3 x 4′ TR 28spm	3 x 4′ TR 28spm	3 x 4′ TR 30spm
2	6 x 1′ AN 32spm	6 x 1′ AN 34spm	8 x 1′ AN 36spm
3	4 x 2′ TR 30spm	5 x 2′ TR 32spm	6 x 2′ TR 32spm
4	2 x 8′ AT 24spm	2 x 8′ AT 26spm	2 x 8′ AT 28spm
5	1 x 20′ UT1 20spm	1 x 20′ UT1 22spm	1 x 20′ UT1 24spm

40 Minute Fitness

Target Group: People who can devote up to an hour to a training session.

The 40 minute fitness programme is based on the periodisation of training (see Periodisation of Training in Section 1 : Before and After Exercise), training heart rate (see Training Intensity in Section 3 : Physiology) and the training bands (see Training Bands in Section 3 : Physiology).

The session length, in terms of work, is up to 40 minutes but this does not include time for warm-up, cool down or stretching. Depending on the amount of rest you require, some sessions may overrun the allotted 40 minutes slightly.

This programme (Table 5.4) has been written for anybody who wishes to train from three to five times per week. If you train three times a week, follow the programme for sessions 1, 2 and 3. For four sessions add on Session 4, and for five sessions complete all sessions.

Notes for Table 5.4

i. 1 x 20′ UT1 20spm means row for 20 minutes in your UT1 heart rate range at 20 strokes per minute.

ii. 2 x 8′ UT1 20spm means row for eight minutes in your UT1 heart rate range at 20 strokes per minute, with a short rest of three to four minutes, then repeat.

iii. 6 x 1′ AN 32spm means row one minute intervals in your AN heart rate range, with at least one to two minutes rest between each piece of work, repeat six times.

iv. 4 x 2′TR 30spm means row for two minutes in your TR heart rate at 30 strokes per minute with 30 to 90 seconds rest, repeat four times.

v. Sessions 1 to 3 are fairly hard workouts as they are designed for people only completing three training sessions each week. The less training you do each week the harder the individual sessions need to be so that cumulatively you are doing enough work for it to be beneficial. As you complete more sessions per week the training load of the extra sessions can be reduced. Therefore sessions 4 & 5 are lighter workouts. When completing more than three sessions a week we recommend you adjust the sequence of the sessions to give a more balanced mix of light and hard sessions throughout the week.

Table 5.4

40 Minute Fitness Programme, 3-5 Sessions per Week			
Session	**Light Week**	**Medium Week**	**Hard Week**
	PREPARATION PERIOD		
1	1 x 30′ UT1 18spm	1 x 30′ UT1 20spm	1 x 30′ UT1 22spm
2	3 x 10′ UT1 20spm	3 x 10′ UT1 22spm	3 x 10′ UT1 24spm
3	2 x 15′ UT1 20spm	2 x 15′ UT1 22spm	2 x 15′ UT1 24spm
4	3 x 10′ UT1 22spm	3 x 10′ UT1 23spm	3 x 10′ UT1 24spm
5	1 x 30′ UT2 18spm	1 x 40′ UT2 18spm	1 x 40′ UT2 20spm
	DEVELOPMENT PERIOD		
1	3 x 7′ AT 26spm	4 x 7′ AT 26spm	4 x 7′ AT 28spm
2	2 x 15′ UT1 20spm	2 x 15′ UT1 22spm	2 x 15′ UT1 24spm
3	4 x 6′ AT 26spm	4 x 6′ AT 28spm	5 x 6′ AT 28spm
4	3 x 10′ UT1 22spm	3 x 10′ UT1 23spm	3 x 10′ UT1 24spm
5	1 x 40′ UT2 18spm	1 x 40′ UT2 20spm	1 x 40′ UT2 20spm
	CONSOLIDATION PERIOD		
1	5 x 3′ TR 28spm	6 x 3′ TR 28spm	6 x 3′ TR 30spm
2	2 x (6 x 1′) AN 32spm	3 x (6 x 45 sec) AN 34spm	3 x (6 x 45 sec) AN 36spm
3	6 x 2′ TR 30spm	2 x (4 x 2′) TR 30spm	2 x (4 x 2′) TR 32spm
4	4 x 6′ AT 26spm	4 x 6′ AT 28spm	5 x 6′ AT 28spm
5	3 x 10′ UT1 20spm	3 x 10′ UT1 22spm	3 x 10′ UT1 24spm

2,000m Race Training

Since its introduction, the Indoor Rower has played an important role as an indoor training and testing tool for rowers and indoor rowing is now an international sport in it's own right. The 2,000m test is used worldwide and provides coaches and athletes with a tool to monitor fitness and improvement.

Rowers, like most people, do not like being tested/examined and for this reason the 2,000m test is regarded by many as an unnecessary interruption to on-water training, and not an accurate reflection of on-water performance.

In the last 20 years the volume and intensity of rowing training has increased rapidly; top level club oarsmen and women expect to train more than 15 hours a week and international athletes well over 20. In most cases, the training cycle is building towards an annual event, or series of events. Given the level of commitment made, it makes sense to regularly check that the desired training effect is being achieved. Placing regular tests within the yearly cycle allows both the coach and athlete to monitor the athlete's performance gains and, where necessary, adjust the training programme to suit the individual's needs. If the athlete sees that they are making regular performance gains, their confidence improves and they gain a belief that the training they are doing is effective and return to it with renewed vigour. If there is no performance gain, it acts as a warning signal of either ill health, over-training or that the training programme is not suited to the individual. Whatever the answer, this can be addressed immediately rather than continuing to train, only to be disappointed when performance falls below expectations in competition.

For these reasons a testing procedure should be included in the training programme to fit into the end of each meso cycle, allowing performance gains to be monitored. This way, the testing does not need to interrupt on-water training, but will certainly benefit it. Whilst performance on the Indoor Rower does not directly reflect on-water performance between two people of different technical skill levels, where the skill level is the same, the athlete with the better 2,000m time on the Indoor Rower will inevitably win.

In this section we offer two different training programmes; the original and the interactive. The original programme offers a series of pre-set programmes for four, five or six sessions per week. The interactive offers a bespoke programme taking into account different fitness levels.

The original programme and the interactive programme vary in two ways:

1. The original programme does not take into account current fitness,
2. The interactive programme offers a suggested split for each training zone that can be used for either of the two programmes and is the best split expected for each training zone based on 2,000m time.

The Original 2,000m Training Programme

Target Group: Anyone training for a 2,000m race.

It doesn't matter whether you are an Olympic champion or a "first-timer" to the machine, if you commit yourself fully to a 2,000m race you will find yourself pushed right to your limit. That said, you will be far better equipped to cope with the physiological demands you are placing on your body if you prepare for the race in a systematic way. With this in mind we advise that if you've got less than six weeks to go to your race, and you've not been training, you should probably not go ahead. Tables 5.5 to 5.7 outline a series of pre-set programmes based on training four, five or six sessions per week.

To structure your own programme refer to Section 4 : Creating a Bespoke Training Programme.

Table 5.5

The Original 2,000m Training Programme: 4 Sessions per Week			
Session	**Light Week**	**Medium Week**	**Hard Week**
	PREPARATION		
1	2 x 20′ UT1 20spm	2 x 20′ UT1 22spm	2 x 20′ UT1 24spm
2	1 x 30′ UT1 22spm	1 x 40′ UT1 22spm	4 x 10′ UT1 24spm
3	3 x 10′ UT1 22spm	3 x 15′ UT1 22spm	3 x 20′ UT1 22spm
4	1 x 30′ UT1 20spm	1 x 30′ UT1 22spm	1 x 30′ UT1 24spm
	PRE-COMPETITION		
1	2 x 10′ AT 24spm	2 x 10′ AT 26spm	2 x 10′ AT 28spm
2	2 x 20′ UT1 20spm	2 x 20′ UT1 22spm	2 x 20′ UT1 24spm
3	3 x 6′ AT 24spm	3 x 6′ AT 26spm	3 x 6′ AT 28spm
4	3 x 10′ UT1 22spm	3 x 15′ UT1 22spm	3 x 20′ UT1 22spm
	COMPETITION		
1	3 x 4′ TR 28spm	3 x 4′ TR 30spm	3 x 4′ TR 32spm
2	9 x 1′ AN 32spm	9 x 1′ AN 33spm	9 x 1′ AN 34spm
3	4 x 6′ AT 24spm	4 x 6′ AT 26spm	4 x 6′ AT 28spm
4	6 x 2′ TR 28spm	6 x 2′ TR 30spm	6 x 2′ TR 32spm

Notes

i. Always err on the side of caution in any training regime. These training examples are a guide only and are not appropriate to everyone. You need to use caution and know your own limits when assessing your ability to cope with training doses. Beginners on a training regime of three or four sessions a week may not be able to cope with the above.

ii. To determine which training period you should be working in refer to Section 4.2, Tables 4.1 and 4.2.

Table 5.6

The Original 2,000m Training Programme: 5 Sessions per Week			
Session	**Light Week**	**Medium Week**	**Hard Week**
	PREPARATION		
1	2 x 20′ UT1 20spm	2 x 20′ UT1 22spm	2 x 20′ UT1 24spm
2	1 x 30′ UT1 22spm	1 x 40′ UT1 22spm	4 x 10′ UT1 24spm
3	1 x 60′ UT2 18spm	1 x 60′ UT2 18spm	1 x 60′ UT2 18spm
4	3 x 10′ UT1 22spm	3 x 15′ UT1 22spm	3 x 20′ UT1 22spm
5	1 x 30′ UT1 20spm	1 x 30′ UT1 22spm	1 x 30′ UT1 24spm
	PRE-COMPETITION		
1	2 x 10′ AT 24spm	2 x 10′ AT 26spm	2 x 10′ AT 28spm
2	2 x 20′ UT1 20spm	2 x 20′ UT1 22spm	2 x 20′ UT1 24spm
3	1 x 60′ UT2 18spm	1 x 60′ UT2 18spm	1 x 60′ UT2 18spm
4	3 x 6′ AT 24spm	3 x 6′ AT 26spm	3 x 6′ AT 28spm
5	3 x 10′ UT1 22spm	3 x 15′ UT1 22spm	3 x 20′ UT1 22spm
	COMPETITION		
1	3 x 4′ TR 28spm	3 x 4′ TR 30spm	3 x 4′ TR 32spm
2	9 x 1′ AN 32spm	9 x 1′ AN 33spm	9 x 1′ AN 34spm
3	3 x 10′ UT1 20spm	3 x 10′ UT1 22spm	3 x 10′ UT1 24spm
4	4 x 6′ AT 24spm	4 x 6′ AT 26spm	4 x 6′ AT 28spm
5	6 x 2′ TR 28spm	6 x 2′ TR 30spm	6 x 2′ TR 32spm

Notes

i. Always err on the side of caution in any training regime. These training examples are a guide only and are not appropriate to everyone. You need to use caution and know your own limits when assessing your ability to cope with training doses. Beginners on a training regime of three or four sessions a week may not be able to cope with the above.

ii. To determine which training period you should be working in refer to Section 4.2, Tables 4.1 and 4.2.

Table 5.7

The Original 2,000m Training Programme: 6 Sessions per Week			
Session	**Light Week**	**Medium Week**	**Hard Week**
	PREPARATION		
1	2 x 20′ UT1 20spm	2 x 20′ UT1 22spm	2 x 20′ UT1 24spm
2	1 x 30′ UT1 22spm	1 x 40′ UT1 22spm	4 x 10′ UT1 24spm
3	1 x 60′ UT2 18spm	1 x 60′ UT2 18spm	1 x 60′ UT2 18spm
4	3 x 10′ UT1 22spm	3 x 15′ UT1 22spm	3 x 20′ UT1 22spm
5	1 x 60′ UT2 20spm	1 x 60′ UT2 20spm	1 x 60′ UT2 20spm
6	1 x 30′ UT1 20spm	1 x 30′ UT1 22spm	1 x 30′ UT1 24spm
	PRE-COMPETITION		
1	2 x 10′ AT 24spm	2 x 10′ AT 26spm	2 x 10′ AT 28spm
2	2 x 20′ UT1 20spm	2 x 20′ UT1 22spm	2 x 20′ UT1 24spm
3	4 x 6′ AT 24spm	4 x 6′ AT 26spm	4 x 6′ AT 28spm
4	1 x 60′ UT2 18spm	1 x 60′ UT2 18spm	1 x 60′ UT2 18spm
5	3 x 6′ AT 24spm	3 x 6′ AT 26spm	3 x 6′ AT 28spm
6	3 x 10′ UT1 20spm	3 x 15′ UT1 22spm	3 x 20′ UT1 22spm
	COMPETITION		
1	3 x 4′ TR 28spm	3 x 4′ TR 30spm	3 x 4′ TR 32spm
2	9 x 1′ AN 32spm	9 x 1′ AN 33spm	9 x 1′ AN 34spm
3	3 x 10′ UT1 20spm	3 x 10′ UT1 22spm	3 x 10′ UT1 24spm
4	6 x 1.5′ AN 32spm	6 x 1.5′ AN 33spm	6 x 1.5′ AN 34spm
5	4 x 6′ AT 24spm	4 x 6′ AT 26spm	4 x 6′ AT 28spm
6	6 x 2′ TR 28spm	6 x 2′ TR 30spm	6 x 2′ TR 32spm

Notes

i. Always err on the side of caution in any training regime. These training examples are a guide only and are not appropriate to everyone. You need to use caution and know your own limits when assessing your ability to cope with training doses. Beginners on a training regime of three or four sessions a week may not be able to cope with the above.

ii. To determine which training period you should be working in refer to Section 4.2, Tables 4.1 and 4.2.

Additional Notes for Tables 5.5 - 5.7

i. 1 x 60′ UT2 18spm means row for 60 minutes in your UT2 heart rate at 18 strokes per minute.
ii. 2 x 20′ UT1 20spm means row for 20 minutes in your UT1 heart rate at 20 strokes per minute with enough rest to return to twice your normal resting heart rate before repeating.
iii. 3 x 6′ AT 24spm means row for six minutes in your AT heart rate at 24 strokes per minutes with enough rest to return to twice your normal resting heart rate before repeating, until you have done it three times.
iv. 6 x 2′ TR 28spm means row for two minutes in your TR heart rate at 28 strokes per minutes with enough rest to return to twice your normal resting heart rate before repeating, until you have done it six times.
v. 9 x 1′ AN 34spm means row for one minute in your AN heart rate at 34 strokes per minutes with enough rest to return to twice your normal resting heart rate before repeating, until you have done it nine times.

The Interactive 2,000m Training Programme

Target Group: Anyone training for a 2,000m race.

To help you create your own training programme we have included the building blocks that are used to create the interactive 2,000m training programme that is available on the Concept 2 website. This can be used either as an alternative to the original 2,000m race training programme set out in the previous section or simply to help you create your own programme. By starting with the programme that designates the nearest number of sessions a week to the number that you require you can also use this to give your training programme some flexibility. If you plan to do eight sessions per week but for some reason you know you will only be able to do six then you can look at the sessions that would be removed to create a six session per week programme and only complete those.

The programme below sets out 26 weeks of training. If you have less time to your competition then you will need to remove some of the weeks. The weeks are removed as follows; 13, 14, 15, 12, 11, 10, 16, 17, 18, 9, 8, 7. For example, to create a 22 week programme you remove the first four weeks from the list, these are weeks 13, 14, 15 and 12.

How to Use the Training Pace Guide

In order to get the best from the training programme follow the pace guide for the different training bands. Look at your current 2,000m time in the left hand column then follow across to the right for the target pace in each band. After six weeks retest your 2,000m time and reassess your pace.

Working at the recommended stroke rate will develop your technique and if you can combine stroke rate, heart rate and pace then you will develop both technical and physical efficiency.

Note: Rest between intervals can be calculated by using the information in Periodisation of Training in Section 4 : Creating a Bespoke Training Programme.

The training intensities in each band are based on your current 2,000m time. The figures indicated are at the top end of each band. UT1, AT, and TR training bands, can be identified as lying between the figure in the training band column and the figure in the column to the left.

At max pace, 2,000m is carried out at around 95% of maximum heart rate which is indicated here as the top end of the TR band (85% to 95% of MHR). Training in this band should be equal to or slower than the pace given in the TR column. The pace figure indicated in the AN band is 110% of 2,000m pace. Training in this band should be carried out at the pace shown in the AN column of the table or faster.

Table 5.8

2,000m Training Pace Guide							
Current 2,000m Time	Pace		Stroke Rate				
			20-22	22-24	26-28	30-34	36-46
	Seconds	Watts	UT2	UT1	AT	TR	AN
5:40	85	570	1:38.0	1:34.0	1:35.0	≤1:25.0	≥1:22.0
5:44	86	550	1:39.5	1:35.0	1:35.0	≤1:26.0	≥1:23.0
5:48	87	532	1:40.5	1:36.0	1:35.0	≤1:27.0	≥1:24.0
5:52	88	514	1:41.5	1:37.0	1:35.0	≤1:28.0	≥1:25.0
5:56	89	496	1:43.0	1:38.0	1:35.0	≤1:29.0	≥1:26.0
6:00	90	480	1:44.0	1:39.0	1:35.0	≤1:30.0	≥1:27.0
6:04	91	464	1:45.0	1:40.0	1:36.0	≤1:31.0	≥1:28.0
6:08	92	449	1:46.0	1:41.0	1:37.0	≤1:32.0	≥1:29.0
6:12	93	435	1:47.0	1:42.5	1:37.5	≤1:33.0	≥1:30.0
6:16	94	421	1:48.5	1:43.5	1:38.0	≤1:34.0	≥1:31.0
6:20	95	408	1:50.0	1:45.0	1:39.0	≤1:35.0	≥1:32.0
6:24	96	395	1:51.0	1:46.0	1:40.0	≤1:36.0	≥1:33.5
6:28	97	383	1:52.0	1:47.0	1:41.0	≤1:37.0	≥1:35.0
6:32	98	372	1:53.5	1:47.5	1:42.5	≤1:38.0	≥1:36.0
6:36	99	358	1:54.0	1:48.0	1:43.5	≤1:39.0	≥1:37.0
6:40	100	350	1:55.0	1:49.0	1:45.0	≤1:40.0	≥1:38.0
6:44	101	340	1:56.0	1:50.0	1:46.0	≤1:41.0	≥1:38.5
6:48	102	330	1:57.0	1:51.5	1:47.5	≤1:42.0	≥1:39.0
6:52	103	320	1:58.5	1:53.0	1:48.5	≤1:43.0	≥1:40.0
6:56	104	311	2:00.0	1:54.5	1:50.0	≤1:44.0	≥1:41.0
7:00	105	302	2:01.0	1:56.0	1:51.0	≤1:45.0	≥1:42.0
7:04	106	294	2:02.0	1:57.0	1:52.0	≤1:46.0	≥1:43.5
7:08	107	286	2:03.5	1:58.5	1:53.0	≤1:47.0	≥1:44.0
7:12	108	278	2:04.5	2:00.0	1:54.0	≤1:48.0	≥1:45.0
7:16	109	270	2:06.0	2:02.0	1:55.0	≤1:49.0	≥1:46.0
7:20	110	263	2:07.0	2:03.0	1:56.0	≤1:50.0	≥1:47.0
7:24	111	256	2:08.0	2:04.5	1:57.0	≤1:51.0	≥1:48.5
7:28	112	249	2:09.0	2:05.0	1:58.0	≤1:52.0	≥1:49.0
7:32	113	243	2:10.5	2:06.0	1:59.0	≤1:53.0	≥1:49.5
7:36	114	236	2:12.0	2:07.5	2:00.0	≤1:54.0	≥1:50.0
7:40	115	230	2:13.0	2:09.0	2:01.0	≤1:55.0	≥1:51.0
7:44	116	224	2:14.0	2:10.0	2:02.0	≤1:56.0	≥1:52.5
7:48	117	219	2:15.0	2:11.0	2:03.0	≤1:57.0	≥1:54.0
7:52	118	213	2:16.0	2:12.0	2:04.0	≤1:58.0	≥1:55.0
7:56	119	208	2:17.0	2:13.0	2:05.0	≤1:59.0	≥1:56.0
8:00	120	203	2:18.0	2:14.0	2:07.0	≤2:00.0	≥1:57.0
8:04	121	198	2:19.0	2:15.0	2:08.0	≤2:01.0	≥1:58.0
8:08	122	193	2:20.0	2:16.0	2:09.0	≤2:02.0	≥1:59.0
8:12	123	188	2:21.5	2:17.0	2:10.0	≤2:03.0	≥1:59.5
8:16	124	184	2:23.0	2:18.0	2:11.0	≤2:04.0	≥2:00.0
8:20	125	179	2:24.0	2:19.0	2:12.0	≤2:05.0	≥2:01.0
8:24	126	175	2:25.0	2:20.0	2:13.0	≤2:06.0	≥2:02.0
8:28	127	171	2:26.0	2:21.0	2:14.0	≤2:07.0	≥2:03.0
8:32	128	167	2:27.5	2:22.0	2:15.0	≤2:08.0	≥2:04.0
8:36	129	163	2:29.0	2:23.0	2:16.0	≤2:09.0	≥2:05.0
8:40	130	159	2:30.0	2:24.0	2:17.0	≤2:10.0	≥2:06.0
8:44	131	156	2:31.0	2:25.0	2:18.5	≤2:11.0	≥2:07.0
8:48	132	152	2:32.0	2:26.5	2:20.0	≤2:12.0	≥2:08.0
8:52	133	149	2:33.5	2:28.0	2:21.5	≤2:13.0	≥2:10.0
8:56	134	145	2:35.0	2:29.5	2:23.0	≤2:14.0	≥2:11.5
9:00	135	142	2:36.0	2:31.0	2:25.0	≤2:15.0	≥2:13.0
9:04	136	139	2:37.0	2:31.5	2:25.5	≤2:16.0	≥2:13.5
9:08	137	137	2:38.0	2:32.0	2:27.5	≤2:17.0	≥2:14.0
9:12	138	134	2:39.0	2:32.5	2:28.0	≤2:18.0	≥2:14.5
9:16	139	131	2:40.0	2:33.0	2:28.5	≤2:19.0	≥2:15.0
9:20	140	128	2:41.0	2:33.5	2:29.0	≤2:20.0	≥2:15.5

Table 5.9

The Interactive 2,000,m Training Programme								
Level 5 - Athlete. Trained regularly six to eight sessions per week for at least three years								
6-8 Sessions Per Week								
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 L	45'UT2	2x15'UT1	55'UT2	2x18'UT1	68'UT2	3x15'UT1	55'UT2	2x15'UT1
2 M	65'UT2	2x21'UT1	72'UT2	3x16'UT1	80'UT2	4x13'UT1	72'UT2	3x12'UT1
3 H	76'UT2	3x17'UT1	85'UT2	3x19'UT1	90'UT2	3x20'UT1	85'UT2	2x25'UT1
4 L	45'UT2	2x15'UT1	2x6'AT	3x12'UT1	2x7'AT	3x15'UT1	2x10'AT	3x12'UT2
5 M	65'UT2	2x24'UT1	4x5'AT	3x16'UT1	3x8'AT	3x18'UT1	2x12'AT	3x16'UT1
6 H	76'UT2	2x25'UT1	3x7'AT	3x19'UT1	3x10'AT	5x12'UT1	3x8'AT	3x18'UT1
7 L	**45'UT2**	2x15'UT1	2x8'AT	3x12'UT1	2x10'AT	3x15'UT1	2x9'AT	2x3'TR
8 M	65'UT2	3x14'UT1	2x9'AT	75'UT2	2x8' AT	4x14'UT1	2x7'AT	3x4'TR
9 H	76'UT2	3x17'UT1	3x7'AT	90'UT2	4x5'TR	4X15'UT1	3x8'AT	4x4'TR
10 L	45'UT2	2x15'UT1	2x8'AT	60'UT2	4x2'TR	3x12'UT1	2x9'AT	3x3'TR
11 M	65'UT2	3x15'UT1	2x10'AT	75'UT2	4x3'TR	3x15'UT1	2x10'AT	4x3'TR
12 H	75'UT2	4x15'UT1	3x8'AT	90'UT2	4x4'TR	4x12'UT1	3x10'AT	5x4'TR
13 L	**45'UT2**	2X15'UT1	2x8'AT	60'UT2	3x1'AN	3x15'UT1	2x8'AT	4x2'TR
14 M	65'UT2	3X15'UT1	2x10'AT	75'UT2	4x1.5'AN	4x12'UT1	3x7'AT	6x2'TR
15 H	75'UT2	5x12'UT1	3x10'AT	90'UT2	6x1'AN	5x12'UT1	3x10'AT	6x4'TR
16 L	45'UT2	2X15'UT1	2x9'AT	60'UT2	8x45sAN	4x14'UT1	2x10'AT	5x2'TR
17 M	65'UT2	3X15'UT1	3x10'AT	75'UT2	6x1.5'AN	3x12'UT1	3x8'AT	6x3'TR
18 H	75'UT2	4x15'UT1	4x8'AT	90'UT2	8x1'AN	2x15'UT1	4x9'AT	7x4'TR
19 L	**45'UT2**	2X15'UT1	2x10'AT	60'UT2	4x1.5'AN	3x12'UT1	3x8'AT	6x2'TR
20 M	65'UT2	3X15'UT1	3x12'AT	75'UT2	6x1'AN	3x15'UT1	3x10'AT	7x3'TR
21 H	75'UT2	5x12'UT1	5x8'AT	90'UT2	8x45sAN	5x12'UT1	4x10'AT	8X4'TR
22 L	45'UT2	2x15'UT1	2x10'AT	60'UT2	8x1.5'AN	3x12'UT1	2x7'AT	4x2'TR
23 M	65'UT2	3x15'UT1	3x8'AT	75'UT2	10x45sAN	3x15'UT1	3x7'AT	4x3'TR
24 H	76'UT2	4x15'UT1	4x8'AT	90'UT2	2(6x1')AN	4x15'UT1	2x10'AT	4x4'TR
25 T	50'UT2	2x12'UT1	6' AT	40'UT2	2x1.5'AN	2x15'UT1	4'TR	2x12'UT1
26 T	**OFF**	1x15'UT1	5'AT	1x3'TR	20'UT2	2x2'TR	3x45sAN	**RACE**

Notes:

i. The sessions in bold can be replaced by a 2,000m test to measure progress.

ii. Remove the light grey column to give seven sessions per week and move the tests to column 2.

iii. Remove the dark grey column to give six sessions per week.

Table 5.10

The Interactive 2,000,m Training Programme

Level 4 - Trained. Followed a formal training programme of five sessions per week for at least two years.

4-6 Sessions Per Week

Week	1	2	3	4	5	6
1 L	30'UT2	2x12.5'UT1	36'UT2	2x15'UT1	45'UT2	3x12'UT1
2 M	42'UT2	3x11'UT1	48'UT2	2x20'UT1	54'UT2	3x15'UT1
3 H	51'UT2	3x14'UT1	57'UT2	4x12'UT1	60'UT2	5x10'UT1
4 L	2x12'UT1	10'AT	2x12'UT1	12'AT	2x15'UT1	2x8'AT
5 M	3x11'UT1	2x9'AT	3x13'UT1	2x8'AT	4x11'UT1	2x10'AT
6 H	3x14'UT1	2x10'AT	4x12'UT1	2x10'AT	5x10'UT1	3x7'AT
7 L	**50'UT2**	12'AT	3x10'UT1	12'AT	3x12'UT1	2x8'AT
8 M	2X15'UT1	2x8'AT	3x15'UT1	3x3'TR	3x13'UT1	2x10'AT
9 H	3X15'UT1	2x9'AT	5x10'UT1	5x2'TR	3x14'UT1	3x7'AT
10 L	57'UT2	2x12'UT1	2x13'UT1	2x4'TR	3x10'UT1	2x8'AT
11 M	3x11'UT1	2x10'AT	4x11'UT1	2x6'TR	4x10'UT1	2x9'AT
12 H	4X11'UT1	4x4'TR	3x17'UT1	3x6'TR	5x10'UT1	2x10'AT
13 L	**60'UT2**	3x3'TR	3x12'UT1	2x5'TR	3x13'UT1	2x8'AT
14 M	3x12'UT1	4x1.5'AN	3x15'UT1	4x3'TR	3x14'UT1	2x9'AT
15 H	4x12'UT1	6x1'AN	4x12'UT1	5x3'TR	3x15'UT1	2x10'AT
16 L	60'UT2	8x45s AN	2x15'UT1	5x2'TR	3x14'UT1	2x15'AT
17 M	2x18'UT1	6x1.5'AN	3x15'UT1	6x2'TR	3x15'UT1	3x8'AT
18 H	3x17'UT1	8x1'AN	3x17'UT1	8x2'TR	3x16'UT1	3x10'AT
19 L	**60'UT2**	8x1.5'AN	2x12'UT1	4x3'TR	3x15'UT1	2x9'AT
20 M	3x15'UT1	10x45sAN	2x15'UT1	5x3'TR	3x16'UT1	3x8'AT
21 H	3X17'UT1	2(6x1')AN	2x18'UT1	4x5'TR	3x17'UT1	3x10'AT
22 L	60'UT2	4x1.5'AN	2x13'UT1	3x3'TR	3x10UT1	4x8'AT
23 M	2x20'UT1	6x1'AN	3x13'UT1	4x3'TR	2X16'UT1	2x12'AT
24 H	3x15'UT1	8x45s AN	4x13'UT1	4x4'TR	2x18'UT1	3x12'AT
25 T	50'UT2	3x1'AN	2X10'UT1	2x3'TR	2x9'UT1	1x10'AT
26 T	30'UT2	1x3'TR	2x8'UT1	3x1.5'AN	3x45sAN	**RACE**

Notes:

i. The sessions in bold can be replaced by a 2,000m test to measure progress.

ii. Remove the light grey column to give five sessions per week and move the tests to column 2.

iii. Remove the dark grey column to give four sessions per week.

Table 5.11

The Interactive 2,000,m Training Programme					
Level 3 - Fit. Taken part in exercise at least three sessions per week for the past 12 months.					
4-5 Sessions Per Week					
Week	**1**	**2**	**3**	**4**	**5**
1 L	38'UT2	1x20'UT1	2x12'UT1	2x15'UT1	2x10'UT1
2 M	40'UT2	2x14'UT1	2x16'UT1	2x18'UT1	2x15'UT1
3 H	45'UT2	2x17'UT1	2x19'UT1	4x10'UT1	2x18'UT1
4 L	30'UT2	2x7'AT	2x10'UT1	2x7'AT	2x12'UT1
5 M	45'UT2	2x8'AT	2x14'UT1	2x8'AT	2x16'UT1
6 H	50'UT2	2x9'AT	3x13'UT1	3x7'AT	3x15'UT1
7 L	**30'UT2**	2x7'AT	2x12'UT1	2x7'AT	3x12'UT1
8 M	2x14'UT1	2x8'AT	4x2'TR	2x7'AT	2x4'TR
9 H	3x13'UT1	2x9'AT	2x3'TR	2x9'AT	6x2'TR
10 L	20'UT1	2x8'AT	2x2'TR	2x7'AT	3x2'TR
11M	2x12'UT1	2x10'AT	4x2'TR	2x7'AT	2x4'TR
12 H	3x12'UT1	3x7'AT	5x2'TR	2x9'AT	3x3'TR
13 L	**40'UT2**	2x9'AT	2x2'TR	2x8'AT	3x2'TR
14 M	2x16'UT1	3x7'AT	4x2'TR	2x8'AT	2x4'TR
15 H	2x18'UT1	4x6'AT	5x2'TR	2x10'AT	3x3'TR
16 L	50'UT2	2x10'AT	2x3'TR	2x12'AT	2x4'TR
17M	3x12'UT1	3x8'AT	3x3'TR	3x8'AT	3x4'TR
18 H	2x20'UT1	4x1.5'AN	4x3'TR	3x10'AT	4x4'TR
19 L	**50'UT2**	10x1'AN	2x4'TR	2x12'AT	2x3'TR
20 M	3x13'UT1	5x1'AN	3x4'TR	2x15'AT	3x3'TR
21 H	3x14'UT1	8x45s'AN	4x4'TR	3x13'AT	4x3'TR
22 L	50'UT2	6x1.5'AN	4x2'TR	3x8'AT	2x5'TR
23 M	2x16'UT1	6x1'AN	3x3'TR	3x10'AT	3x5'TR
24 H	2x18'UT1	8x45sAN	4x3'TR	3x12'AT	3x6'TR
25 L	2x15UT1	6x1.5'AN	2x5'TR	2x8'AT	4x2'TR
26	25'UT2	1x3'TR	3x1.5'AN	3x45s AN	**RACE**

Notes:

i. The sessions in bold can be replaced by a 2,000m test to measure progress.

ii. Remove the grey column to give four sessions per week.

Table 5.12

The Interactive 2,000,m Training Programme				
Level 2 - Moderately Fit. Informal regular exercise throughout the past 12 months.				
3-4 Sessions Per Week				
WEEK	**1**	**2**	**3**	**4**
1 L	30'UT2	1x18'UT1	2x11'UT1	1x18'UT1
2 M	2x10'UT1	2x12'UT1	13+14'UT1	20'UT1
3 H	2x13'UT1	2x14'UT1	3x10'UT1	2x15'UT1
4 L	40'UT2	2x7'AT	1x18'UT1	1x8'AT
5 M	20'UT1	2x8'AT	2x10'UT1	10'AT
6 H	2x15'UT1	2x7'AT	2x14'UT1	2x8'AT
7 L	**30'UT2**	10'AT	1x18'UT1	10'AT
8 M	2x13'UT1	4x2'TR	25'UT1	2x8'AT
9 H	3X8'AT	2x15'UT1	6x2'TR	30'UT1
10 L	40'UT2	2x2'TR	2x12'UT1	2x8'AT
11 M	4x2'TR	4x20'UT1	2x10'AT	2x14'UT1
12 H	3x8'AT	5x2'TR	2x15UT1	3x3'TR
13 L	**40'UT2**	15'AT	2x12'UT1	3x2'TR
14 M	3x7'AT	20'UT1	2x4'TR	2x12'UT1
15 H	3x10'AT	2x15'UT1	3x3'TR	2x15'UT1
16 L	30'UT2	4x2'TR	2x12'UT1	2x8'AT
17 M	4x2'TR	20'UT1	4x1.5'AN	2x10'AT
18 H	2x15'UT1	3x8'AT	10x1'AN	2x15'UT1
19 L	**40'UT2**	5x1'AN	2x12'UT1	2x8'AT
20 M	20'UT1	2x10'AT	8x45s'AN	3x3'TR
21 H	2x15'UT1	4x4'TR	6x1.5'AN	3x8'AT
22 L	40'UT2	2x10'AT	6x1'AN	2x12'UT2
23 M	6x2' TR	2x15' UT1	8x45sAN	3x7'AT
24 H	30'UT1	6x2'TR	6x1.5'AN	3x8'AT
25 R	30'UT2	2x3'TR	2x12'UT2	2x8'AT
26 R	1x3'TR	2x1.5'AN	3x45s AN	**RACE**

Notes:

i. The sessions in bold can be replaced by a 2,000m test to measure progress.

ii. Remove the grey column to give three sessions per week.

Table 5.13

The Interactive 2,000,m Training Programme			
Level 1 - Sedentary. Not exercised regularly during the past 12 months.			
3 Sessions Per Week			
Week	**1**	**2**	**3**
1 L	10'UT2	12'UT2	15'UT2
2 M	14'UT2	16'UT2	18'UT2
3 H	17'UT2	19'UT2	20'UT2
4 L	10'UT1	25'UT2	30'UT2
5 M	12'UT1	18'UT1	8'AT
6 H	30'UT2	2x10'UT1	2x7'AT
7 L	**15'UT1**	20'UT2	7'AT
8 M	18'UT1	25UT2	9'AT
9 H	4x2'TR	30'UT2	2X12'UT1
10 L	2x2'TR	15'UT1	20'UT2
1 1M	4x2'TR	18'UT1	25'UT2
12 H	6x2'TR	2X12'UT1	30'UT2
13 L	**2x3'TR**	2x10'UT1	2x7'AT
14 M	4x2'TR	16'UT1	25'UT2
15 H	2x4'TR	2x12'UT1	3x7'AT
16 L	6x2'TR	2x8'UT1	20'UT2
17 M	2x9'AT	18'UT1	30'UT2
18 H	2x10'AT	3x2'TR	20'UT1
19 L	**4x1.5'AN**	2x12UT1	2x8'AT
20 M	3x2'TR	25'UT1	2x9'AT
21 H	2x4'TR	30'UT2	2x10'AT
22 L	2x4'TR	15'UT1	2x7'AT
23 M	30'UT2	18'UT1	2x9'AT
24 H	3x2'TR	30'UT2	2x12'UT1
25 T	5x2'TR	6x1.5'AN	3x3'TR
26 T	2x1.5'AN	3x45s AN	**RACE**

Note:

The sessions in bold can be replaced by a 2,000m test to measure progress.

Marathon Training

Introduction

The full marathon distance is 42,195m and the half marathon 21,097m. Indoor rowing marathons are becoming increasingly popular and as such Concept 2 now promote an annual Indoor Rowing Marathon Day which coincides with the London Marathon each year.

Structuring a Marathon Programme

Indoor rowing marathons are very demanding and require careful preparation to ensure the best result. Rather than structuring your training programme on the Training Bands model, we recommend you base it around your predicted marathon pace. If you have already completed a marathon, then you know what your pace will be. If you are going for a personal best then base your training around the pace of your new target.

Training Pace

The following marathon training plans make use of these training paces:

- Expected pace for 5,000m.
- Expected pace for 10,000m.
- Expected pace for half marathon.
- Expected pace for marathon.

If you have not established a time for all of these distances then the following is suggested. Take your 500m pace for 5,000m and your 500m pace for 10,000m and calculate the difference. (If you don't have a best time for these distances then row a set piece for both distances at some stage during the first meso-cycle to give you some meaningful figures to work from).

Add the difference between your 500m paces at 5,000m and 10,000m to your 500m pace for 10,000m to give you an approximation of your likely 500m pace for the half marathon. Add twice this difference to your likely 500m pace for the half marathon pace to give you your likely per 500m pace for the full marathon.

For example, if your 500m pace for 5,000m and 10,000m are 1:51 and 1:53 respectively, then the difference is two seconds. Your predicted half marathon 500m pace will be 1:55 and your predicted marathon 500m pace will be 1:59.

You will notice that these predictions vary significantly from those predicted in Table 5.14. The truth is that the times in the training plans err on the side of caution and are based on data from marathons completed on foot rather than the Indoor Rower, as it was compiled at a time when very little Indoor Rower based data was available. It's now becoming increasingly clear that the percentage drop off in pace as you move through the distances on the Indoor Rower is significantly less than the drop off when running due to the less stressful nature of indoor rowing. However, it should be noted that the above formula is for guidance only and, for example, a power based athletes' performance is likely to drop off more rapidly than implied as the distance increases, whereas an endurance based athlete might be able to beat the above drop offs.

As you work through the programme, the times that you find yourself completing the long weekly row in will give you a feel for how accurate your original estimate is and you can adjust accordingly.

Common sense needs to be applied when using these ‘expected paces’. For example, if the above implies that you should be able to maintain 2:00, 2:03 and 2:09 pace for 10,000m, half marathon and full marathon respectively but, when you try to hold these paces for a lactate threshold session, you find you simply can’t hold the pace towards the end of the session, then try 2:01, 2:04 and 2:10. Likewise, if after a few weeks 2:00, 2:03 and 2:09 start feeling significantly easier, then try 1:59, 2:02 and 2:08, and so on.

The long weekly row should be conducted at a steady pace. As a guideline, you should be able to hold a conversation with someone throughout. Over time expect your steady pace at a given distance to improve. If you feel "too" comfortable at the end of a long row, next time you row that distance try a slightly faster pace.

Table 5.14

Estimated Marathon Pace Based on 5,000m Pace

5,000m		Predicted 10,000m		Predicted Half Marathon		Predicted Marathon	
500m Pace	**Time**	500m Pace	Time	500m Pace	Time	500m Pace	Time
1:30.0	**15:00.0**	1:34.0	31:20.0	1:40.0	1:10:19.4	1:46.0	2:29:05.3
1:32.0	**15:20.0**	1:36.0	32:00.0	1:42.0	1:11:43.8	1:48.0	2:31:54.1
1:34.0	**15:40.0**	1:38.0	32:40.0	1:45.0	1:13:50.4	1:51.0	2:36:07.3
1:36.0	**16:00.0**	1:40.0	33:20.0	1:47.0	1:15:14.8	1:53.0	2:38:56.1
1:38.0	**16:20.0**	1:42.0	34:00.0	1:49.0	1:16:39.1	1:56.0	2:43:09.2
1:40.0	**16:40.0**	1:44.0	34:40.0	1:51.0	1:18:03.5	1:58.0	2:45:58.0
1:42.0	**17:00.0**	1:46.0	35:20.0	1:54.0	1:20:10.1	2:00.0	2:48:46.8
1:44.0	**17:20.0**	1:49.0	36:20.0	1:56.0	1:21:34.5	2:03.0	2:53:00.0
1:46.0	**17:40.0**	1:51.0	37:00.0	1:58.0	1:22:58.9	2:05.0	2:55:48.8
1:48.0	**18:00.0**	1:53.0	37:40.0	2:00.0	1:24:23.3	2:07.0	2:58:37.5
1:50.0	**18:20.0**	1:55.0	38:20.0	2:02.0	1:25:47.7	2:10.0	3:02:50.7
1:52.0	**18:40.0**	1:57.0	39:00.0	2:05.0	1:27:54.2	2:12.0	3:05:39.5
1:54.0	**19:00.0**	1:59.0	39:40.0	2:07.0	1:29:18.6	2:14.0	3:08:28.3
1:56.0	**19:20.0**	2:01.0	40:20.0	2:09.0	1:30:43.0	2:17.0	3:12:41.4
1:58.0	**19:40.0**	2:03.0	41:00.0	2:11.0	1:32:07.4	2:19.0	3:15:30.2
2:00.0	**20:00.0**	2:05.0	41:40.0	2:14.0	1:34:14.0	2:21.0	3:18:19.0
2:02.0	**20:20.0**	2:07.0	42:20.0	2:16.0	1:35:38.4	2:24.0	3:22:32.2
2:04.0	**20:40.0**	2:09.0	43:00.0	2:18.0	1:37:02.8	2:26.0	3:25:20.9
2:06.0	**21:00.0**	2:11.0	43:40.0	2:20.0	1:38:27.2	2:28.0	3:28:09.7
2:08.0	**21:20.0**	2:14.0	44:40.0	2:22.0	1:39:51.5	2:31.0	3:32:22.9
2:10.0	**21:40.0**	2:16.0	45:20.0	2:25.0	1:41:58.1	2:33.0	3:35:11.7
2:12.0	**22:00.0**	2:18.0	46:00.0	2:27.0	1:43:22.5	2:36.0	3:39:24.8
2:14.0	**22:20.0**	2:20.0	46:40.0	2:29.0	1:44:46.9	2:38.0	3:42:13.6
2:16.0	**22:40.0**	2:22.0	47:20.0	2:31.0	1:46:11.3	2:40.0	3:45:02.4
2:18.0	**23:00.0**	2:24.0	48:00.0	2:34.0	1:48:17.9	2:43.0	3:49:15.6
2:20.0	**23:20.0**	2:26.0	48:40.0	2:36.0	1:49:42.3	2:45.0	3:52:04.3
2:22.0	**23:40.0**	2:28.0	49:20.0	2:38.0	1:51:06.7	2:47.0	3:54:53.1
2:24.0	**24:00.0**	2:30.0	50:00.0	2:40.0	1:52:31.0	2:50.0	3:59:06.3
2:26.0	**24:20.0**	2:32.0	50:40.0	2:42.0	1:53:55.4	2:52.0	4:01:55.1
2:28.0	**24:40.0**	2:34.0	51:20.0	2:45.0	1:56:02.0	2:54.0	4:04:43.9
2:30.0	**25:00.0**	2:36.0	52:00.0	2:47.0	1:57:26.4	2:57.0	4:08:57.0
2:32.0	**25:20.0**	2:39.0	53:00.0	2:49.0	1:58:50.8	2:59.0	4:11:45.8
2:34.0	**25:40.0**	2:41.0	53:40.0	2:51.0	2:00:15.2	3:01.0	4:14:34.6
2:36.0	**26:00.0**	2:43.0	54:20.0	2:54.0	2:02:21.8	3:04.0	4:18:47.8
2:38.0	**26:20.0**	2:45.0	55:00.0	2:56.0	2:03:46.1	3:06.0	4:21:36.5
2:40.0	**26:40.0**	2:47.0	55:40.0	2:58.0	2:05:10.5	3:08.0	4:24:25.3
2:42.0	**27:00.0**	2:49.0	56:20.0	3:00.0	2:06:34.9	3:11.0	4:28:38.5
2:44.0	**27:20.0**	2:51.0	57:00.0	3:02.0	2:07:59.3	3:13.0	4:31:27.3
2:46.0	**27:40.0**	2:53.0	57:40.0	3:05.0	2:10:05.9	3:16.0	4:35:40.4
2:48.0	**28:00.0**	2:55.0	58:20.0	3:07.0	2:11:30.3	3:18.0	4:38:29.2
2:50.0	**28:20.0**	2:57.0	59:00.0	3:09.0	2:12:54.7	3:20.0	4:41:18.0
2:52.0	**28:40.0**	2:59.0	59:40.0	3:11.0	2:14:19.1	3:23.0	4:45:31.2
2:54.0	**29:00.0**	3:01.0	00:20.0	3:14.0	2:16:25.6	3:25.0	4:48:19.9
2:56.0	**29:20.0**	3:04.0	01:20.0	3:16.0	2:17:50.0	3:27.0	4:51:08.7
2:58.0	**29:40.0**	3:06.0	02:00.0	3:18.0	2:19:14.4	3:30.0	4:55:21.9
3:00.0	**30:00.0**	3:08.0	02:40.0	3:20.0	2:20:38.8	3:32.0	4:58:10.7

Marathon Training Plans

by Frank Birch

These training plans cover a period of six months, terminating on the day of the London Marathon and National Indoor Rowing Marathon Day. Two plans are shown, referred to below as the 110,000m plan and the 80,000m plan. The number of metres being the maximum number of metres you intended to row during the peak week of either plan. The 110,000m and 80,000m plans assume a training baseline of at least four weeks at 40,000m and 30,000m per week respectively.

Training Principles Underlying the Plans

An indoor rowing marathon is a fairly new event so it is sensible to look at longer established endurance events and draw on their experience whilst being mindful of the differences between indoor rowing and other endurance disciplines. For example, training for and running a marathon is a high impact activity which introduces constraints into training schedules that are imposed to minimise the risk of injury. It is reasonable to expect that these constraints can, to an extent, be relaxed when participating in a lower impact activity such as indoor rowing. These training plans are built so as to:

- Exercise and improve the different energy systems utilised when rowing long distances (see Your Body in Section 3 : Physiology).
- Progressively increase the training load (overall kilometres being rowed) over a period of time.
- Prepare your body (and mind) for rowing long distances.

With these points in mind the training plans build progressively to a weekly total of 110,000m and 80,000m respectively.

Weekly Distances Rowed in the 110,000m and 80,000m Plans

The build up is based on the principle used in distance running of not increasing distance on successive weeks by more than a set percentage. The rule generally used in running is a maximum of 10% for experienced runners and less for others (typically 5% for a novice). As rowing is not as stressful as running this rule, although applied in principle, is not always adhered to rigidly.

The maximum weekly distance is planned to take place four to five weeks before undertaking the marathon as is typically the case when preparing to run the distance.

Additionally, within each week a long set piece is scheduled. This progressively gets closer to the full marathon distance, helping to prepare both physically and psychologically for the demands of the event.

The training plans are structured using meso- and micro-cycles that alternate placing a training load on the body whilst providing recovery time to allow adaptation to take place. The meso-cycle length chosen is four weeks, consisting of three hard weeks, followed by a recovery week. The micro-cycle is seven days consisting of a mix of hard and recovery sessions (including rest days). The 110,000m plan is based on training for six days in most weeks. There are five training days during a typical week for the 80,000m plan.

The plans are based on six (four week) meso-cycles followed by a two week taper immediately prior to performing the marathon. For the first four week cycle, emphasis is on general endurance. This provides a platform for moving onto other forms of training in subsequent cycles. During cycles two to five VO_2 max, strength and lactate threshold training are introduced as indicated in the following table.

Table 5.15

Weekly Totals								
	110,000m				80,000m			
	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4
Cycle 1	40,000m	45,000m	50,000m	35,000m	30,000m	33,000m	36,000m	25,000m
Cycle 2	50,000m	55,000m	60,000m	45,000m	36,000m	40,000m	36,000m	30,000m
Cycle 3	60,000m	67,500m	75,000m	55,000m	45,000m	50,000m	45,000m	40,000m
Cycle 4	75,000m	82,500m	95,000m	70,000m	55,000m	60,000m	55,000m	50,000m
Cycle 5	95,000m	100,000m	105,000m	85,000m	65,000m	70,000m	65,000m	60,000m
Cycle 6	105,000m	110,000m	95,000m	80,000m	75,000m	80,000m	75,000m	60,000m
TAPER	65,000m	40,000m			50,000m	30,000m	70,000m	

Training Plan Structure

During the final cycle, some power based training is added to improve underlying speed and help make marathon pace seem easier. Information about the effects of different intensities of training are included in Your Body in Section 3 : Physiology.

Table 5.16

Marathon Training Programme Structure							
	Weeks 1-4	Weeks 5-8	Weeks 9-12	Weeks 13-16	Weeks 17-20	Weeks 21-24	Weeks 25/26
General Endurance (Preparation)	■	■	■	■	■	■	■
VO_2 Max		■	■	■	■	■	■
Strength			■				
Lactate Threshold				■	■	■	■
Power						■	

The Long Weekly Row

The single most important ingredient to marathon success is the long session. You are preparing for a long row and the best way to prepare for a long row is to do long rows. The benefits of doing progressively longer rows, approaching the marathon distance include:

- Teaching your body to utilise both fat and glycogen to produce muscular energy. Exhaust your glycogen supplies and you've run into that infamous wall. Long rows will train your body to utilise fat more efficiently and reduce the rate at which glycogen is consumed.
- Allowing you to test your body's reaction to water and various sports drinks taken whilst rowing and to eating different food in the hours preceding the row. They also provide an opportunity to find the best way of taking on liquid during a row. During a marathon taking on liquid is essential, and the food you take on in the hours before and during the row (sports drinks) can make a significant difference to your final performance.
- Preparing your mind for the event. The further you know that you can row, the stronger and more confident you will feel.

How to Use the Plans

These plans can either be used as is, or as a model for constructing your own plan based on your specific needs and aspirations. When using these plans you will, as a minimum, need to decide when to have rest days. These don't need to be the same day(s) each week and can be used to best fit your training plan into a week around other commitments. Beyond this, many variations are possible.

The "long row" in each week's schedule is intended to be aligned with the weekend (say Sunday) because this is frequently the day when there is most free time. But for some people this will not be the case. You may want to reschedule the daily sessions within a week so that the long sessions can be tackled on the days that you have most time available. In general, when shuffling sessions try to alternate long sessions with short sessions, and try to alternate types of training.

There is nothing sacred about the four week meso-cycle. Three week and five week cycles are also often used. Which works best depends on a number of factors, for example, how hard the "hard weeks" are. One of the reasons for choosing a four week cycle is that this is the unit of time chosen for focusing training at different energy systems. However, it may be convenient if certain weeks aligned with the easy weeks in the plan. For example, if you are going away on holiday for a week it may be sensible to schedule this as an easy week. Christmas week falls on week 11 of the plans as shown Table 5.17. By making weeks nine to 11 a three week cycle, and weeks 12 to 16 a five week cycle you can force Christmas week to be an easy week.

Training Plan Calendar

The fourth week in each meso-cycle is intended to be an easy week. Its main purpose is to allow your body the chance to adapt to the load you placed on it during the previous three weeks. When you start the next meso-cycle you should feel ready for the challenge. The kilometre target for these weeks is just for guidance and it is better to do less than to start the next cycle exhausted.

Although the two plans are based on five and six days per week this can, to an extent, be varied to fit your plan with other commitments. In fact, in the early weeks of both plans an extra rest day is sometimes inserted in a recovery week or immediately following a particularly challenging session (or sessions).

Calculating the Distance Rowed in Each Session

The kilometre distance shown in the training schedules is an estimate based on the following assumptions.

When doing strength training, rowing ten strokes flat out carries you 150m approximately, rowing lightly until you reach 300m gives sufficient recovery. Therefore 1 x (10 x 10) will carry you 3,000m.

To give recovery between sets round up as follows:-

(6 x 10) = 1,800m, row another 1,200m totalling 3,000m and then start the second set.

(8 x 10) = 2,400m, row another 1,600m totalling 4,000m and then start the second set.

(10 x 10) = 3,000m, row another 2,000m totalling 5,000m and then start the second set.

The final figure is obtained by adding a 1,000m warm-up row before starting the first set of flat out strokes.

When doing the VO_2 max training, the total distance is calculated by adding all of the intervals rowed along with a warm-up of 1,000 to 2,000m.

When doing power training, the distance shown in the training schedules is an estimate of the likely distance travelled whilst undertaking these sessions.

With all of the sessions the actual distance travelled will vary from person to person and will need to be worked into an individual's training plan if they want to hit the distance targets exactly for that week by increasing/decreasing as appropriate one of the subsequent training sessions.

Table 5.17

Training Plan Calendar			
Week	**Monday**	**Sunday**	
1	Oct 15th	Oct 21st	cycle 1
2	Oct 22nd	Oct 28th	cycle 1
3	Oct 29th	Nov 4th	cycle 1
4	Nov 5th	Nov 11th	easy
5	Nov 12th	Nov 18th	cycle 2
6	Nov 19th	Nov 25th	cycle 2
7	Nov 26th	Dec 2nd	cycle 2
8	Dec 3rd	Dec 9th	easy
9	Dec 10th	Dec 18th	cycle 3
10	Dec 17th	Dec 23rd	cycle 3
11*	Dec 24th	Dec 30th	cycle 3
12	Dec 31st	Jan 6th	easy
13	Jan 7th	Jan 13th	cycle 4
14	Jan 14th	Jan 20th	cycle 4
15	Jan 21st	Jan 27th	cycle 4
16	Jan 28th	Feb 3rd	easy
17	Feb 4th	Feb 10th	cycle 5
18	Feb 11th	Feb 17th	cycle 5
19	Feb 18th	Feb 24th	cycle 5
20	Feb 25th	Mar 3rd	easy
21	Mar 4th	Mar 10th	cycle 6
22	Mar 11th	Mar 17th	cycle 6
23	Mar 18th	Mar 24th	cycle 6
24	Mar 25th	Mar 31st	easy
25	Apr 1st	Apr 7th	taper
26	Apr 8th	Apr 14th	taper

Note

These dates are taken from a six month marathon training plan terminating on the day of the London Marathon and the National Indoor Rowing Marathon Day.

* Christmas week.

Notes for Marathon Training Plans

General Notes

i. Damper refers to damper setting and is an indicator of drag factor.
ii. SS means your standard, or preferred, damper setting or drag factor. For more information see The Damper Lever and Drag Factor in Appendix.
iii. +2 means set the damper at two levels higher than your standard setting. So, if you usually row at damper setting three, increase it by two levels to damper setting five. If you are using the drag factor you should increase the drag factor by 20.
iv. 5kP means your predicted 5,000m pace.
v. 10kP means your predicted 10,000m pace.
vi. HMP means your predicted half marathon pace.
vii. MP means your predicted marathon pace.

General Endurance (GE)

i. 30′ @ MP means row for 30 minutes at your predicted marathon pace.
ii. 10,000m @ MP means row 10,000m at your predicted marathon pace.

Strength

i. 1 x (10 x 10) means row ten strokes ‘flat out’, recover by rowing lightly until heart rate is below 75% of MHR, and repeat ten times.
ii. 2 x (6 x 10) means row ten strokes ‘flat out’, recover by rowing lightly until heart rate is below 75% of MHR and repeat six times. Then row lightly for five to ten minutes and repeat the whole set.
iii. To give the recovery between sessions round up as follows:

(6 x 10) = 1,800m, row another 1,200m totalling 3,000m and then start the second set.

(8 x 10) = 2,400m, row another 1,600m totalling 4,000m and then start the second set.

(10 x 10) = 3,000m, row another 2,000m totalling 5,000m and then start the second set.

VO_2 Max

i. 3 x Alternate (5′ @ 5kP/8′ @ MP) means row for 5 minutes at 5,000m pace followed by eight minutes at your predicted marathon pace and repeat three times.
ii. 3 x Alternate (1,500m @ 5kP/2,000m @ MP) means row 1,500m at 5,000m pace followed by 2,000m at your predicted marathon pace and repeat three times.

Power

i. 2 x (6 x 1′/2′) @ 30spm means row hard for one minute at 30 strokes per minute, then row lightly for two minutes and repeat this six times. Take a break (five to ten minutes of light rowing) and repeat the whole set.
ii. 8 x 90 sec/3′ @ 34spm means row hard for 90 seconds at 34 strokes per minute, then row lightly for three minutes and repeat this eight times.
iii. 4 x 3′/5′ @ 30spm means row hard for three minutes at 30 strokes per minute, then row lightly for five minutes and repeat this four times.

Lactate Threshold (LT)

i. 15′ @ MP/15′ @ 10kP/15′ @ HMP means row continuously for 45 minutes. The first 15 minutes at your predicted marathon pace, the next 15 minutes at 10,000m pace and the last 15 minutes at half marathon pace.
ii. 60′ Alternate (10′ @ 10kP/10′ @ MP) means row for ten minutes at 10,000m pace, then row ten minutes at your predicted marathon pace. Repeat until you have completed 60 minutes of continuous rowing.
iii. 4,000m @ MP/4,000m @ 10kP/4,000m @ HMP means row continuously for 12,000m, the first 4,000m are rowed at marathon pace, the second 4,000m are rowed at 10,000m pace and the final 4,000m are rowed at half marathon pace.
iv. 2 x (2,000m @ MP/2,000m @ 10kP/2,000m @ HMP) means row continuously for 6,000m, the first 2,000m are rowed at marathon pace, the second 2,000m are rowed at 10,000m pace and the final 2,000m are rowed at half marathon pace and repeat the whole set.

Taper

i. 20′ @ MP & (2 x 3′/5′) @ 32spm means row 20 minutes at your predicted marathon pace. Then complete your session with two hard three minute rows at 32 strokes per minute with five minutes light rowing in between.
ii. (5 x 5′/5′) @ 10kP means row five minutes at 10,000m pace followed by five minutes light rowing. Keep alternating until you have completed five sets.
iii. 30′ @ HMP & (6 x 1′/2′) @ 36spm means row for 30 minutes at half marathon pace. Then complete your session with six hard one minute rows at 36 strokes per minute with two minutes light rowing between each one minute row.

Table 5.18

110,000m Marathon Training Plan				
Cycle 1				
Week 1	**Distance**	**Type**	**Work**	**Damper**
Day 1	7,500m	GE	7,500m @ MP	SS
Day 2	5,000m	GE	5,000m @ MP	SS
Day 3	7,500m	GE	7,500m @ MP	SS
Day 4	5,000m	GE	5,000m @ MP	SS
Day 5	5,000m	GE	5,000m @ MP	SS
Day 6	10,000m	GE	10,000m @ MP	SS
Totals	**40,000m**			
Targets	**40,000m**			
Week 2	**Distance**	**Type**	**Work**	**Damper**
Day 1	7,500m	GE	7,500m @ MP	SS
Day 2	5,000m	GE	5,000m @ MP	SS
Day 3	7,500m	GE	7,500m @ MP	SS
Day 4	5,000m	GE	5,000m @ MP	SS
Day 5	7,500m	GE	7,500m @ MP	SS
Day 6	12,500m	GE	12,500m @ MP	SS
Totals	**45,000m**			
Targets	**45,000m**			
Week 3	**Distance**	**Type**	**Work**	**Damper**
Day 1	10,000m	GE	10,000m @ MP	SS
Day 2	5,000m	GE	5,000m @ MP	SS
Day 3	10,000m	GE	10,000m @ MP	SS
Day 4	7,500m	GE	7,500m @ MP	SS
Day 5	5,000m	GE	5,000m @ MP	SS
Day 6	12,500m	GE	12,500m @ MP	SS
Totals	**50,000m**			
Targets	**50,000m**			
Week 4	**Distance**	**Type**	**Work**	**Damper**
Day 1	5,000m	GE	5,000m @ MP	SS
Day 2	10,000m	GE	10,000m @ MP	SS
Day 3	5,000m	GE	5,000m @ MP	SS
Day 4		Rest		
Day 5	5,000m	GE	5,000m @ MP	SS
Day 6	10,000m	GE	10,000m @ MP	SS
Totals	**35,000m**			
Targets	**35,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.19

110,000m Marathon Training Plan				
Cycle 2				
Week 5	**Distance**	**Type**	**Work**	**Damper**
Day 1	5,000m	GE	5,000m @ MP	SS
Day 2	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	8,000m	GE	8,000m @ MP	SS
Day 4	12,000m	VO_2 Max	3 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 5		Rest		
Day 6	15,000m	GE	15,000m @ MP	SS
Totals	**50,000m**			
Targets	**50,000m**			
Week 6	**Distance**	**Type**	**Work**	**Damper**
Day 1	11,000m	VO_2 Max	3 x Alternate (1,250m @ 5kP/2,000m @ MP)	SS
Day 2	8,000m	GE	8,000m @ MP	SS
Day 3	5,000m	GE	5,000m @ MP	SS
Day 4	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 5	7,500m	GE	7,500m @ MP	SS
Day 6	12,500m	GE	12,500m @ MP	SS
Totals	**55,000m**			
Targets	**55,000m**			
Week 7	**Distance**	**Type**	**Work**	**Damper**
Day 1	7,500m	GE	7,500m @ MP	SS
Day 2	13,000m	VO_2 Max	4 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	7,500m	GE	7,500m @ MP	SS
Day 4	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 5	6,000m	GE	6,000m @ MP	SS
Day 6	15,000m	GE	15,000m @ MP	SS
Totals	**60,000m**			
Targets	**60,000m**			
Week 8	**Distance**	**Type**	**Work**	**Damper**
Day 1	10,000m	GE	10,000m @ MP	SS
Day 2	5,000m	GE	5,000m @ MP	SS
Day 3	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 4				
Day 5	5,000m	GE	5,000m @ MP	SS
Day 6	15,000m	GE	10,000m @ MP	SS
Totals	**45,000m**			
Targets	**45,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.20

110,000m Marathon Training Plan				
Cycle 3				
Week 9	**Distance**	**Type**	**Work**	**Damper**
Day 1	5,000m	Strength	1 x (10 x 10)	+2
Day 2	13,000m	VO_2 Max	4 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	7,000m	GE	7,000m @ MP	SS
Day 4	5,000m	Strength	1 x (10 x 10)	+2
Day 5	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 6	20,000m	Rest	20,000m @ MP	SS
Totals	**60,000m**	GE		
Targets	**60,000m**			
Week 10	**Distance**	**Type**	**Work**	**Damper**
Day 1	7,000m	Strength	2 x (6 x 10)	+3
Day 2	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	9,000m	Strength	2 x (8 x 10)	+2
Day 4	13,000m	VO_2 Max	4 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 5	11,000m	Strength	2 x (10 x 10)	+3
Day 6	17,500m	GE	17,500m @ MP	SS
Totals	**67,500m**			
Targets	**67,500m**			
Week 11	**Distance**	**Type**	**Work**	**Damper**
Day 1	10,000m	Strength	3 x (6 x 10)	+4
Day 2	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 3	13,000m	Strength	3 x (8 x 10)	+3
Day 4	5,000m	GE	5,000m @ MP	SS
Day 5	16,000m	Strength	3 x (10 x 10)	+4
Day 6	20,000m	GE	20,000m @ MP	SS
Totals	**75,000m**			
Targets	**75,000m**			
Week 12	**Distance**	**Type**	**Work**	**Damper**
Day 1	11,000m	Strength	2 x (10 x 10)	+2
Day 2	4,000m	GE	4,000m @ MP	SS
Day 3	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 4	10,000m	Strength	3 x (6 x 10)	+2
Day 5	5,000m	GE	5,000m @ MP	SS
Day 6	15,000m	GE	15,000m @ MP	SS
Totals	**55,000m**			
Targets	**55,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.21

110,000m Marathon Training Plan				
Cycle 4				
Week 13	**Distance**	**Type**	**Work**	**Damper**
Day 1	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 2	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 3	5,000m	GE	5,000m @ MP	SS
Day 4	12,000m	Strength	2 x (2,000m @ MP/2,000m @ 10kP/2,000m @ HMP)	SS
Day 5	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP / 2,000m @ MP)	SS
Day 6	25,000m	GE	25,000m @ MP	SS
Totals	**75,000m**			
Targets	**75,000m**			
Week 14	**Distance**	**Type**	**Work**	**Damper**
Day 1	15,000m	LT	5,000m @ MP/5,000m @ 10kP/5,000m @ HMP	SS
Day 2	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 3	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 4	12,000m	VO_2 Max	3 x (1,500m/2,000m)	SS
Day 5	12,000m	LT	2 x (2,000m @ MP/2,000m @ 10kP/2,000m @ HMP)	SS
Day 6	20,000m	GE	20,000m @ MP	SS
Totals	**82,000m**			
Targets	**82,500m**			
Week 15	**Distance**	**Type**	**Work**	**Damper**
Day 1	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 2	11,000m	VO_2 Max	3 x Alternate (1,250m @ 5kP/2,000m@ MP)	SS
Day 3	18,000m	LT	6,000m @ MP/6,000m @ 10kP/6,000m @ HMP	SS
Day 4	12,000m	VO_2 Max	3 x Alternate (1/5,000m @ 5kP/2,000m @ MP)	SS
Day 5	12,000m	LT	2 x (2,000m @ MP/2,000m @ 10kP 2,000m @ HMP)	SS
Day 6	25,000m	GE	25,000m @ MP	SS
Totals	**90,000m**			
Targets	**90,000m**			
Week 16	**Distance**	**Type**	**Work**	**Damper**
Day 1	9,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 2	11,000m	VO_2 Max	3 x Alternate (1,250m @ 5kP/2,000m @ MP)	SS
Day 3	6,000m	GE	6,000m @ MP	SS
Day 4	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 5	12,000m	VO_2 Max	3 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 6	20,000m	GE	20,000m @ MP	SS
Totals	**70,000m**			
Targets	**70,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.22

110,000m Marathon Training Plan				
Cycle 5				
Week 17	**Distance**	**Type**	**Work**	**Damper**
Day 1	15,000m	LT	5,000m @ MP/5,000m @ 10kP/5,000m @ HMP	SS
Day 2	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	13,000m	GE	13,000m @ MP	SS
Day 4	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 5	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 6	30,000m	GE	30,000m @ MP	SS
Totals	**90,000m**			
Targets	**90,000m**			
Week 18	**Distance**	**Type**	**Work**	**Damper**
Day 1	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 2	15,000m	VO_2 Max	4 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 3	18,000m	LT	6,000m @ MP/6,000m @ 10kP/6,000m @ HMP	SS
Day 4	13,500m	GE	13,500m @ MP	SS
Day 5	14,000m	VO_2 Max	4 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 6	25,000m	GE	25,000m @ MP	SS
Totals	**97,500m**			
Targets	**97,500m**			
Week 19	**Distance**	**Type**	**Work**	**Damper**
Day 1	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 2	21,000m	VO_2 Max	4 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 3	10,000m	GE	10,000m @ MP	SS
Day 4	17,000m	VO_2 Max	4 x Alternate (2,000m @ 5kP/2,000m @ MP)	SS
Day 5	15,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 6	30,000m	GE	30,000m @ MP	SS
Totals	**105,000m**			
Targets	**105,000m**			
Week 20	**Distance**	**Type**	**Work**	**Damper**
Day 1	9,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 2	15,000m	VO_2 Max	4 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 3	10,000m	GE	10,000m @ MP	SS
Day 4	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 5	14,000m	VO_2 Max	4 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 6	25,000m	GE	25,000m @ MP	SS
Totals	**85,000m**			
Targets	**85,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.23

110,000m Marathon Training Plan				
Cycle 6				
Week 21	**Distance**	**Type**	**Work**	**Damper**
Day 1	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 2	14,000m	Power	3 x (6 x 1'/2') @ 30spm	-2
Day 3	19,000m	GE	19,000m @ MP	SS
Day 4	21,000m	VO_2 Max	4 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 5	9,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 6	30,000m	GE	30,000m @ MP	SS
Totals	**105,000m**			
Targets	**105,000m**			
Week 22	**Distance**	**Type**	**Work**	**Damper**
Day 1	11,000m	Power	2 x (5 x 90secs/3') @ 32spm	-2
Day 2	15,000m	VO_2 Max	4 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 3	20,000m	GE	20,000m @ MP	SS
Day 4	14,000m	Power	3 x (6 x 1'/2') @ 32spm	-2
Day 5	15,000m	LT	5,000m @ MP/5,000m @ 10kP/5,000m @ HMP	SS
Day 6	35,000m	GE	35,000m @ MP	SS
Totals	**110,000m**			
Targets	**110,000m**			
Week 23	**Distance**	**Type**	**Work**	**Damper**
Day 1	14,000m	Power	3 x (6 x 1'/2') @ 34spm	-2
Day 2	15,000m	VO_2 Max	4 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 3	10,000m	GE	10,000m @ MP	SS
Day 4	15,000m	LT	5,000m @ MP/5,000m @ 5kP/5,000m @ HMP	SS
Day 5	11,000m	VO_2 Max	3 x Alternate (1,250m @ 5kP/2,000m @ MP)	SS
Day 6	30,000m	GE	30,000m @ MP	SS
Totals	**95,000m**			
Targets	**95,000m**			
Week 24	**Distance**	**Type**	**Work**	**Damper**
Day 1	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 2	15,000m	GE	15,000m @ MP	SS
Day 3	8,000m	Power	1 x (4 x 3'/5') @ 32spm	-2
Day 4	6,000m	GE	6,000m @ MP	SS
Day 5	15,000m	LT	5,000m @ MP/5,000m @ 10kP/5,000m @ HMP	SS
Day 6	25,000m	GE	25,000m @ MP	SS
Totals	**80,000m**			
Targets	**80,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.24

110,000m Marathon Training Plan				
TAPER				
Week 25	**Distance**	**Type**	**Work**	**Damper**
Day 1	9,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/1,500m @ MP)	SS
Day 2	11,000m	Power	2x (5 x 90secs/3') @ 32spm	-2
Day 3	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 4	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 5	8,000m	Power	2 x (5 x 1'/2') @ 32spm	-1
Day 6	15,000m	GE	15,000m @ MP	SS
Totals	**65,000m**			
Targets	**65,000m**			
Week 26	**Distance**	**Type**	**Work**	**Damper**
Day 1	9,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/1,500m @ MP)	SS
Day 2	8,500m	GE	8,500m @ MP	SS
Day 3	9,500m	GE + Power	5,000m @ HMP & (6 x 1'/2') @ 32spm	SS
Day 4	8,000m	GE	2,000m @ 5kP/6,000m @ HMP	SS
Day 5	5,000m	GE	5,000m @ HMP	SS
Day 6		**MARATHON**		SS
Totals	**40,000m**			
Targets	**40,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.25

80,000m Marathon Training Plan				
Cycle 1				
Week 1	**Distance**	**Type**	**Work**	**Damper**
Day 1	7,500m	GE	7,500m @ MP	SS
Day 2	5,000m	GE	5,000m @ MP	SS
Day 3	7,500m	GE	7,500m @ MP	SS
Day 4		Rest		
Day 5	10,000m	GE	10,000m @ MP	SS
Totals	**30,000m**			
Targets	**30,000m**			
Week 2	**Distance**	**Type**	**Work**	**Damper**
Day 1	7,500m	GE	7,500m @ MP	SS
Day 2	5,000m	GE	5,000m @ MP	SS
Day 3	7,500m	GE	7,500m @ MP	SS
Day 4		Rest		
Day 5	13,000m	GE	13,000m @ MP	SS
Totals	**33,000m**			
Targets	**33,000m**			
Week 3	**Distance**	**Type**	**Work**	**Damper**
Day 1	7,000m	GE	7,000m @ MP	SS
Day 2	5,000m	GE	5,000m @ MP	SS
Day 3	7,000m	GE	7,000m @ MP	SS
Day 4	5,000m	GE	5,000m @ MP	SS
Day 5	12,000m	GE	12,000m @ MP	SS
Totals	**36,000m**			
Targets	**36,000m**			
Week 4	**Distance**	**Type**	**Work**	**Damper**
Day 1	5,000m	GE	5,000m @ MP	SS
Day 2	7,500m	GE	7,500m @ MP	SS
Day 3	5,000m	GE	5,000m @ MP	SS
Day 4		Rest		
Day 5	7,500m	GE	7,500m @ MP	SS
Totals	**25,000m**			
Targets	**25,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.26

80,000m Marathon Training Plan				
Cycle 2				
Week 5	**Distance**	**Type**	**Work**	**Damper**
Day 1	5,000m	GE	5,000m @ MP	SS
Day 2	7,000m	VO_2 Max	2 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	5,000m	GE	5,000m @ MP	SS
Day 4	7,000m	GE	7,000m @ MP	SS
Day 5	12,000m	VO_2 Max	3 x (1,500m/2,000m)	SS
Totals	**36,000m**			
Targets	**36,000m**			
Week 6	**Distance**	**Type**	**Work**	**Damper**
Day 1	5,000m	GE	5,000m @ MP	SS
Day 2	11,000m	VO_2 Max	3 x Alternate (1,250m @ 5kP/2,000m @ MP)	SS
Day 3	5,000m	GE	5km @ MP	SS
Day 4	7,000m	VO_2 Max	2 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 5	12,000m	GE	12,000m @ MP	SS
Totals	**40,000m**			
Targets	**40,000m**			
Week 7	**Distance**	**Type**	**Work**	**Damper**
Day 1	5,000m	GE	5,000m @ MP	SS
Day 2	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 3	6,000m	GE	6km @ MP	SS
Day 4	8,000m	VO_2 Max	2 x Alternate (1,250m @ 5kP/2,000m @ MP)	SS
Day 5	15,000m	GE	15,000m @ MP	SS
Totals	**45,000m**			
Targets	**45,000m**			
Week 8	**Distance**	**Type**	**Work**	**Damper**
Day 1	7,000m	GE	7,000m @ MP	SS
Day 2		Rest		
Day 3	8,000m	VO_2 Max	2 x Alternate (1,250m @ 5kP/2,000m @ MP)	SS
Day 4	5,000m	GE	5,000m @ MP	SS
Day 5	10,000m	GE	10,000m @ MP	SS
Totals	**30,000m**			
Targets	**30,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.27

80,000m Marathon Training Plan				
Cycle 3				
Week 9	**Distance**	**Type**	**Work**	**Damper**
Day 1	5,000m	Strength	1 x (10 x 10)	+2
Day 2	13,000m	VO_2 Max	4 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	7,000m	GE	7,000m @ MP	SS
Day 4	5,000m	Strength	1 x (10 x 10)	+2
Day 5	15,000m	GE	15,000m @ MP	SS
Totals	**45,000m**			
Targets	**45,000m**			
Week 10	**Distance**	**Type**	**Work**	**Damper**
Day 1	7,000m	Strength	2 x (6 x 10)	+3
Day 2	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	7,000m	Strength	2 x (8 x 10)	+3
Day 4	8,000m	VO_2 Max	2 x Alternate (1,250m @ 5kP/2,000m @ MP)	SS
Day 5	10,000m	GE	18,000m @ MP	SS
Totals	**50,000m**			
Targets	**50,000m**			
Week 11	**Distance**	**Type**	**Work**	**Damper**
Day 1	13,000m	Strength	3 x (8 x 10)	+4
Day 2	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 3	6,000m	GE	6,000m @ MP	SS
Day 4	10,000m	Strength	3 x (6 x 10)	+4
Day 5	15,000m	GE	15,000m @ MP	SS
Totals	**55,000m**			
Targets	**55,000m**			
Week 12	**Distance**	**Type**	**Work**	**Damper**
Day 1	8,000m	Strength	2 x (10 x 10)	+2
Day 2		Rest		
Day 3	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 4	10,000m	Strength	3 x (6 x 10)	+2
Day 5	12,000m	GE	12,000m @ MP	SS
Totals	**40,000m**			
Targets	**40,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.28

80,000m Marathon Training Plan				
Cycle 4				
Week 13	**Distance**	**Type**	**Work**	**Damper**
Day 1	9,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 2	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 3	5,000m	GE	5,000m @ MP	SS
Day 4	12,000m	LT	2 x (2,000m @ MP/2,000m @ 10kP/2,000m @ HMP)	SS
Day 5	18,000m	GE	18,000m @ MP	SS
Totals	**55,000m**			
Targets	**55,000m**			
Week 14	**Distance**	**Type**	**Work**	**Damper**
Day 1	9,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 2	11,000m	VO_2 Max	3 x Alternate (1,250m @ 5kP/2,000m @ MP)	SS
Day 3	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 4	8,000m	VO_2 Max	2 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 5	20,000m	GE	20,000m @ MP	SS
Totals	**60,000m**			
Targets	**60,000m**			
Week 15	**Distance**	**Type**	**Work**	**Damper**
Day 1	15,000m	LT	5,000m @ MP/5,000m @ 10kP/5,000m @ HMP	SS
Day 2	11,000m	VO_2 Max	3 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 3	9,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 4	12,000m	VO_2 Max	3 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 5	18,000m	GE	18,000m @ MP	SS
Totals	**65,000m**			
Targets	**65,000m**			
Week 16	**Distance**	**Type**	**Work**	**Damper**
Day 1	9,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 2	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	4,000m	GE	4,000m @ MP	SS
Day 4	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 5	15,000m	GE	15,000m @ MP	SS
Totals	**50,000m**			
Targets	**50,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.29

80,000m Marathon Training Plan				
Cycle 5				
Week 17	**Distance**	**Type**	**Work**	**Damper**
Day 1	15,000m	LT	5,000m @ MP/5,000m @ 10kP/5,000m @ HMP	SS
Day 2	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 3	8,000m	GE	8,000m @ MP	SS
Day 4	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 5	20,000m	GE	20,000m @ MP	SS
Totals	**65,000m**			
Targets	**65,000m**			
Week 18	**Distance**	**Type**	**Work**	**Damper**
Day 1	15,000m	LT	5,000m @ MP/5,000m @ 10kP/5,000m @ HMP	SS
Day 2	11,000m	VO_2 Max	2 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 3	9,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 4	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 5	25,000m	GE	25,000m @ MP	SS
Totals	**70,000m**			
Targets	**70,000m**			
Week 19	**Distance**	**Type**	**Work**	**Damper**
Day 1	12,000m	LT	4km @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 2	15,000m	VO_2 Max	4 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 3	18,000m	LT	2 x (3,000m @ MP/3,000m @ 10kP/3,000m @ HMP)	SS
Day 4	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 5	20,000m	GE	20,000m @ MP	SS
Totals	**75,000m**			
Targets	**75,000m**			
Week 20	**Distance**	**Type**	**Work**	**Damper**
Day 1	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 2	15,000m	VO_2 Max	4 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 3	6,000m	GE	6,000m @ MP	SS
Day 4	9,000m	LT	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 5	18,000m	GE	18,000m @ MP	SS
Totals	**60,000m**			
Targets	**60,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.30

80,000m Marathon Training Plan				
Cycle 6				
Week 21	**Distance**	**Type**	**Work**	**Damper**
Day 1	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 2	14,000m	Power	3 x (6 x 1'/2') @ 30spm	-2
Day 3	8,000m	GE	8,000m @ MP	SS
Day 4	16,000m	VO_2 Max	3 x Alternate (2,000m @ 5kP/3,000m @ MP)	SS
Day 5	25,000m	GE	25,000m @ MP	SS
Totals	**75,000m**			
Targets	**75,000m**			
Week 22	**Distance**	**Type**	**Work**	**Damper**
Day 1	11,000m	Power	2 x (5 x 90secs/3') @ 32spm	-2
Day 2	15,000m	VO_2 Max	4 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 3	9,000m	GE	9,000m @ MP	SS
Day 4	15,000m	LT	5,000m @ MP/5,000m @ 10kP/5,000m @ HMP	SS
Day 5	30,000m	GE	30,000m @ MP	SS
Totals	**80,000m**			
Targets	**80,000m**			
Week 23	**Distance**	**Type**	**Work**	**Damper**
Day 1	11,000m	Power	2 x (5 x 90secs/3') @ 32spm	-2
Day 2	12,000m	VO_2 Max	3 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 3	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 4	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 5	25,000m	GE	25,000m @ MP	SS
Totals	**70,000m**			
Targets	**70,000m**			
Week 24	**Distance**	**Type**	**Work**	**Damper**
Day 1	12,000m	LT	4,000m @ MP/4,000m @ 10kP/4,000m @ HMP	SS
Day 2	9,000m	Power	2 x (6 x 1'/2') @ 30spm	-2
Day 3	7,000m	GE	7,000m @ MP	SS
Day 4	12,000m	VO_2 Max	3 x Alternate (1,500m @ 5kP/2,000m @ MP)	SS
Day 5	20,000m	GE	20,000m @ MP	SS
Totals	**60,000m**			
Targets	**60,000m**			

Please refer to page 5.29 for full notes on this table.

Table 5.31

80,000m Marathon Training Plan				
TAPER				
Week 25	**Distance**	**Type**	**Work**	**Damper**
Day 1	9,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/1,500m @ MP)	SS
Day 2	7,000m	GE	7,000m @ MP	SS
Day 3	9,000m	Power	2 x (6 x 1'/2') @ 32spm	-2
Day 4	10,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/2,000m @ MP)	SS
Day 5	15,000m	GE	15,000m @ MP	SS
Totals	**50,000m**			
Targets	**50,000m**			
Week 26	**Distance**	**Type**	**Work**	**Damper**
Day 1	9,000m	VO_2 Max	3 x Alternate (1,000m @ 5kP/1,500m @ MP)	SS
Day 2	8,500m	GE	8,500m @ MP	SS
Day 3	7,500m	GE + Power	3,000m @ MP/3,000m @ 10kP/3,000m @ HMP	SS
Day 4	5,000m	GE	5,000m @ MP	SS
Day 5		**MARATHON**		SS
Totals	**30,000m**			
Targets				

Please refer to page 5.29 for full notes on this table.

Frequently Asked Questions

answered by Terry O'Neill

As well as using the Concept 2 my wife and I ride bicycles as part of cross-training, and do so wearing heart rate monitors. When going up a decent sized hill, my wife frequently has a heart rate of more than 100% of maximum rate as defined by the usual 220 minus age equation. This also happens to us both when doing a 2,000m test. What recommendations could you make regarding sustaining very high output levels for non-professional sportspeople?

220 minus your age is a very rough guide of maximum heart rate and errs on the side of caution when used to recommend training intensities. The heart rate rises in response to the demand for oxygen and different activities will bring about a different heart rate maximum. Factors that will affect the maximum heart rate include how many major muscle groups are involved in the activity and the body position; whether seated, standing or lying down.

A measure of your physical condition is your ability to do prolonged work close to your maximum heart rate. As a result of training, anaerobic threshold is pushed up to around 85% of heart rate maximum. The heart also benefits and increases the amount of blood it is able to pump around each beat. This means that for a given task, as you get fitter your heart rate will come down or alternatively you will be able to do more work at a given heart rate. Unless you have some heart or circulatory problems there is no danger in going flat out. Training at the higher heart rate will have the most impact on your cardio-vascular system with low heart rate exercise improving muscular efficiency.

At what stage during a session should you reach the desired beats per minute? If, for example, I'm rowing for 45 minutes at 75% of my maximum heart rate, should I aim to reach 75% as quickly as possible then maintain it by gradually easing off, or should I aim to reach 75% by the end of the row?

Training is a combination of quality and quantity. Quality is reflected in the pace while quantity is measured in the duration of the session. Training at different intensities is designed to challenge the whole spectrum of the energy producing system. In the lower training bands UT1 and UT2 (Utilisation) it is better to get into the band reasonably quickly and hold it throughout the session.

With AT (anaerobic threshold) and TR (oxygen transportation) you are looking to finish the session just in the band. This is because the rate of increase in the heart rate is very steep and it is easy to shoot through a band and end up in the band above. The consequence of this is that the benefits of training in the band are missed and the programme becomes unbalanced. With AN (anaerobic) and AL (alactate), depending on the duration of the intervals, you may find that the heart rate will continue to rise even though you have finished the piece.

The World Rowing Federation have a table giving boat speeds as a percentage of 2,000m speed, for the different training zones, e.g. UT1 65 to 75%, AT 75 to 85% etc. I presume that these are lower than for a rowing machine as there is not the same increased resistance on one compared with on the water. Is this the case?

An oarsman could row 2,000m in February, return in August without doing any training in between, and row the same 2,000m at least ten seconds faster. This would be purely as a result of the increase in water temperature which would lead to a corresponding reduction to the drag on the hull. There is no parallel to

this with indoor rowing where to achieve an increase of ten seconds will require hours of training. Training on the rowing machine is far more efficient than on the water where, to get the same training benefits, you would need an increase in training time of around 25%.

Of course an oarsman also needs to practice the skills required to move a boat and boat speed ultimately determines the success of oarsmen. Boat speed alone is not a good general measure of training intensity. Any measuring system has to be reliable so that you are only measuring the difference brought about by improved performance. Differences in wind speed and direction, water and ambient temperature plus the movement of the water will each have a considerable effect on boat speed.

On the other hand using pace as a measure of intensity on the rowing machine is totally reliable and makes a lot of sense. One of the alternatives is measuring heart rate, but pace will continue to increase beyond heart rate maximum. Stroke rate can also be used as a measure but as athletes fatigue, stroke length shortens in order to maintain rate. For this reason we recommend a combination of heart rate, stroke rate and pace as the best way to measure training intensity.

I am a blood donor and I want to continue to donate blood at the recommended frequency - once every three months or so. Does this present any risk to my health or to my performance? Does a temporary loss in red cells reduce my capacity to get oxygen to and carbon dioxide/lactate from my muscles? When moving into more intense training phases, should blood donation be avoided?

For a normal healthy person donating blood is not a problem and your normal blood volume would be restored certainly by the next day; red cell volume, however, could be down for around ten days.

Avoid doing any flat out tests until your red cell count is back to normal. The only other thing you need to watch is to make sure that the actual point where they take the blood from has healed as if you start rowing, even at a low intensity you could cause the exit point to start bleeding again.

What contribution does a 10,000m session make towards maximising performance over 2,000m?

The longer session improves muscular efficiency by increasing the number of capillaries around the muscle fibre and the density of mitochondria (the site of energy production) in the cells. This has the effect of increasing the contact time for oxygen to pass from the blood to the muscle. As a result there is an increase in the maximum oxygen uptake, which is a vital parameter for an endurance athlete.

The higher intensity sessions identified by the elevated heart rate have a greater effect on the oxygen delivery system, heart/lung function and stroke volume. However, they will also increase capilliarisation and at a faster rate than at low intensity. The problem is that high intensity training causes high lactate accumulation and glycogen depletion which need time between sessions to recover. The number of sessions a week you train will determine how many of them should lead to a lactate build up. Five to six sessions a week should allow enough recovery to train at high intensity. However, you will need to factor in the energy costs of your job and whether it is heavy manual or stressful.

In 2,000m racing what are the pros and cons of level-pacing as opposed to rowing the first and last 500m segments faster than the middle two?

Level pacing is covering the distance at the highest sustainable pace. There are two other alternatives; going off as hard as possible or going off steady and building up to a big finish. If you go off too hard then you have to cope with high lactate levels caused by oxygen debt. This will result in a slowing down in the

latter stages of the race that will cost twice as much as early gains. If you go off steady and build to the finish you may not get it right and finish with energy to spare.

Even with level pacing the first 500 metres are normally the fastest. To start with you have instantly available energy in the muscles that will last for about ten seconds. Replacing this fuel takes time and therefore work cannot continue at the same intensity but you can still blast off for the first ten to 15 seconds and it is this that reduces the overall time of the first 500 metres.

The last 500 metres is normally the second fastest because you empty your tanks on this one to finish exhausted.

I've been rowing 30,000m pieces in preparation for a marathon attempt. The only problem is I seem to hit acute hunger pains after about 25,000m, pains which take about three days to go away. The first time I did 30,000m was with no lunch or evening meal and with no drink throughout. The next time I tried using Isostar throughout the row. It was better but I still got the hunger pains. Next time I will have a decent lunch. Any ideas?

When you are rowing for two and a half hours it is quite normal to get hungry. The way to combat this is to load up on carbohydrates before these long sessions. The problem is that the body can only store a limited amount of carbohydrates so you need to ensure that your stores are full. This can be done by eating a high carbohydrate diet for the days leading up to a marathon or long training piece. The type of meals that you would expect to eat would be high in complex carbohydrate (potatoes, rice and pasta) in the days leading up to the event then, on the day, supplement this with simple carbohydrates (sugars, sweets, energy drinks). The way that the body responds to this is individual and you should test different combinations of food to see which is the most effective for you.

With the fluids, there is an arrangement that triathletes use by which they can take fluid constantly without stopping. The liquid is carried in a pouch on the back with a feeder tube to the mouth. If you make a weak carbohydrate drink (5%) this will also help. If the solution is higher than 5%, which you would get in energy drinks, you could become dehydrated.

I am planning to take part in a marathon and have been trying to follow the training programme published on the Concept 2 website but am finding that when I row for more than one hour I get a seriously painful backside. Do you have any suggestions?

This is a fairly common problem and there is a range of possible solutions. Firstly, ensure that you are sitting towards the back of the seat on the ergonomically designed section. If that does not help then there are a range of seat pads available, two (standard and deluxe) from Concept 2. An alternative is to use bubble wrap, the type with the small bubbles is best, to create your own padding. The final recommendation is to have a custom designed seat pad made. For more information see the website www.eelpie-rowing.co.uk.

Section 6 :

Cross-Training

Introduction

When Concept 2 created the first rowing machine it was made for and used primarily by rowers. More recently indoor rowing has become a sport in its own right and the Indoor Rower has become a valuable tool for people wishing to add variety to their training for other sports. This section of the training guide gives an outline of how indoor rowing can benefit other sports.

Specific training is practising your sport while cross-training is when you add non-specific activities into your training regime. In this section we explain the principles to apply in order to develop a useful cross-training programme.

Firstly, what are the benefits of cross-training? Many sports use isolated muscles that lead to structural imbalance. Perhaps the clearest examples of this are games like squash and tennis. Here the racquet is held in one hand and the repeated action of hitting the ball develops the arm, shoulder and hand on one side. This causes the body to become unbalanced which in turn will limit the progress of the player. By developing the non-playing side of the body the balance will be restored and then further progress can be achieved. However, trying to restore the muscle balance by a right-handed player playing left handed would be a very inefficient method and so a different approach is needed.

By analysing the muscles used in the game, considering the range of movement, speed of contraction and loading, alternative exercises can be developed to restore balance.

All sports are a combination of skill and physical effort. Rowing is a closed skill sport, which means it requires the rower to learn one simple sequence of movements. The skill level is further reduced on the rowing machine where the issues of balance and oar control are removed. The fact that this movement has to be repeated continuously over a period of time requires a great deal of physical effort.

Team sports like rugby and football require a high degree of coordination between the players who all have a specific role to play within the team. During a game they are faced with a constantly changing set of circumstances and these require hours of practice drills. Although these games require a high degree of physical condition, the success of the team will depend on the level of coordination, which can take years to develop.

Because indoor rowing is predominantly a physical activity it has developed as a very efficient cross-training method. Below are some of the benefits of using the Indoor Rower to complement and enhance your training:

- It adds variety to your programme.
- It offers a time-efficient method of aerobic improvement by using large muscle mass.
- It can provide excellent anaerobic workouts complementary to explosive power sport training.
- It offers all weather training to cope with times when conditions prohibit outdoor activities.
- It is weight-bearing and non-jarring and so can be a safe and effective way of training whilst recovering from illness or injury.
- Positive reinforcement can be gained by tracking improvement via the Performance Monitor.
- It is transportable, so can be used either at home or at other locations.

Cross-Training on the Concept 2 DYNO

In 1999 Concept 2 brought out the DYNO, a strength-training machine. By using the same principles of air resistance as the rowing machine, but with a modified fan arrangement, a much greater load can be developed. The advantage of this machine is that with no fixed weight a load of 1000kgs can be developed on a machine weighing only 50kgs. Because the load is dependent on the force developed by the user it is a very safe method of strength training. The load varies with the force applied so it mirrors the varying force that muscles are able to develop over their range of contraction. Despite many advantages of the DYNO over traditional strength training systems it has its critics. The main criticism is that there is no eccentric component to the exercise. Whilst this is true this would only be relevant if the DYNO replaced all other forms of exercise.

Muscles cannot push, they can only pull (shorten), and this action is known as a concentric contraction. There are two long strand proteins called actin and myosin arranged in bands along the length of the muscle fibre. On receipt of an electrical stimulus from the brain a chemical reaction takes place called the actomyosin complex that requires ATP to supply the energy for contraction. A bridge is formed and the actin glides over the myosin, which has a series of tentacles that draw the actin along. These are microscopic movements individually but repeated over the length of the muscle fibre combine to move a limb over its full range. Muscles can be used in two other ways; contraction without shortening is called static or isometric contraction (i.e. holding something still), and contraction whilst lengthening is called eccentric contraction. Which of these three options are used will depend on the task but the actomyosin process is common to all three, the difference is a neurological function.

Muscles are made up of a number of fibres and for any task only a relatively small proportion of the total number of fibres are recruited at any one time. If we consider a situation where you are lowering an object, while you are holding the load still the muscles are neither shortening nor lengthening. There is a balance between the number of fibres and the load, creating a static situation. To lower the object some of the fibres are switched off so that those still working cannot stop the muscle lengthening. This process has created an eccentric contraction, that is, the muscle is lengthening while under contraction.

The development of the neurological element is a vital ingredient in the preparation of an athlete and so eccentric as well concentric exercise is essential. Eccentric use of the muscle occurs for example in ball games where the athlete has to stop suddenly and change direction and also when landing in jumping events. Static, eccentric or concentric contractions are functions of the muscle and because of the sport specific nature of these functions it is best done whilst practising the sport and specific sport drills.

Strength on the other hand is determined by the cross sectional area of the muscle fibre and is a limiting factor of the loads that can be tolerated during the muscle functions. Rapid strength gains can be achieved through eccentric training but the majority of muscle damage is done during eccentric exercise. Therefore the safest way to increase the cross sectional area of the muscle fibre is by progressive overload of the muscle in concentric contractions. This is only one aspect of training and greater strength alone will not necessarily improve performance. Acquired strength has to be developed into greater speed and power in the context of the sport you are training for by using a comprehensive programme of exercises and practice.

Training the Energy Systems

Anaerobic Alactate Training

For athletes requiring instant power e.g. throwers, jumpers, sprinters (60m and 100m).

Development of the Anaerobic Alactate System

The exercise pattern should be a low number of hard strokes at a high stroke rate, interspersed with some light ones.

Example: 3 x (10/5 x 10) AN 32 to 36spm. Damper setting: 3 to 5

Row ten hard strokes at 34 strokes per minute followed by five light strokes repeated ten times, rest then repeat the whole process twice more, giving a total of 300 hard strokes. During the hard stroke phase, the heart rate will soar but, unlike during longer intervals, there will be no lactic acid accumulation. Progression would lead up to 3 x (17/7 x 10), AN 32 to 36 spm.

Anaerobic Training

For games players and 400m runners.

Development of Explosive Power

The exercise pattern should be a series of high intensity intervals of 30 to 60 seconds duration. Work to rest ratio 1:2.

Example: 2 x (45 secs/90 secs x 8) AN 32 spm. Damper setting: 8 to 10

Row 45 seconds maximum effort (this will cause high lactic acid levels) followed by 90 seconds of very light and relaxed rowing to allow the shunt mechanism to work. Repeat eight times, rest for five minutes, then repeat. Progression is indicated by improved power output measured on the monitor during hard strokes. Maintaining a higher output throughout the session indicates greater lactate tolerance.

Aerobic Training

For most sports, including those with low physical requirements e.g. bowls and curling.

Development of Endurance

For aerobic training the monitoring of output is vital. Heart rate is the simplest and most practical way to control work intensity as it increases with an increase in physical output. This is perhaps more important during long periods of aerobic training to ensure that you stay in the correct training band. Aerobic exercise intensity should be carried out at between 65 to 85% of MHR continuously for a duration of 20 to 90 minutes depending on the fitness level of the athlete. The damper setting/drag factor should be quite low, enabling the athlete to row with a flowing rhythm.

Blood Washout/Regeneration

For all sports, especially contact sports e.g. hockey, rugby, football and basketball.

Another excellent use of the machine is blood washout. After strenuous exercise, muscle damage and small lesions can occur, especially for those involved in contact sports. As a result, debris accumulates in the muscles leading to soreness and muscle stiffness. A period of low intensity rowing keeping the heart rate slightly elevated at 65% of maximum, increases the blood flow through the muscles. This not only speeds up the metabolisation of accumulated lactic acid but also carries away any debris, thereby aiding recovery.

Indoor Rowing for Games Players

The fitness levels of both football and rugby players has increased in direct proportion to the rewards in the game and so has the rate of injury and illness. It is quite normal in any squad for 25 to 30% of team members to be sidelined through illness or injury. One of the reasons for this is that very hard training suppresses the immune system which means that athletes are not only more vulnerable to picking up illnesses but will suffer from the symptoms more than a sedentary person whose immune system is under less physical stress. The second reason is as players get fitter they get faster, increasing impact speed and also operating muscles right on their limits. In addition to this, players are expected to be involved in more games, further increasing the risk of injury. Rugby and football players are bigger and heavier and these factors combine to shorten the player's career. One way to reduce this problem is a smarter approach to training. Drills and set plays are an important part in the preparation of players, however, contact and impact during training should be kept to an absolute minimum. Professional football and rugby teams are businesses and any business that has 25 to 30% of its staff out of action has a serious problem.

In ball games, aerobic endurance underpins the entire performance. This is the ability of the heart and lungs to deliver oxygen to the working muscles and is known as aerobic capacity. A well developed aerobic capacity benefits games players in two ways; it ensures that the players can provide the required energy for the entire length of the game and also helps the body recover more quickly between bouts of intense activity. Games players need whole body aerobic fitness, not just individual muscle fitness, to perform. To raise the aerobic fitness level the entire body should be exercised and exercise on the Indoor Rower uses both upper and lower body muscles, therefore recruiting a very large muscle mass.

Quite often injuries sustained through contact are not to the primary mover of a particular joint but to the smaller muscles that support the joint, the fixators or synergists. Often training programmes fail to develop these muscles to the same extent as the primary mover. Cross-training has the affect of developing muscles other than the prime movers used in the given sport, thus reducing the likelihood of impact damage. With the high number of games that players are expected to cope with the games themselves should be considered as part of the training programme. This means that skills and drills can be reduced in other parts of the programme and replaced with a safer method of fitness training.

If the statement that aerobic fitness underpins the whole performance is true then it would make sense to follow the training programme of a rower. Rowers are generally recognised as athletes with amongst the greatest aerobic capacity. This is achieved with no risk of injury through impact, as training is weight supported and non-contact. A slightly modified programme currently used by rowers in preparation for their competitions would meet all the physical requirements of ball players.

The games player's season consists of pre-season, the regular season and post-season, followed by a four to six week transition period. The transition period is the time for complete mental and physical relaxation and can include holidays. A minimum level of activity should be maintained. This is time for reflection on the past season and to set goals for the next season. Pre-season should focus on developing strength and endurance, the baseline of physical performance. This also provides a chance to develop team cohesion. During the regular season, where two or more games a week are played, this will meet all the requirements of specific training. Non-specific training should involve immediate post-game blood washout to remove any muscle debris and allow meaningful training to resume as soon as possible. Continued

focus on aerobic capacity and strength training should form the major part of the programme (90%), with the remaining 10% focusing on high intensity speed training. If there is only one competitive game per week one training session should involve game situation practices.

The post season involves representative matches and the most important aspect is team cohesion and strategic planning. During this time the physical requirements will largely be met through drills but should still be supplemented with cross-training. This is especially useful for blood washout after competition plus alternate endurance and speed sessions on the rowing machine.

Good aerobic training should consist of 30 to 60 minutes at 70 to 85% of maximum heart rate, e.g. three times 20 minutes.

Threshold training should involve 25 to 40 minutes at 80 to 85% of maximum heart rate e.g. five times five minutes to five times eight minutes with two to four minutes rest between intervals.

Speed training should involve six to nine minutes of short bursts, at 95 to 100% of maximum heart rate e.g. six times 90 seconds or 12 times 45 seconds.

Indoor Rowing for Runners

by Andy Darling

Indoor rowing functions as a middle-ground meeting place for all sports. Heavyweight boxer Danny Williams is a keen enthusiast while World Championship silver medallist decathlete Dean Macey did 6:29.2 at the 1998 British Indoor Rowing Championship. At the 2001 British IRC, I spotted triathletes Sarah Springman and Sarah Coope, swimmer Adrian Moorhouse, and former rugby union stars Andy Ripley and Roger Uttley. In the men's 35-39 Lightweight event, meanwhile, 2:12 marathoner Andrew Green from Warrington completed the 2,000m in 6:47.5. Runners tend to be good at indoor rowing, and the activities complement each other astonishingly well.

George Meredith is something of a legend in the world of Indoor Rowing. At age 55 he has been winning his age category and setting records at the nationals, and medalling at the world championships since taking to the machine eight years ago. He also represents Scotland at cross-country running, has a 66:48 best for the half marathon, and a 2:26 for the full distance, set in the early 80s. His introduction to indoor rowing was via the typical runner's route: he was injured and in need of rehab.

'I was having trouble with my right knee and one of my toes' he says, 'and I was advised to incorporate indoor rowing into my training, so there would be less impact. It's definitely given me a second lease of life; my upper body's much stronger, and I wish I'd had it as part of my training earlier in my running career. I have no doubt that it helps when it comes to sprinting towards the end of a race.'

George's indoor rowing sessions are not dissimilar to his running workouts. The 2,000m distance, when raced, boils down to about 80% aerobic work, and 20% anaerobic. That ratio results in a fairly hellish degree of oxygen debt, hence James Cracknell's collapse after a time trial on the BBC's Gold Fever documentary series. To increase his ability to function when lactic acid is telling him otherwise, Meredith favours indoor rowing sessions such as three times 2,000 metres at close to race pace, with six minute rests between each. As with running training, these are done off the back of plenty of long, steady sessions that build up a sound aerobic base. Andy Millbank of Herne Hill Harriers does similar indoor rowing training, based around the knowledge he's gained from a quarter of a century of running. He has done a 3:53 on the track for 1,500 metres, a distance that requires a similar aerobic:anaerobic ratio to the 2,000m row, and like George Meredith and Andy Ripley, whose knees were shot after years of impact on the running track and rugby field, it was an injury that initially brought him to the rower.

'I ripped my hamstring years ago, so I've always tried to cross-train. A guy in my gym said he was doing the British IRC last year, so I had a go, applying the rep system from running. It's similar to running in that everything needs to be timed, all the splits.'

Anyone familiar with the Concept 2 Indoor Rower knows about the 500 metre split time on the performance monitor. Every stroke you take, it tells you how fast you're going, whether you're sticking to your intended times or flagging. People become obsessed: comparing their PB splits for single strokes on the Concept 2 message board, the equivalent of weight training's one rep max. At the other end of the scale, there are the Million Metre men, bashing out 1,000 kilometres in under seven days, and later complaining about no longer having any buttocks. Somewhere in the middle, there's the marathon. 42,195m on the erg requires far less in the way of pure strength, and runners manage to translate their huge aerobic fitness into some excellent times: when he was 50, George Meredith completed the distance in a UK age record of 2:46, which breaks down to 500 metre splits of 1:58.

The first time barrier for men on the Indoor Rower is completing 2,000m in less than seven minutes, for women the same being true of 7:30. And then there's the six minute barrier. On a par with running a sub 2:10 marathon, doing 2,000m before six revolutions of the second-hand are complete truly marks out the world class. No lightweight has ever done it, but a few heavyweights manage it each year: the 2001 Pinsent/Cracknell head to head at the British IRC took 5:47.5. Not too far behind, sneaking under the barrier by a second and a half, was Tony Larkman, a 33 year old former international water rower. After 20 years of high class rowing, this was the first time he'd broken six minutes. He credits the improvement not to extra hours on the erg, nor to long weight training sessions, but to running.

'I decided to enter the London Marathon in 2001 and retire from competitive rowing. I trained for the marathon and thought I'd enter the British IRC as part of my training to give my knees a rest. I completely gave up weight training in April 2001 and watched my weight go from 100kgs to 90kgs from running and cycling, plus using the ergo. I raced at the British IRC and recorded a personal best of 5:58.8, winning a silver. Obviously, I was overjoyed and praised my running for this PB, which was a complete surprise. As a rower who hated running, I've realised the significance running has placed on my cardiovascular system and the improvements I've gained. I understand that lighter smaller people may not receive the same benefits as I did, but for bigger people, running in my opinion definitely improves leg strength, cardiovascular fitness, and your anaerobic threshold. Because of running, I lost 10kgs and did well in my rowing boat as well - thanks running!

'I continued to run including hill sprints, cycling, indoor rowing and do the odd bit of rowing, and I won a gold in Boston at the World IRC (dead-heating with two other Britons). I now cross-train using the Indoor Rower, bike, and running. I find the whole combination, mixed with a variety of work sessions, aerobic and anaerobic, works with great benefits. I'm convinced the combination of the two plus cycling gives an athlete the ultimate return.'

Philip Healy would agree with Larkman, though at around 2/3 of the weight, he comes from the other end of the sporting spectrum.

'I used to run a lot at a decent level: 3:40 for 1,500 metres and 29:35 for 10km. Then I got injured and did little for several years. I then got introduced to the Indoor Rower, and trained on it for about five months with just the occasional easy run. I ran a five mile road race prior to the British IRC last year, and finished 3rd in 25:10 and then came second at the British IRC in 6:24, in the men's 30-35 lightweight category.

In a nutshell, indoor rowing, in my opinion, is, by a long way, the best exercise to complement running. During my running career I had frequent injuries and ran in the pool, or cycled but nothing gives you the type of fitness the Indoor Rower gives.'

I've also followed a similar trajectory to Healy, and am finding that my running, put into hibernation for a couple of years, is back to the reasonably high levels of half a decade ago. Undoubtedly this is due to training on the Indoor Rower, building up a good aerobic base via those long sessions, and then sharpening up with hard anaerobic efforts. Mortality permitting, the day will come when, cartilage-free, we all have to follow the example of nonagenarian John Hodgson, and train on the erg and nothing else. Until then, though, the future's bright for rowers who run, and runners who row.

Section 7 :

Weight Training

Weight Training - An Introduction

Almost every muscle group is used in rowing, some in a dynamic way whilst others are used to stabilise the body. Any weakness or muscle imbalance will lead to poor technique and possible injury. Weight, or resistance, training is a way to address this and gain improvements in strength. One advantage of weight training when used in conjunction with rowing training is that the muscles used simultaneously during the rowing action can be developed individually, removing any muscular inequality while developing structural strength. However, weight training for rowing is not just about the development of "Structural Strength". Like any complicated movement rowing requires the body to learn the movements in order that they can become automatic. When you first learn a skill, especially a complicated skill like rowing, riding a bicycle or driving a car, it takes your entire concentration. You make mistakes and are unable to concentrate on anything else at the same time but as you become more proficient at the skill it requires less of your brainpower to do it and in the end it becomes fully automatic.

The Skill Strength Connection

A common feature amongst people who are really good at their job, whether a top class athlete or a skilled craftsman, is that they make it look so easy. When we try to emulate these experts we realise that it is not as easy as it looks and it is from this experience of failure that we appreciate what they have achieved. Strength is the basis for all movement, but this does not necessarily mean that the more skilled people are stronger; it simply means that they use the strength that they do have more efficiently. They achieve this by creating a closed circuit where all their effort is directed to the task. All parts of the body that are not directly involved in achieving the aim remain loose and relaxed. Amongst those less skilled you can see all this energy escaping through contorted faces, gritted teeth and tight shoulders that consume huge amounts of effort but contribute nothing to achieving the task.

Although a certain amount of strength is required to overcome any task, in rowing there is no evidence that suggests that improving your absolute strength results in better performance over 2,000m. What is more important is the strength that you can maintain over the entire race, your functional strength. For this reason the alternative programme is designed with improving that area of performance in mind.

As we grow and develop, our structural strength increases naturally through the release of growth hormones, allowing us to carry out activities in a non-prescribed way. Increasing structural strength would be the first stage of strength development, however, when we embark on a programme of weight, or resistance, training to develop a specific skill or movement, there are two further stages of strength development that we need to address to gain any transferable benefit;

Functional strength training is the process by which the muscle begins to learn its role, familiarising it with the load, range and speed of the outcome task and to coordinate with other muscles in a more specific way. These types of exercises are analytical in that they reflect the movements of the outcome task.

Cognitive strength training begins when the muscle knows its role. Load, range of movement and speed of contraction are specific to the outcome task. Use of the words "learn" and "know" are deliberate because apart from the mechanical component there is also a neurological component in the muscle. Muscular contractions occur on receipt of an electrical stimulus from the brain. These small electrical impulses travel along pathways, which must be developed through practice. Until these pathways exist, movements are awkward and require deep concentration. Once strong neurological pathways are established the movement becomes autonomous.

In this section of the Training Guide different methods of weight training are examined. Traditional weight training is compared to an alternative rowing programme developed by Terry O'Neill. Both of these methods use conventional free weights and require access to a gym. For developing core stability (the muscles that support your spine) there is a training programme developed by rowing coach Ade Roberts.

The 12 core exercises for both the traditional and alternative weight training methods are set out below:

The Exercises

Exercise 1 - High Pulls


Compound exercise that works the back, shoulders, legs and arms.

Method: Stand with feet under the bar and shoulder width apart. Lean forward with your back flat and bend the knees. Grip the bar with hands outside of the knees and knuckles forward. Stand up bringing the bar up to your chin in a straight line close to the body. Lower the bar to the thighs then bend the legs and return to the start position. Avoid arching the back and always lower the bar in a controlled manner.

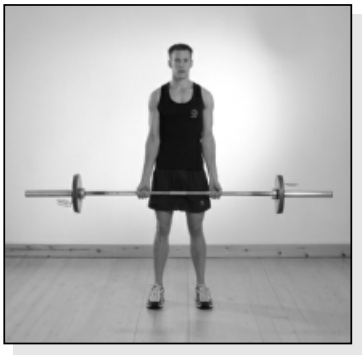
Exercise 2 - Press Behind Neck



Works the medial deltoids and triceps.

Method: Start with the bar behind your neck across the shoulders and the hands slightly wider than the shoulders. Extend the arms upwards and hold the bar overhead. Bring back to the start position and repeat. Can be either free weights or machine.

Exercise 3 - Front Curl



Develops the biceps and brachial muscles.

Method: Hold the bar in front on your thighs with the palms of the hand pointing upwards. Bend your arms upward bringing the bar to the chest as close to the body as possible. Lower in a controlled manner back to the start position.

Exercise 4 - Bent Over Rowing


Develops the lattisimus dorsii as well as the back and arms.

Method: Stand feet apart, knees slightly bent and holding the bar knuckles forward. Bend forward with the back flat and let the bar hang. Holding this position bend the arms raising the bar to the chest then lower to the start position.

Exercise 5 - Lateral Dips (right hand)


Internal and external obliques.

Method: Standing feet well apart with the left hand on your hip and your right hand holding the dumbbell. Bend to the right then back to the start position.

Exercise 6 - Lateral Dips (left hand)


Internal and external obliques.

Method: Standing feet well apart with the right hand on your hip and your left hand holding the dumbbell. Bend to the left then back to the start position.

Exercise 7 - Squat



Development of the thighs and the calf muscles.

Method: Stand feet apart with the bar balanced behind your neck. Sink down keeping the back flat and head up until your thighs are horizontal. Rise up onto your toes then back to the start position. Do not let the knees turn inwards. A squat machine is better for beginners until they are familiar with the range of movement but use of free weights is ultimately better as it allows a wider range of muscles to be used.

Exercise 8 - Bench Press


Compound exercise to develop the upper body, arms, chest and shoulders.

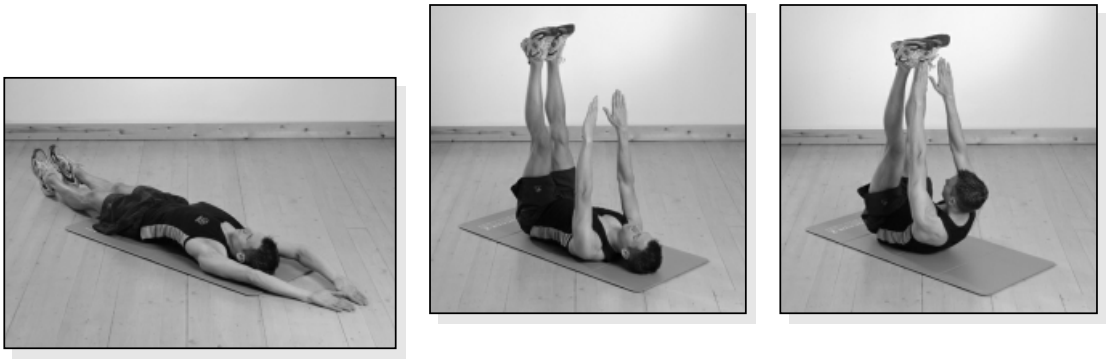
Method: Lying flat on your back on a firm bench, knees bent and feet on the floor, letting the bar rest across your chest. Hold the bar with your palms forward and your arms bent then extend your arms upwards and hold the bar above your chest. The bar should be raised and lowered vertically. Lower the bar to the start position but do not let the bar rest on the chest between exercises.

Exercise 9 - Clean and Press

Compound exercise working the legs, back, deltoids and biceps.

Method: Stand feet apart with your toes under the bar. Crouch down keeping the back flat and grasp the bar with the knuckles facing forward. Stand erect pulling the bar straight up close to the body until it is in line with the top of the chest. At this point bend the knees, and bring the elbows under the bar so it is resting on the chest. Press up with your arms and hold the bar at arms length above the head then bend the arms and bring the bar back across the chest. Lower the bar close to the body down to the thighs then bend the legs keeping the back flat lowering the bar to the floor.

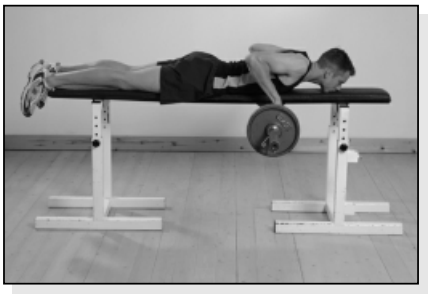
Exercise 10 - Jack-knife Crunch



Excellent abdominal exercise involving the inferior rectus abdominus.

Method: Lie flat on your back on a flat surface with your arms stretched overhead. Raise your legs, trunk and arms simultaneously to balance on your hips, bringing your arms forward as though attempting to grasp your ankles. Return in a controlled way to the start position to avoid injury.

Exercise 11 - Bench Pull



Upper back and lats.

Method: Lay face down on a bench with the arms hanging down holding the bar. Bend the arms bringing the bar straight up until it touches the underside of the bench. The chest should be kept in contact with the bench at all times. Lower the bar slowly to the start position.

Exercise 12 - Back Extensions

Works the lower back

Method: (With or without weight). Starting with your body straight lower your chest until your body and legs make a 90° angle. Straighten your body then repeat.

Traditional Weight Training for Rowing

Traditional weight training for rowing is based on the one repetition maximum (1RM) principle. The loading for the various exercises is based on a percentage of the maximum weight that can be lifted in one concerted effort. The percentage of the 1RM varies depending on the training aim of each training period.

The year is divided into training periods, as discussed in Periodisation in Training in Section 4 : Creating a Bespoke Training Programme, into transition, preparation, pre-competition and competition. The training aims of these periods are general conditioning, strength endurance, power and maximum strength. The number of exercises, repetitions and percentage of 1RM changes as you pass through each of the training periods.

The sessions are done in either circuit or station mode. A circuit is where the athletes move between the exercises, which remain in one place. This reduces the time between exercises. A station is when the athlete remains in one place and the weights and apparatus are changed for the different exercises. Which method you choose will depend on the size of the gym, equipment available and whether you use free weights or fixed multi-gym equipment. As a general rule the heavy weights maximum strength and power sessions would be done at stations but the general condition and strength endurance training would be done as a circuit.

Table 7.1

Training Intensities				
	General Condition	**Maximum Strength**	**Power**	**Strength Endurance**
Total Exercises	1-12	1, 8, 9, 11	1, 3, 4, 7, 8, 9, 11	1, 3, 4, 7, 8, 9, 10, 11, 12
% of 1RM	40-55	90-100	75-85	60-75
Repetitions	30-40	1-6	10-12	20-25
Sets	4-6	3-5	3-5	4-6
Method	Circuit/Station	Circuit/Station	Circuit/Station	Circuit/Station
Rest : Exercise	Continuous	3 : 1	3 : 1	2 : 1
Period	Transition and competition	Early preparation	Mid to late preparation	Pre- and early competition

This type of weight training brings about a significant improvement in strength relatively quickly as measured by increases in the one repetition maximum. Athletes find this very motivating, but unless a strength retention element is built into the programme these early gains cannot be reproduced later in the season. By increasing strength early in the preparation it enables the athlete to train at a higher intensity during the more specific pre-competition and competition phases.

An Alternative Weight Training Method

by Terry O'Neill

The drawback of traditional weight training for rowing is that the loading is based on the one repetition maximum and not the loading encountered in the rowing action. As the athlete's one repetition maximum (1RM) increases it is an indication of two things; increased strength and better technique. There is no guarantee that it indicates an increase in power. Power is the rate of doing work. For this reason an athlete may produce more power by lifting a sub-maximal weight faster than they would by lifting 1RM slowly. Because rowing is a test of power not strength the Alternative Weight Training Method is constructed specifically to maximise gains in power.

The basic principle of weight-training is that the muscles involved have to be exercised over the range and speed of the primary activity. The whole of the Drive phase of the rowing stroke takes in the region of 0.6 to 0.7 seconds. This means that the individual muscle groups involved are working even faster and weight training that does not reflect this fact and so may not produce any transferable benefits. Muscles develop as a result of the stimulus of the exercise and muscles trained with slow moving heavy loads could reduce their effectiveness for rowing.

This is not to say there is no role for the one repetition maximum system in rowing training. A case could be made to use this form of training for those muscles not used in the rowing action as a way to develop muscle balance. However, because a significant improvement in power can be gained from a small increase in strength, if you follow this type of training for rowers it should not exceed four weeks. Rowers with long levers are not built to handle heavy weights, this is the domain of the shorter, more compact athlete.

The twelve exercises are the same as those used in the traditional weight training programme, the difference is in the methodology and it is important that the changes to the weights and the speed of the circuit are closely followed in order to gain maximum benefit.

By varying the duration and rating of work when rowing we can alter the training effect. In the same way the training aims of each of the development phases can be met by subtle changes to the way the weight circuit is carried out.

Methodology

The biggest difference between traditional weight training and this programme is in the periodisation. The traditional periods are replaced by six week rotating blocks as described in Periodisation of Training in Section 4 : Creating a Bespoke Training Programme. The first block equates to the transition period and so only needs to be completed once at the start of the programme. After this, on completion of week 24, the programme continues on week 7. This is done so that the physiological benefits developed over the block are carried over into the next block. By returning to the beginning, a positive upward spiral is created. The changes between the blocks are less dramatic than those of traditional weight training further aiding the upward spiral. All the sessions are circuit format and involve all twelve exercises. Also, the difference in the loading through the periods is less than in traditional weight training, which promotes a gradual gain in power with less risk of injury. The programme is set out below:

Weeks 1-6

This period addresses basic fitness as well as the development of the aerobic system. Load the weight bars sufficiently so that each exercise can be comfortably carried out continuously for one minute. At the end of one minute move onto the next exercise as swiftly as possible so the circuit flows. Total work time is from 24 up to 48 minutes non-stop at a pace of 75 to 80% maximum heart rate (MHR). Two complete circuits should be completed in the first two weeks with a third added for weeks three and four and finally four full circuits on weeks five and six. Special attention needs to be paid to the correct execution of the exercises.

Weeks 7-12

The focus changes to specific strength training. The weight on the bar is increased so that the athlete can complete repeated lifts at a given rate for a period of 20 seconds during which time the heart rate will rise to maximum. At the end of 20 seconds the athlete should not be able to complete another lift. Rest for 20 seconds and repeat before moving onto the next exercise. One minute is allowed for changes between the exercises. As the athlete improves, incremental increases in the loading are achieved by either increasing the weight up to the maximum as shown in Table 7.2 or increasing the rate of lifting. These increases should only be applied when the athlete can complete the 20 seconds without any loss of technique.

Weeks 13-18

This is the specific power phase where the weight is reduced. This is so that the athlete can complete 45 seconds of continuous rhythmic exercise at a given rate at each station. At the end of which the athlete moves onto the next exercise without stopping. This gives a total of eight minutes work during which time the heart rate will rise to 85-95% MHR so that total time and heart rate reflect the demands of a 2,000m race. Rest for two minutes at the end of each complete circuit.

Three complete circuits should be completed in the first three weeks with a fourth added for weeks 4, 5 and 6.

Weeks 19-24

The final phase deals with speed which, along with strength, are the components of power. Keeping the weight the same as the previous session, the time on each exercise is reduced to 15 seconds during which time the athlete tries to carry out as many repetitions as possible whilst maintaining good technique. At the end of 15 seconds, rest for 15 seconds and repeat. For the first three weeks a total of three sets are carried out on each exercise before moving onto the next until one complete circuit is completed. One minute is allowed for change over. For weeks 4, 5 and 6 the time on each exercise is reduced to ten seconds with ten seconds rest and the number of circuits is increased to two.

Table 7.2

Schedule					
Weeks	**Exercises**	**Time**	**Reps**	**Rest**	**Circuits**
1-2	1-12	1 minute	Continuous	None	2
3-4	1-12	1 minute	Continuous	None	3
5-6	1-12	1 minute	Continuous	None	4
7-12	1-12	20 seconds	15-35+	20 seconds	2
13-15	1-12	45 seconds	20-40+	None	3
16-18	1-12	45 seconds	20-40+	None	4
19-21	1-12	15 seconds	15-25+	15 secs/repeat	1
21-24	1-12	10 seconds	15-25+	10 secs/repeat	2

Table 7.3

Loading Table						
Exercise Number	**Children**	**Adolescents**	**Juniors & Women**	**Club Men**	**Elite**	**Notes**
1	2-5kg	5-15kg	15-25kg	20-30kg	30-45kg	Improve technique before increasing weight
2	2-5kg	5-15kg	15-25kg	20-30kg	30-45kg	Weights machine is better for beginners
3	2-5kg	5-15kg	15-25kg	20-30kg	30-45kg	One foot forward for increased stability
4	2-5kg	5-15kg	15-25kg	20-30kg	30-45kg	Core stability exercise
5	2-5kg	5-15kg	15-25kg	20-30kg	30-45kg	Core stability exercise
6	2-5kg	5-15kg	15-25kg	20-30kg	30-45kg	Avoid leaning forward during the exercise
7	2-5kg	5-15kg	15-25kg	20-30kg	30-45kg	Beginners can place feet on the bench
8	2-5kg	5-15kg	15-25kg	20-30kg	30-45kg	Teach beginners sound technique
10	None	None	None	None	None	Beginners may be better with sit ups
11	2-5kg	5-15kg	15-25kg	20-30kg	30-45kg	Keep the chest in contact with the bench
12	Nil	Nil	Nil	5-10kg	10-15kg	Do not hyperextend by going too far past level

Weight Training for Children and Adolescents

Suggesting weight training for children is a contentious issue. It has been found that lifting heavy weights before and during puberty can stunt growth and lead to postural problems in later life. For this reason we suggest that although this circuit is safe for pre-pubescent children and adolescents it should be done with little or no weights and the focus should be on good technique and not the weights they are lifting.

When coaching children the coach often has to protect them from themselves, as their perception of exertion is lower than that of an adult working at an equivalent level.

Weight Training

by Jurgen Grobler

If you asked ten top chefs to prepare a meal, although the recipe may be the same the results would be different. A good chef would rely on his feelings as to what is needed rather than what is written down. It is similar to a coach who, although he might have a training programme to follow, will have a feel as to whether the athletes have to back off or push on.

A successful athlete/coach partnership must be coach driven but the coach cannot function without good feedback from the athletes. So an important part of the coach's job is to listen, but first he has to establish this partnership with the athlete. Like all good partnerships, it has to be based on trust.

When I started coaching as a young man I was very lucky in the fact that I was surrounded by outstanding coaches. In particular I owe a lot to Theo Corner who was my mentor. I believe a good education in your sport, so that you know it inside out, is vital to be successful. This doesn't mean that you have to have rowed at a high level; many top coaches were not international oarsman. Although I never rowed at the highest level I learned enough at my level to know how tough it is and how hard you need to train to reach the top.

High performance coaching is not like working on a production line where the parts appear at one end and a car comes out at the other. A coach has to have a vision of what an athlete needs to look like to be a winner. Every athlete is unique and requires special attention and so a coach faces constantly changing challenges to progress from where the athlete is today to where he needs to be to match the coach's vision. This is both stimulating and exhausting but is worth it when your crews are successful.

Our training can be divided into three main areas; land training, water training and cross-training. Land training involves the rowing machine, weights and running. Once a week we have a 30 minute row on the machine at rate 20. This is to develop strength per stroke and the top rowers cover 9,000m. We also use the machine for anaerobic alactate work, which involves short bursts of up to 20 strokes at maximum intensity. Of course we use the rowing machine for all out testing but I am a big believer in the benefits of training on the rowing machine and it plays a big part in our preparation. We also use weights in our land training two to three times a week. We include both strength and strength endurance circuits.

We mainly use the water work for low intensity training where we can develop the necessary technique to row powerful strokes. From the 12 to 14 sessions a week that we carry out, I only do two to three sessions where we accumulate lactate. One of these is either on the water, or the Indoor Rower, where we row 3 x 2,000m at stepped rate from 24 to 28 strokes a minute.

The third area is cross-training. We mainly do this at training camps where we take part in different activities from cross-country skiing to cycling. The training camps play a vital role in two ways: it breaks up the tedium of the daily routine, and training in different surroundings in itself is stimulating. More important however, is the need to develop athletic qualities in the rowers. Many rowers come into the sport because they lack the skills and dexterity for ball games. They tend to be big and ungainly but with tremendous physiological characteristics. However, to be fully able to exploit these, rowers must be able to develop athleticism. Tables 7.4 and 7.5 show examples of the strength/core stability and strength/endurance weights circuits that we use.

Table 7.4

Strength/Core Stability				
Exercise	**Weight**	**Sets**	**Reps**	**Total**
Bench Pull	80-90%	5	8	40
Leg Extension	80-90%	5	10	50
Bench Press	80-90%	5	8	40
Crunches and Twist	80-90%	5	10	50
Squats	80-90%	5	8	40
Leg Curls	80-90%	5	10	50
Dorsal Raise	25kg	5	8	40
Seated Twists	15kg	5	10	50
Expander	80-90%	5	30	150
Lunges	30kg	5	10	50
Total				**560 reps**

Notes:

Percentages are given of one repetition maximums.

Bench Pull

Method: Lay face down on a bench with the your arms hanging down holding the bar. Bend your arms bringing the bar straight up until it touches the underside of the bench whilst keeping the chest in contact with the bench. Lower the bar slowly to the start position.

Leg Extension


Method: Sitting with an upright, neutral, back position, raise your feet until your legs are straight, then lower the weight. If possible the machine should be adjusted so that the pads are just above the ankle joints.

Bench Press


Method: Lying flat on your back on a firm bench, knees bent and feet on the floor, letting the bar rest across your chest. Hold the bar with your palms forward and your arms bent then extend your arms upwards and hold the bar above your chest. The bar should be raised and lowered vertically. Lower the bar to the start position but do not let the bar rest on the chest between exercises.

Crunches with Twist



Method: Lying on your back with your feet flat on the floor, knees in the air. Draw your right elbow to your left knee, lifting your right shoulder clear off the floor. Lower, then repeat with the left elbow going to the right knee.

Squats



Method: Stand feet apart with the bar balanced behind your neck. Sink down keeping the back flat and head up until your thighs are horizontal. Rise up onto your toes then back to the start position. Do not let the knees turn inwards. A squat machine is better for beginners until they are familiar with the range of movement but use of free weights is ultimately better as it allows a wider range of muscles to be used.

Leg Curls



Method: Enuring that your knees are close to the pivot of the machine and, where possible, the pads are just above your ankles. Raise your feet until your shins are vertical. Then lower your feet back to the horizontal starting position.

Dorsal Raise


Method: Lying flat on your front raise the feet and shoulders from the ground. Ensure that the back is not so arched that it causes pain in the spine.

Seated Twists



Method: Seated with your legs flat, feet pointing forward. Twist your torso one way as far as it will go, then return to the centre and repeat in the opposite direction.

Expander



Method: Sit on the machine with your legs slightly bent, arms straight and body rocked forwards from the hips. Draw your shoulders back, then pull your arms through as in the rowing stroke. Let your arms return to the straight position then rock from the hips, returning to the start position.

Lunges


Method: Start standing with your weight evenly on both feet. Step forward with one leg and bend the front knee, keeping your back vertical. Then straighten the front leg, returning to the standing position.

Note: when starting this exercise begin with small steps and no weights until you are familiar with the action.

Table 5.5

Strength/Endurance		
Exercise	**Weight**	**Reps**
Bench Pull, at rate 26	50 kg	35
Angels	2 x (2.5kg)	20
Squat Box Jumps		20
Bench Press	45kg	25
Crossed Leg Crunches		20
Expander	50kg	25
Leg Press	120kg	20
Dorsal Raise with Twist and Hold	15kg	10
Lateral Pulls to Neck	50kg	20
Windscreen Wiper	7.5kg	15
Bench Pull, at rate 30	40kg	30
Leg Extensions	50-60kg	15
Upper Body Rotations	15kg	20
Dyno Leg Drive		15
Deep Squats with Arm Pulls	2 x (12.5kg)	20
Four Complete Circuits Total Exercises		**1,200**

Bench Pull, at rate 26

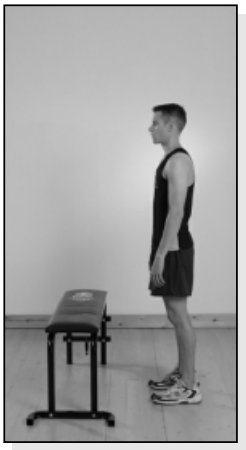
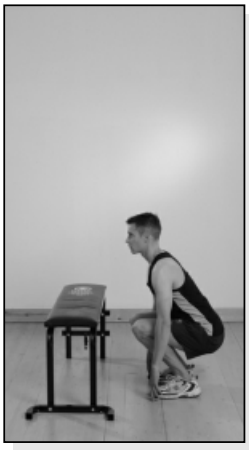

Method: Lay face down on a bench with the arms hanging down holding the bar. Bend the arms bringing the bar straight up until it touches the underside of the bench whilst keeping the chest in contact with the bench. Lower the bar slowly to the start position.

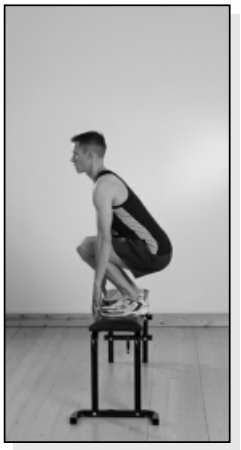
Angels



Method: Lie on your front (with or without weights) and raise the opposite arm and leg, trying to keep hips and lower back as still as possible. Return to lying flat then repeat using the other leg and arm.

Squat Box Jump




Method: Start standing, squat down until the thighs are horizontal and the hands can touch the floor. Jump up onto the bench, then squat down until the thighs are horizontal then stand up. Return to the starting position by jumping down and repeat the exercise immediately.

Bench Press

Method: Lying flat on your back on a firm bench, knees bent and feet on the floor, letting the bar rest across your chest. Hold the bar with your palms forward and your arms bent then extend your arms upwards and hold the bar above your chest. The bar should be raised and lowered vertically. Lower the bar to the start position but do not let the bar rest on the chest between exercises.

Crossed Leg Crunches

Method: Lying on your back with calves horizontal, raise the shoulder blades from the floor keeping the legs still. Return to the starting position and start again.

Expander

Method: Sit on the machine with your legs slightly bent, arms straight and body rocked forwards from the hips. Draw your shoulders back, then pull your arms through as in the rowing stroke. Let your arms return to the straight position then rock from the hips, returning to the start position.

Leg Press


Method: There are many different leg press machines but the same principle applies to all. The range of movement used should be from straight legs to a 90° angle between the calves and thighs, then straighten.

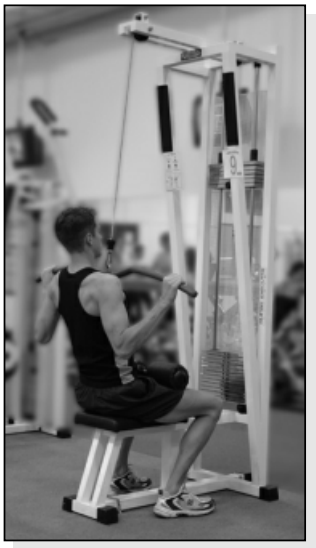
Dorsal Raise with Twist and Hold



Method: Starting with your body straight lower your chest until your body and legs make a 90° angle. Straighten your body and twist to face the left, then repeat to the right side.

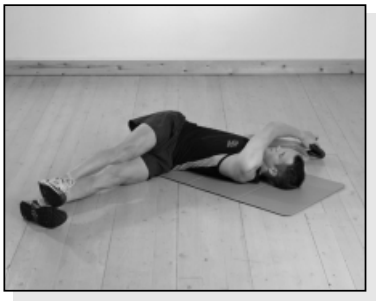
Lateral Pulls to Neck



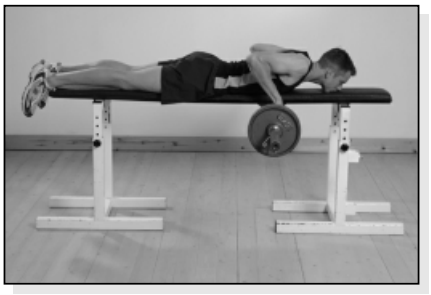
Method: Start with your arms extended, draw the bar behind the neck until level with the top of the shoulders. Return to the start and repeat, drawing the bar in front of your face until level with the front of the shoulders.

Windscreen Wiper

Method: Lying on your back with with your legs and arms vertical in air. Lower your legs to one side and your arms to the other. Return to the starting position and repeat on the other side.

Bench Pull, at rate 30

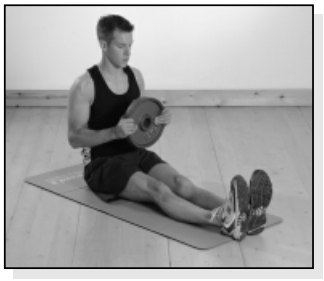



Method: Lay face down on a bench with your arms hanging down holding the bar. Bend your arms bringing the bar straight up until it touches the underside of the bench whilst keeping your chest in contact with the bench. Lower the bar slowly to the start position.

Leg Extension


Method: Sitting with an upright, neutral, back position, raise your feet until your legs are straight, then lower the weight. If possible the machine should be adjusted so that the pads are just above the ankle joints.

Upper Body Rotations



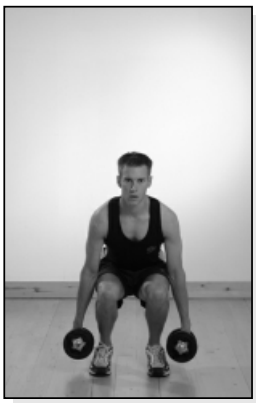
Method: Seated with your legs flat, your feet pointing forward. Twist your torso one way as far as it will go, then return to centre and repeat in opposite direction.

DYNO Leg Drive



Method: Sit with the back upright and pushing firmly against the padding. Place the feet in the foot stretcher and hold the hand grips under the seat.

Deep Squats with Arm Pulls



Method: Start standing then squat down until your hands are just off the ground. Stand up and continue to raise the weights until they are just below your arm pits. Repeat.

Core Stability Training

by Ade Roberts

What is it?

Core stability training is used to strengthen abdominal and spinal muscles with the aim of increasing spinal stability. Traditional abdominal training targets the prime movers in the trunk such as the rectus abdominis muscle. Core stability training works on the postural muscles (e.g. transversus abdominis) that help to stabilise the spine and maintain a desired position while performing an activity, that is to say they help to provide "dynamic stability".

Why do it?

There are two main reasons for using core stability training in a programme:

- To facilitate good rowing technique via improved posture.
- To increase spinal stability during exercise.

An upright, forward leaning posture is a feature of good rowing technique. It is used to create a position where the weight of the athlete is on their feet rather than the back of the seat. Therefore it helps to produce a strong leg drive and helps to connect the leg drive to the handle via a strong trunk.

This position is achieved through flexibility (particularly in the hamstrings), postural awareness, and the ability to sustain a posture during the fatiguing demands of exercise.

Core stability training targets the postural muscles and is a means of training the recruitment and strength of those muscles, and in the advanced stages enables voluntary recruitment during dynamic exercise.

Spinal stability is relevant to most people because most sports, and everyday activities, load the spine. Both postural and prime mover muscles contribute to spinal stabilisation. The prime movers such as rectus abdominis assist in balancing large external forces. Local stabilisers such as transversus abdominis act on individual lumbar vertebrae to help maintain a neutral spinal position at times when the spine is under stress. Strength and balance in both systems could therefore help to reduce the risk of injury. Both systems are often trained in the rehabilitation from back injury.

How do I do it?

The concept of the trunk muscles protecting the neutral position of the spine during movement is key to the success and correct understanding of core stability training. This point is often forgotten and can result in exercises promoting static rigidity rather than dynamic stability.

Core stability training involves relaxation and the low-level recruitment of postural muscles. No muscle bulging, breath holding, teeth gritting is required!

The most difficult part of core stability training is getting started and recruiting the correct muscle. Achieving 'Level 1' is perhaps the hardest.

Level 1

Exercise 1

Starting position:

Lie on your back with your knees bent to 90 degrees. Feet resting flat on the floor.

There should be a small arch under the lumbar spine (lower quarter of the back).

Place your right hand just inside of the pelvis at a level midway between your pubic bone and stomach button.

Rest your left hand flat on your stomach, positioned level with the bottom of your rib-cage.

Activity:

Suck your stomach towards your spine, while maintaining the neutral spine position. Your back should not flatten to the floor. This is called recruiting the core muscles.

Your hands should feel the stomach pull downwards under the right hand. No significant change should be felt with the left.

You should continue breathing and still be able to maintain the muscle contraction. Hold for 30 seconds. Repeat three times.

If you feel a tensing of the stomach with the left hand, the upper abdomen rises or falls significantly, or you are holding your breath, the exercise is being performed incorrectly and needs to be restarted.

Tip: It is harder to achieve Level 1 if sit-ups or other significant dynamic abdominal work has been performed immediately beforehand e.g. avoid doing sit-ups immediately before a core stability session.

Exercise 2

This is a variation on Exercise 1.

Starting position:

Kneel on the floor in the four point kneeling position.

Activity:

Recruit the core muscles. The aim is to lift the lower abdomen (not the upper) towards the spine without losing the neutral position of the lower back.

Level 2

Once the correct contraction has been identified, it needs to be used to assist the spine during dynamic activity. Level 2 introduces simple movement tasks. Level 3 uses more complex movement tasks.

Exercise 3

Starting position:

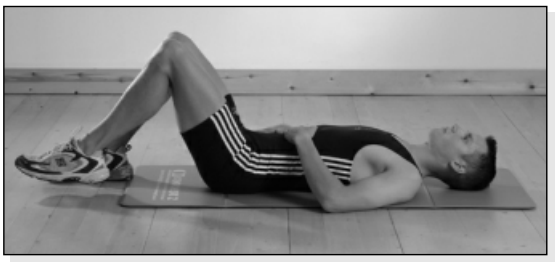
As for Exercise 1.

Activity:

Recruit the core muscle as in Exercise 1. Keep the muscles recruited and lower the right knee slowly towards the floor, pause then return to the starting position. Both feet remain static and maintain contact with the floor. There should be no movement at the pelvis. The lumbar spine should remain in the neutral position.

Repeat ten times on each side.

Exercise 4



Starting position:

As for Exercise 1.

Activity:

Recruit the core muscles as before and then slowly lift the right foot 1 to 2cm from the floor and then lower back to the floor. No pelvic or lumbar spine movement should occur.

Repeat ten times on each side.

Progression 1: Having lifted the foot 1 to 2cm above the floor, straighten your knee, still holding the foot 1 to 2cm above the floor and then return to the start position. No lumbar or pelvic movement.

Progression 2: Perform with the pelvis on an unstable surface such as a cushion or "Sit fit".

Exercise 5

Starting position:

Sitting on a chair with knees and hips bent to 90 degrees, feet resting flat on the floor. Maintain an upright body posture with the neutral lumbar spine.

Activity:

Slowly lift your right foot from the floor and then straighten your leg out in front of you. Maintain your upright starting position with the neutral lumbar spine.

Repeat ten times.

Progression 1: Perform while sat on a 'Swiss Ball'. Neither the ball, your pelvis or lumbar spine should move during the activity.

Progression 2: As progression 1 but the supporting leg is also on an unstable surface such as a cushion or "Sit fit".

Level 3

Exercise 6 - Superman

Starting position:

Four Point kneeling.

Activity:

Slowly raise and straighten your right arm and left leg so that they are horizontal, hold for ten seconds then return to the starting position. Maintain the neutral spinal position. No pelvic rotation should occur.

Repeat ten times on both sides.

Exercise 7

Starting position:

In the press-up position, with knees straight, but with both feet resting on a 'Swiss ball' such that your body is parallel to the floor.

If possible look sideways to a mirror to ensure the correct starting position has been achieved.

Activity:

Recruit the core muscles. Bend your hips and knees until your thighs reach an angle of 90 degrees to your trunk. Return to the start position. Maintain a neutral spine position while this occurs.

Repeat ten times.

How Do I Apply my Training?

The conscious recruitment, as learned at Level 1, of the core muscles and an awareness of neutral spinal posture during rowing or weight lifting and other activities will maximise your gain from the training by ensuring that you are training the correct muscle groups and not relying only on the prime movers.

Terry O'Neill's Hour of Pain

The cause of pain during exercise is the build up of lactic acid in the working muscles. Lactic acid is the end product of glycolisis, which is the process by which high intensity work can be carried out in the absence of oxygen. A small amount of lactic acid can be resynthesised to glycogen in the absence of oxygen by the reversal of glycolisis. For the remainder to be oxidised requires an abundance of oxygen but if the exercise intensity is high then there is an oxygen debt and the lactate starts to accumulate in the working muscles.

The build up of lactic acid reduces the efficiency of the muscle and eventually contractions will cease completely. The build up of lactic acid in the muscles and carbon dioxide in the blood makes this session quite unpleasant.

There are two good reasons why you need to go through this process. Firstly, working at this intensity increases enzyme activity in the muscles, which acts as a buffer and slows down the accumulation process. Secondly, you develop a tolerance to lactic acid accumulation so you are able to perform at a higher level of efficiency.

The Exercises

The following circuit is designed to fulfil two purposes. It develops muscular endurance and lactate tolerance within the muscle whilst working the cardiovascular system. If you have an hour to fill with a non-rowing workout then this is the one for you. All you need is a 20kg weights bar, a bench and an area where you can run 30m.

The hour is broken into three 20 minute blocks that run consecutively with no breaks between them.

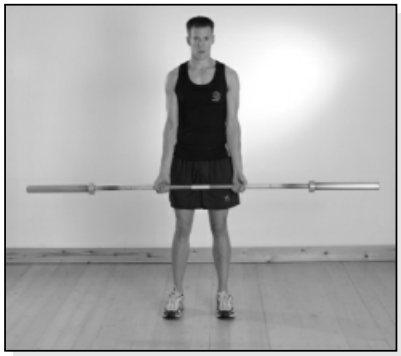
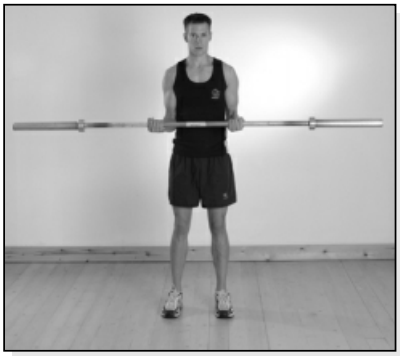
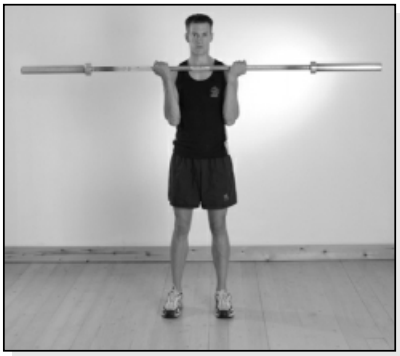
Circuit 1

This circuit is six exercises completed with a 20kg weights bar and a bench. Each exercise is done continuously for one minute and the circuit is repeated three times. This gives 18 minutes of activity followed by two minutes of rest before starting Circuit 2.

Table 7.6

Hour of Pain Circuit 1		
Exercise	**Position**	**Exercise**
1	Standing	Bicep Curls
2	Sitting	Press Behind the Neck
3	Lying	Bench Press
4	Lying	Triceps Press
5	Standing	Bent Over Rows
6	Standing	Straight Arm Canoeing

Bicep Curls

Method: Hold the bar in front on your thighs with the palms of the hand pointing upwards. Bend your arms upward bringing the bar to the chest as close to the body as possible. Lower in a controlled manner back to the start position.

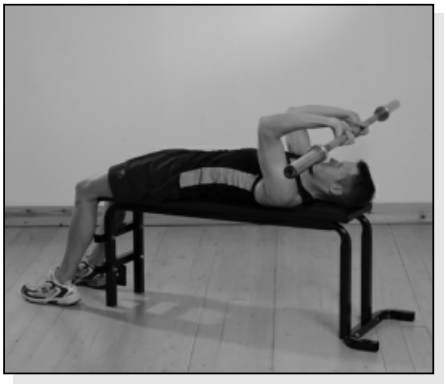
Press Behind the Neck


Method: Sitting with your back upright start with the bar resting on your shoulders. Straighten your arms, lifting the bar to above your head. Lower slowly to the start position.

Bench Press


Method: Lying flat on your back on a firm bench, knees bent and feet on the floor, letting the bar rest across your chest. Hold the bar with your palms forward and your arms bent then extend your arms upwards and hold the bar above your chest. The bar should be raised and lowered vertically. Lower the bar to the start position but do not let the bar rest on the chest between exercises.

Triceps Press

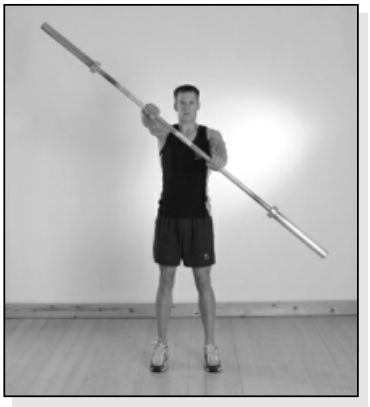


Method: Start with the bar held above your chest, with your arms straight. Bend at the elbows lowering the bar until the forearms are horizontal. Then lift the weight back to the start position.

Bent Over Rows

Method: With your knees slightly bent, body at 45°, raise the bar from straight arms to the chest. Keep the body as still as possible.

Straight Arm Canoeing



Method: Standing upright, hold the bar in front of you with straight arms. Rotate the bar in a canoeing action so that each end creates large circles.

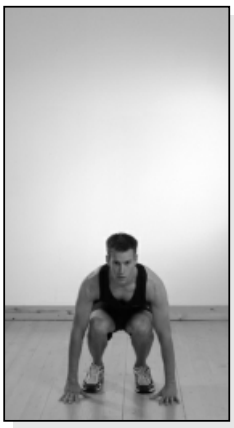
Circuit 2

This circuit is five exercises; squat jumps, press ups, burpees, sit ups and running. Start with ten squat jumps, then run 30m, do ten press ups, run back and do 11 squat jumps, followed by a 30m run, then 11 press ups. Continue until you have completed 25 reps on both squat jumps and press ups. Replace squat jumps with burpees and press ups with sit ups. Starting at ten reps work up to 25 reps again. This is designed so that the faster you go the more rest you have. If you do not complete all of the reps in the 20 minutes, remember where you are and finish them at the end of the hour.

Table 7.7

Hour of Pain Circuit 2		
Exercise	**Position**	**Exercise**
1	Standing	Squat Jump
2	Lying	Press Ups
3	Standing/Lying	Burpees
4	Lying	Sit Ups
5	Standing	Running

Squat Jumps

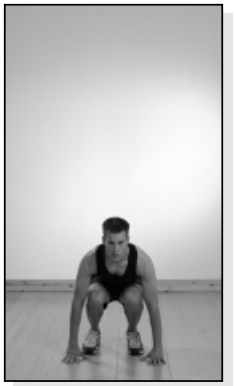



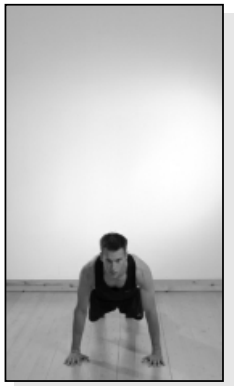
Method: Start in a standing position, squat down until your thighs are horizontal and you can place your hands on the floor. Jump into the air. Then repeat. Look forwards at all times.

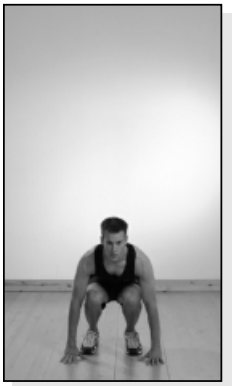
Press Ups

Method: Start lying on your front with your palms below your shoulders, fingers pointing forwards and on the balls of your feet. Straighten your arms keeping your trunk in a straight line. Return to starting position.

Burpees







Method: Start standing, squat down and place your palms on the floor with your fingers pointing forward. Straighten your legs, taking your weight on your hands until you are in a press up position. Bring your legs back so your feet are between your hands, then jump as high as you can into the air.

Sit Ups

Method: Lie on your back with your feet flat on the floor and your arms crossed on your chest. Lift up your shoulders and back until your body is off the floor. Return slowly to the starting position.

Circuit 3

This circuit consists of three six minute sessions of upright sculling, with one minute of rest between each. The rate should reflect what time of the training season you are in (see Periodisation of Training in Section 4 : Creating a Bespoke Training Programme), if you are in the preparation period you should do approximately 18 to 22 repetitions per minute, if you are in the pre-competition period then you should gradually build from 22 to 32 repetitions per minute. Once you are in the competition period you should try and complete a race profile, with the rate as it would be in your race. Note that if you are training for a marathon you should maintain your marathon rate throughout but decrease the rest between each six minutes until you are doing one 18 minute session.

Upright Sculling

Method: Start in a standing position, squat down opening your arms so that your hands do not touch the floor. Your thighs should be just below the horizontal. From this position stand up drawing your arms though. To make the exercise more explosive jump up from the squat position whilst drawing the hands through.

Recommended Reading

- **Anita Beau, *The Complete Guide to Strength Training***
  A & C Black, 2002
  ISBN: 0713660406
- **Tudor O Bompa, *Periodisation Training for Sports: Programmes for Peak Strength in 35 minutes***
  Human Kinetics Europe Ltd, 1999
  ISBN: 0880118407

Section 8 :

Nutrition & Weight Management

Diet

by Marjorie T Hagerman

Introduction

A 2,000m race requires all-out effort for approximately six to eight minutes. If a rower goes into the race having followed a proper diet during the preparatory training period, there should be enough glycogen stored in the muscles and liver to support the demands of the anaerobic/aerobic effort required. It is not necessary for a rower to superload the muscles with glycogen as a marathon runner or Tour de France cyclist might do. A rower's goal on race day, with regard to diet, is to have enough glycogen stored in the working muscles to fuel less than ten minutes of intense exercise. During such an intense effort, a rower will expend approximately 25 to 35 calories per minute, depending on individual body size and rate of metabolism. When the diet is optimal in carbohydrate, the body's working muscles can store up to 300 to 400 grams of glycogen (1,200 to 1,600 calories) to have available as fuel during exercise. The liver will contain stores of an additional 100 grams of glycogen (400 calories) that can be converted to glucose to fuel the exercising muscles. Fat can be stored by the body in larger amounts, and can also be used to fuel energy demands, however, carrying excess body fat is usually detrimental to performance. Fat is also less efficient than carbohydrate at producing calories from the limited amount of oxygen available during flat-out exercise.

The real issue, then, when looking at a rower's diet, is not what he or she eats on the day of the race, but whether they are able to maintain glycogen in the muscle at an optimum level to support their training regime for the days leading up to the competition. To support the high energy requirements of one or two vigorous training sessions on a daily basis requires a diet which is high in carbohydrate; adequate in protein, vitamins, minerals and fluids, and minimal in fat. Without attention to diet composition the rower runs the risk of gradually depleting glycogen stores during each training session and never allowing the muscle to fully regain its potential supply. This situation not only makes it difficult to obtain the greatest benefits from a training programme, it also means the athlete could enter the competition with glycogen stores that are unable to sustain an all-out competitive effort. At a recent team selection process, for example, an oarswoman participated in nutritional counselling, mainly because she was suffering from low energy and was unable to train at the level she wanted to. She thought that her low energy level might be due to a diet lacking in iron. Analysis, however, showed that, while her iron intake was fine, only 36% of her daily calories came from carbohydrate - well below the recommended 60% level. In reality, she was not eating enough carbohydrate foods to provide the necessary glycogen levels to support her training. Her goal was to change her diet to maximise her training and competitive efforts.

Carbohydrate: 60% of Total Calories

Practically speaking, how does one get the recommended 60% of total calorie intake as carbohydrate? Since a normal diet provides about 50-55% of calories as carbohydrate at best, food selection for a rower has to change to facilitate a good training diet. Foods supplying a high level of nutritious carbohydrate need to be increased; these include breads, cereals, pastas, fruits and vegetables, dried beans and peas and dairy products made from skimmed milk. Instead of the recommended four daily servings each from the high carbohydrate containing fruit/vegetable and bread/cereal groups, an athlete should have eight servings

from each of these groups to continually replenish glycogen stores which are consumed during training efforts. Also, it's wise to have some of the fourteen weekly servings from the protein rich meat/fish/poultry/nut group provided by legumes - kidney beans, butter beans and soya beans, peas and dried peas, and lentils; these inexpensive foods not only provide a source of almost fat free protein, they are also high in carbohydrate.

Many rowers believe that eating toast and cereal for breakfast and a plate of spaghetti for dinner translates into a high carbohydrate diet but this is not necessarily so. Although grain products certainly are an important part of a high carbohydrate diet, one must also include generous amounts of fruits, fruit juices and vegetables, and at least two to three servings of low fat milk products daily. Remember, in order to keep the carbohydrate intake high, and the protein level adequate, the only expendable item in the diet is fat.

In summary, a rower would want to plan his/her diet around the following foods:

Breakfast

- Cereal, toast, bagels
- Fruit and fruit juices
- Eggs (boiled or poached are prepared without added fat and are therefore preferred); limit to 3 to 5 per week
- Lean ham - no more than twice per week (no bacon or sausage)
- Low fat yoghurt or soft cheese
- Skimmed or semi-skimmed milk

Lunch and Dinner

- Low fat soup
- Salads with low fat or vingerette dressings
- Vegetables of all kinds
- Lean meat, fish, poultry; skinless and steamed or roasted rather than deep-fried
- Peanut butter (in limited amounts)
- Bread/rolls/bagels
- Fresh or tinned fruit in unsweetened juice
- Low-fat frozen yogurt, sorbet (other desserts limited to 2 to 3 times per week only)
- Skimmed or semi-skimmed milk

Snacks

- Jam or peanut butter sandwiches
- Fresh or dried fruits and fruit juices
- Fig bars, oatmeal cookies
- Ice lollies, low-fat fruit yogurt, power bars

Athletes often wonder about the wisdom of including sweets as a part of their high carbohydrate training diet. From a standpoint of glycogen replacement, in the first 24 hours following an event, carbohydrate from simple sugars has a slight edge over starch carbohydrate in replenishing muscle glycogen. However, during the following 48 hours, starch carbohydrate is preferable for optimal glycogen stores. The practical

suggestion is to include a mixture of carbohydrates, with concentrated sweet foodstuffs (biscuits, sweets, cakes, sweet desserts) eaten only in limited amounts, since they are also frequently high in fat and don't come packaged with as many other valuable vitamins and minerals (folic acid and iron, for example) as do carbohydrates from grains, fruits, vegetables and legumes.

What is the coach's role in helping the athlete to choose a high-carbohydrate diet? Making sound information available to the athlete is certainly an important first step, but probably even more important than your words (or the words of a sport nutritionist or registered dietician), are your actions. Whenever a team meal is planned, arrange for it to be high in nutritious carbohydrate foods, so a model of appropriate choices is apparent to the rower. If the oarsmen/women know the rationale for high carbohydrate training diets, and are then taught through example what foods are good choices to include in their training meals, they can benefit from a perfect follow-up of educational theory put into practice.

Protein: 15-20% of Total Calories

Protein is used by the body to build and maintain cell tissues of all kinds - from blood to bone and especially muscle. Since an athlete usually has a higher proportion of lean body mass to fat and bone than the non-athlete, protein needs are slightly greater than those of the average person. Protein need is based on one's size and stage of growth and is expressed as grammes of protein required per kilogramme of body weight. A standard recommended daily allowance (RDA) chart found in any nutrition textbook will list a recommended protein intake for various age groups, based on an average weight. An individual athlete's protein need can be worked out more precisely by multiplying their weight in kilogrammes by 1.4 to obtain the recommended number of grammes of protein they need per day.

Example: An oarsman weighing 95 kilogrammes would need 133 grammes of protein each day. i.e.
95 kilogrammes x 1.4 grammes protein per kilogramme of body weight = 133 grammes protein per day

An athlete who is receiving the correct amount of protein each day will have enough to meet present body needs and also have enough additional protein to provide for any increase in lean muscle mass which may be realised through a weight training programme. It is not difficult to obtain this amount of protein through a balanced diet. Protein is available from many different foods in varying amounts:

	Grammes Protein
1/2 pint of milk (any fat level)*	8
4 ounces of meat, fish, or poultry without bone*	28
1 cup serving of dried beans or peas, cooked	9
2 servings of peanut butter	14
1 cup serving of cereal, potatoes, or pasta	6
1 slice of bread, 1/2 bread roll or bagel	3
1/2 cup serving of vegetables	2

* high quality complete protein

In order to check whether they are getting enough protein in their diets, athletes may want to keep a record of everything eaten during one day, along with the amount of each, and use the protein equivalent value to calculate total protein available from these foods. Most athletes who follow a balanced diet that includes foods from all four food groups and has enough calories to maintain weight, will have no difficulty

in meeting protein needs. The exceptions may be those who follow a strict vegetarian or vegan diet, or lightweight rowers who practice severe calorie intake restriction. Vegans who include no meat, fish, poultry, eggs, or dairy products in their diet should be concerned about getting enough high quality protein from their daily meals. These athletes should monitor their protein intake carefully and, if it is below the recommended amount for their body size, they may wish to consult a dietician to help incorporate more protein into their diet. For lightweight rowers, a 5 to 6% body fat for men or 10 to 11% for women represent dangerously low levels of body fat and should prompt immediate consultation with a dietician to adjust dietary intake.

In recent research conducted with candidates for US national teams, all of the men, both heavyweights and lightweights, obtained adequate protein from their diets to meet the recommended level of 1.4 grammes protein per kilogramme of body weight. In contrast, only 60% of the women, again including both light- and heavyweights, met their protein needs. More of the women tended to be vegetarians, or were at least limiting their intake of protein foods from both the meat and dairy groups. It is important to remember that, while carbohydrate is very important, so is protein, and protein intake must be adequate to meet the demands of the exercising body. It may be difficult for the heavyweight vegetarian rower to meet calorific and protein needs on a totally plant-based diet; the sheer bulk of such a diet may mean one is filled up before adequate calories and protein are consumed.

Occasionally athletes wonder about taking protein or amino acid supplements to boost their protein intake. This is unnecessary if one eats a balanced diet; in such a case protein intake from food will usually more than meet needs, and food is certainly the preferred source, since it comes packaged with other nutrients like the B complex vitamins, iron and zinc, all of which are important to an athlete's health. Keep in mind there are inherent dangers in consuming excessively high amounts of protein, whether from food or a combination of food plus protein supplements. Protein foods often carry saturated fat with them, so excess fat intake - something we are all urged to avoid for good health, particularly of our hearts - can accompany excess protein from foods. Since water is required to break down protein to its component amino acids before the body can use it, dehydration can also accompany a high protein intake. This is a particular risk for exercising athletes who require that body fluids be present at an optimum level to cool the working muscles. Also, any excess protein not required for either tissue maintenance or energy production is broken down by the body and stored as fat - again, an undesirable outcome for the competitive athlete.

Fat: 20-25% of Total Calories

Fat is not quite the villain we sometimes make it out to be! The body needs fat to perform a variety of functions - everything from production of healthy skin and sex hormones to protecting the internal organs and carrying certain vitamins throughout the body. Fat is also a valuable energy source, particularly during low-intensity exercise. When the intensity of the exercise increases, however, the body relies primarily on glycogen stores to fuel the working muscles.

Since the body normally has virtually unlimited stores of fat it is not necessary to eat a high fat diet to have adequate fat available for any low intensity workouts. A well balanced diet will provide all the fat required to resupply adipose tissue deposits in the body, which in the average person store in excess of 11,000 grams of fat, or over 100,000 calories! With all this fat stored in the body, we require only about 2 to 10% of our total daily calories as fat to supply adequate amounts of fatty acid called linoleic acid, which the

body cannot make and must obtain from food. Unfortunately, the average person consumes much more than 10% of calories as fat - the figure is currently about 37%.

Not only is it unnecessary to eat a high fat diet to provide fuel for low intensity training, it is undesirable. Total fat, and especially saturated fat from meat, poultry, whole milk dairy products, and several tropical plant oils - coconut, palm and palm kernel - have all been implicated as contributing factors in heart disease, diabetes, and cancer. Also, a diet high in fat can lead to excess weight gain since, gramme for gramme, fat will provide more than twice the calories of carbohydrate and protein, and fat from food is very efficiently converted to fat stores in the body.

Is this recommended amount of fat a change from a usual balanced diet? Definitely. And to achieve this level of fat intake, which is appropriate for rowing training as well as for overall good health. Suggestions to reduce fat from the present 37% of total calories to the recommended 20 to 25% include:

- Limit cheese consumption. (This is one of most commonly eaten high fat foods in a rower's diet.) Switch to the lower fat types of cheese, low or half fat cheese such as mozzarella or cheddar and low fat cottage cheese
- Switch from the regular or premium type ice creams to low fat frozen yoghurt or sorbet.
- Choose margarines made from liquid vegetable (non-tropical) oils rather than butter.
- Limit amount of salad dressings used to no more than two to three tablespoons per salad and stick to low fat or vinegarette varieties.
- Limit the amount of mayonnaise-containing salads such as tuna, ham, egg, pasta and chicken; when preparing these yourself, use the lower fat types of mayonnaise and try substituting low fat yoghurt or fromage frais.
- Avoid fried foods, especially those that are deep-fried. Food which is baked, boiled or steamed absorbs far less fat than those which are fried.
- Limit the amount of rich sauces made with cream and/or butter. Instead, eat pasta with tomato sauce and vegetables with a dash of grated cheese.
- Choose leaner cuts of red meats, eat fish that is poached or baked rather than fried, and remove the skin from poultry.
- Limit intake of concentrated sweets like cakes, biscuits and sweets, all of which are frequently high in fat.

In addition to reducing the total amount of fat you eat, the type of fat you select is also important. Olive, peanut, sunflower and sesame seed oils are all relatively high in monounsaturated and polyunsaturated fatty acids, and low in saturated fatty acids, and are therefore considered more heart-healthy. Avoid foods containing lard, the tropical oils (e.g. palm oil), beef suet, and butter - these are all high in saturated fat. You can tell the kind of fat in a product by reading the ingredients listed on the label, which are required to be in descending order of weight.

Vitamins and Minerals

If a rower has an adequately balanced diet, it is not necessary to take a vitamin/mineral supplement to supply recommended amounts of these regulatory nutrients. The one exception to this might be iron and calcium, which females may need to supplement. In a mixed diet of 1,000 calories, one can expect to receive about 6mg of iron. Since the pre-menopause female requires about 15mg of iron per day, she would have to ingest about 2,500 calories daily, to provide an adequate iron intake. Most oarswomen will eat at this level, and probably even higher, but a lightweight female rower may be consistently below this level of calorie intake and she may need to discuss an iron or calcium supplement with her doctor.

Rowers may wish to consume vitamin C at a level somewhat higher than the RDA for this vitamin. Some research suggests that athletes should consume 3mg of vitamin C per kilogramme of body weight, rather than the RDA of 60mg. A diet that includes four to five servings of the following fruits and vegetables that are rich in vitamin C should easily meet the need:

- Citrus fruit and juice.
- Cantaloupe and watermelon.
- Strawberries.
- Broccoli, spinach and Brussels sprouts.
- Cabbage.
- Tomatoes.

Example: If a rower weighs 82 kilogrammes his/her vitamin C requirement would be 82 x 3 or 246mg vitamin C per day. This could easily be obtained through:

	Mg of Vitamin C
1/2 pint of orange juice	120
1 medium tomato	22
1/2 cup cooked broccoli	49
1/4 of a cantaloupe melon	68
Total	**257**

Including enough fruits and vegetables to meet this higher vitamin C level would have the added advantage of also including the minerals potassium and magnesium, which were low in the diets of many national rowing team candidates studied recently. As noted previously, fruits and vegetables also provide a rich supply of carbohydrates.

Whenever possible, vitamins and minerals are best obtained from food rather than from supplements. In foods, they come packaged with other nutrients important to good health. Furthermore, when these nutrients come in food, there is little if any danger of ingesting such high levels as to be toxic to the body. The same cannot always be said for supplements, which are often taken in amounts great enough to be dangerous to normal body function.

If a rower for one reason or another however, is unable to eat an optimally balanced diet, he or she may wish to consider a vitamin/mineral supplement. The best advice is to choose an all-purpose "one a day" supplement that provides between 50 and 100% of the RDA for the given vitamins and minerals. In combination with nutrients received from the diet, this should provide a safe level of supplementation. It is wise to check with a doctor before supplementing iron to the diet.

Fluid Consumption

It is essential to take onboard enough fluid to maintain an adequate level of body hydration. During training, heat is generated as a by-product of energy production to fuel the muscles, and this heat must be dissipated in order to stop the body's core temperature from rising to a dangerously high level. The body can rid itself of heat by:

- Dilating the blood vessels of the skin, which in turn increases the flow of blood to the skin and releases the heat to the environment by radiation and convection.
- Secretion of sweat onto the surface of the skin requiring heat calories to evaporate the moisture, causing a cooling reaction.

In hot weather especially, it is the cooling by evaporation process that allows exercise to continue, but only if these sweat losses are replaced. When training in hot weather, sweat losses from the body can be in excess of two litres per hour, and these need to be replaced during and following training. Some practical guidelines to help maintain optimal fluid balance during training:

- Cool fluids (5 to 10°C) are more quickly absorbed from the stomach and small intestine.
- If a sweet drink is preferred, the carbohydrate content should be present in no greater than an 8% solution, so as not to delay fluid emptying from the stomach or absorption of fluid from the intestinal tract into the blood.
- Drink 400 to 600ml 2 to 3 hours before exercise.
- During exercise, rehydrate by drinking 200 to 300 ml of cold fluid every ten to 20 minutes of activity. It's important not to wait until you feel thirsty to replace fluids. Thirst usually doesn't develop until 1 to 2% of body weight is lost through dehydration, and performance can be adversely affected at a 2% loss. The neurophysiologic stimulus for thirst is inadequate during and following exercise.
- Following exercise, it is recommended that 800ml of fluid should be consumed for every pound of weight lost through sweating. Rehydrate within two hours of exercise.
- In general, use of mineral supplements such as salt tablets to replace electrolytes lost in sweat is not necessary for rowers engaging in usual training regimes. Adding a little extra salt to daily meals and including high-potassium foods, such as citrus fruits and bananas, should easily replace the small amount of electrolytes lost.
- Loss of valuable electrolytes in sweat depends on such factors as gender, body size, heat adaptation, fitness, and environmental conditions. Losses of sodium, calcium, potassium, chloride, and other important ions will vary among individuals. Commercial drinks will provide adequate replacement of electrolytes and, at the same time, replenish carbohydrate stores. More importantly, however, drinking an isotonic sports drink and water will restore depleted body fluids for both the muscle and its transport systems and also ensure successful thermoregulatory function.

The Pre-Race Meal

The ideal pre-race meal will vary with the individual, depending what he or she has learned through experience is comfortable and effective. The following general guidelines may be of help as each athlete learns what foods are tolerated best during pre-race anxiety.

- Eat a small meal of no more than 500 to 800 calories about two to three hours before the race, so the stomach has time to start emptying before competition begins.
- Select starchy or "complex" carbohydrate foods that are digested relatively quickly and can boost glycogen supplies in the working muscles. Avoid excessive intake of foods high in sugar, which may cause stomach upset and may trigger reactive low blood sugar levels.
- A small amount of protein should be eaten, but avoid fatty foods or those prepared in fat. Fat takes longer than any type of food to leave the stomach.
- Avoid those foods that tend to produce gas, such as beans, onions, peppers, cabbage, cauliflower and apples. Gas-forming foods will vary for each individual.
- Avoid spicy foods and those that are new and untried. Just before a competition is not a good time to experiment with new cuisine; stay with the tried and tested.
- Be wary of foods that are high in indigestible fibre. Though high fibre foods help promote good intestinal function, they can also lead to diarrhoea and increase the risk of dehydration. General abdominal discomfort from flatulence can also be a problem with high fibre intake.

Below are two examples of a pre-event meal. This is especially important for athletes who suffer from nervous stomachs before competition and will better tolerate more readily digestible liquids and smaller amounts of certain solids than large amounts of solids.

Breakfast

Total Calories: 419

- 1/2 pint orange juice
- 1 poached egg
- 2 slices toast
- 2 tablespoons jam
- 1/2 pint skimmed milk

Lunch

Total Calories: 550

- 1/4 pint tomato juice
- 2 ounces baked fish
- 1 cup rice
- 1 orange
- 2 biscuits
- 1/2 pint skimmed milk

Don’t neglect nutrition after the race is over. This is the time to replace glycogen used during the event. Research suggests that 1.5 grammes of carbohydrate per kilogramme of body weight should be consumed immediately and at two hour intervals during the first four hours after exercise. Don’t forget to replace fluids after the event, as discussed earlier.

Weight Control

Lightweight rowers must constantly face weigh-ins, and are thus concerned with techniques to lose weight without losing strength and endurance. Weight should be lost gradually through a combination of reduced calories from food and increased calorie expenditure via more intense, frequent and longer duration workouts. Try to limit weight loss to a maximum of 1% of current body weight per week. By using a two-pronged approach, reducing calorific intake and increasing energy expenditure through exercise, the weight is more likely to be kept off rather than regained, and most of the weight lost is fat rather than lean muscle mass.

When losing weight, it is important for males to consume a minimum of 1,500 to 1,800 calories per day and for females to not go below 1,000 to 1,200 calories per day. Going below these minimum calorie levels risks a low intake of vitamins, minerals and protein, thus compromising nutritional health. When cutting calories, start with alcohol and then look for foods high in fat and sugar, as these are expendable. Fresh fruits and vegetables, whole grain breads and cereals, skimmed milk, fish, poultry, and lean red meats should provide the basis for a weight loss diet. It is neither necessary nor desirable to eliminate any food group from a reduced calorie diet - simply choose those foods within each group that contain fewest calories from fat, and eat smaller servings of all foods.

Don't neglect fluids. Even when trying to lose weight, the body should be kept adequately hydrated. Losing water weight is deceiving - the scale may register a lower number of pounds or kilogrammes, but it is weight that must be replaced for safe and optimal training and performance. Weight loss should mean fat loss not water loss. The practice of losing water weight by excessive sweating, use of diuretics, laxatives, even enemas prior to weigh-in, and then planning on whatever time is available (often little or none) between weigh-in and race time to rehydrate the body to normal levels, is risky at best and dangerous at worst. It should be noted that the use of diuretics is banned. Research at Ohio University's Human Performance Laboratory has shown a decrease in aerobic endurance occurs with as little as 2% of body weight lost through dehydration, and a decrease in strength has been documented when 3 to 5% of weight is lost through dehydration. Furthermore, one should probably allow a minimum of six hours to completely rehydrate the fluid depleted body. Although weight regain will occur in less time when rehydrating, it takes more than five hours for fluid to become evenly distributed to all the cells, where it is essential for proper metabolism.

Recommended Reading

- **Nancy Clark, *Nancy Clark's Sports Nutrition Guidebook***
  Human Kinetics Europe Ltd, 1997
  ISBN: 0873227301
- **Anita Beau, *The Complete Guide to Sports Nutrition (Nutrition and Fitness)***
  A & C Black, 2000
  ISBN: 0713653892

Losing Weight without Losing Strength

Different people use different approaches to achieving race weight. A point of agreement was that weight should not rise more than around 6kg during the winter. However, earlier in the guide Kurt Jensen explained that he believed that lightweights should not reduce their food intake but should increase their training volume to lose the required weight. Below we have also included interviews with former world champions Gearoid Towey and Tony O'Connor who do diet but avoid salads because of their high water content despite their low calorific value. Tom Kay however, another former world champion, does use salads as a part of his dieting to achieve his target weight. This highlights the fact that what works for one person is not necessarily right for everyone.

As lightweights normally allow their weight to increase by up to 6kg in winter, above their summer racing weight, and as indoor rowing is predominately a winter sport, we take this into consideration when setting weight limits.

Gearoid Towey and Tony O'Connor

Gearoid Towey and Tony O'Connor were the 2001 Lightweight Pairs World Champions. They have set out below the strategy that they employ when coming down to weight for a competition.

Gearoid has been an international lightweight oarsman since 1995, representing Ireland in almost every boat class. He raced the lightweight coxless four at the Sydney 2000 Olympics.

Tony has been an international lightweight since 1993 and has represented Ireland in sweep rowing at nine World Championships. He has raced the lightweight coxless four at two Olympics and has five medals from World Championships.

"In the winter we allow ourselves to get up to 76kg but no higher if at all possible. From Christmas onwards we become more conscious of what we eat and try to cut out fatty foods, for example only using skimmed milk. This allows us to come down to 73kg without much difficulty. When we start to come down to weight it is important not only what we eat but when. Normally, after a long distance or a high energy usage session, we would try to eat within 20 to 30 minutes something high in simple carbohydrates. After a weights session we try to have a high protein intake in the first 20 minutes, for example a pint of milk. Whenever possible we avoid eating immediately before bed and preferably eat before 8pm. About three weeks before the first weigh-in we begin to be very careful about what we eat, avoiding crisps, chocolate and other luxuries whilst maintaining a low fat but high energy diet.

On the week of the race we aim to be a maximum of 1.5kg overweight; we then control these last 1.5 kg with food and drink intake. In the last two days the most important thing is how much the food and drink you consume weighs, so we tend to eat pastas and cereal bars in small quantities. Lots of lightweights eat salad in the week before the race but this actually retains water and means that it is then harder to get down to weight. We feel it is much better to eat small amounts of higher energy foods that prepare you better for your race.

The night before the race we aim to be 1kg over weight. Of this it is normally possible to lose 0.6kg overnight whilst sleeping and lose the remaining 0.4kg in the warm up paddle.

It is important to be well prepared at the weigh-in. We normally take two bottles of sports drink each and three bread rolls with jam. This means that as soon as we have weighed in we can replace as much

energy and fluids as early before the race as possible. We try and eat these slowly as if you bolt them down you often feel sick. We then sip water right up until we boat and take a waterbottle with us. During the two hours between weigh-in and racing we normally consume about 1.5 litres of water each. During the last two days it may be necessary to become slightly dehydrated, this is preferable to not eating as you can replace lost fluids in the two hours after weigh-in but cannot make up for days of insufficient energy intake."

When asked whether they do weight training in the lead up to a regatta Gearoid and Tony commented:

"As lightweights we never aim to gain weight through doing weight training because we do not tend to do the eight to 15 reps weights and so do not put on much muscle bulk. We tend to do weights right up to six days before an international regatta and three days before a domestic regatta. These are either power weights of six or seven repetitions at 50 to 60% of maximum or maximal lifts weights, one to three reps."

When you are tapering do you change your sleep patterns?

"People get tied up with oversleeping etc before a big regatta. This actually decreases metabolic rate and hence affects your performance. Sleep patterns should be kept as normal as possible as the decrease in workload should allow you to feel as rested as possible."

Tom Kay

Tom Kay has been a lightweight international oarsman since 1989. He has raced at nine world championships and two Olympics. He has four World Championship medals, three of which are gold. At the time of writing Tom was preparing for the World Championships in the lightweight double with the aim to continue on to the Athens Olympics.

"During the winter my weight when I am training can be as high as 79kg and if I am not training that goes quickly up to 84kg. This means that I have to be aware of my diet throughout the year. If I am not I find myself over 80kg, and this would make it very difficult for me to reach my racing weight of 71kg. I try to come down to weight gradually over the year so that I am close to the 75kg limit required for the winter trials, and then can, if necessary, sweat down to reach weight.

"This year I have been working with a nutritionist, and have been keeping a diary of my food intake and counting the calories of the foods I am eating. This has had two benefits for me. I know that a person of my size with my training load should require between 3,000 and 3,500 calories per day so I try to maintain an energy intake of between 2,000 and 2,500 calories. The second benefit is that my diary of food intake has also been analysed to ensure that I am getting all of the required dietary constituents and as a result of this I am taking the required supplements."

It is just over three weeks until the World Championships: how heavy are you now and are you on target to make weight?

"At the moment I am 74kg and am happy that I am on target to make the 71kg I need to be on race day. The last few weeks have been difficult for me as I have been unwell and I always struggle to know whether to eat well to help get better more quickly or to continue dieting. For me, losing three kilos in the last few weeks is normal. At the first race of the season I am normally 74kg a couple of days before weigh-in and I struggle to make weight but, as the season progresses, my body weight comes down gradually and so by the World Championships I should be on weight without losing any strength."

How will you approach the last few days before your race?

"During the last week I will aim to lower my body weight by reducing food intake whilst keeping a balanced diet including maintaining my protein intake, without which the body burns its own stores e.g. muscle, as well as maintaining my intake of vegetables and salads which, whilst being more or less free calorifically, contain vital nutrients. The day of the race I aim to wake up at 72kg which leaves me only 1kg to sweat out before the weigh-in."

Weight Management

Target Group: Anyone wishing to lose weight or maintain a healthy weight.

Introduction

Many people confuse being overweight with obesity. Being overweight may just mean that you weigh more than the average for your height. Often this can be explained by an unusually heavy bone structure or well-developed musculature.

Obesity on the other hand relates solely to the percentage of body fat deposited about the body. These fat deposits will result in body changes such as a bulging stomach or double chins. Women in particular will display drooping breasts and fat deposits on the thighs and both sexes will be subject to flat feet.

Obesity will increase the risk of disease, in particular respiratory and heart disease. It can also lead to conception and pregnancy problems as well as shorter life expectancy and higher mortality rates. High blood pressure, cirrhosis of the liver and diabetes are more common in obese people. In addition obesity will increase the risk of kidney disease, inflammation of the gall bladder, hernias, arthritis and varicose veins.

Weight Check

There are some simple checks to see whether you are overweight; perhaps the simplest is not to weigh yourself but to look at your profile in a mirror. Without pulling in your stomach check for bulges.

A doctor can calculate your percentage body fat by taking a series of measurements with callipers at different points of the body. Pinching yourself on the upper arm, thigh and midriff and seeing if there is more than 2.5cm is a good guide to being overweight.

As you get older, your body shape and make up will change and relying on the scales alone may not be enough. Use a tape to measure your waist, hips and chest to see if there is any increase. When you do use the scales, always use the same ones and at the same time of day, as your weight will fluctuate naturally.

Weight Reduction

Weight reduction is a health issue and it is therefore wise to consult your doctor before embarking on any drastic eating regime.

Psychologial Eating Disorders

Anorexia Nervosa is a serious eating disorder, which occurs most commonly in adolescent girls and young women. Dieting is taken to such an extreme that the person becomes emaciated and, the dangers to health, created by obesity, are replaced with another equally dangerous range of health risks if not treated.

Bulimia Nervosa is characterised by periods of binge eating followed by vomiting or purging the body through excessive fasting, use of enemas, laxatives, diuretics and compulsive exercising.

Compulsive eating is also a psychological problem where the sufferer becomes addicted to food, which often results from depression, frustration, boredom and loneliness.

If you suffer from any of the above eating disorders then you should seek medical advice.

Methods of Weight Reduction

There are two types of aids that are designed to help reduce weight. Active aids require the user to carry out physical activity, which burns calories. Passive aids claim to reduce weight without the need to exercise but these are of little use. For example muscle contractions caused by external electrical stimulation may improve muscle tone if you are particularly flabby but will not reduce weight. Vibrating belts do not break down fat. Although the user may find them relaxing, they do not burn calories. Reducing garments and saunas can lead to temporary weight loss due to sweating, but this loss will be replaced as soon as you take a drink.

Reducing weight will require an amount of self discipline if you are going to be successful. Going to health farms is expensive and they will only control your diet while you are there. For long term success it is up to you. Even your doctor will be able to do little to help unless the weight problem is as a result of a medical condition. If you do need support then a diet club is the best option but you will still have to do the work.

When deciding on an exercise activity, there are a few things to consider. If you are overweight there is already additional stress on muscle and joints. For this reason it is better to avoid activities that cause impact like running. Also it is better to look at activities that are non-weight bearing and this is why the Indoor Rower is ideal.

Start off gently and remember that initially it is better to finish feeling you could do more than being dead on your feet. Gradually increase the training volume as your fitness level improves and don't expect miracles. It took a long time for the fat to accumulate, it will not disappear overnight.

Anyone, whether they train or not, must balance their energy intake with energy expenditure in order to maintain their bodyweight. This is represented by the energy balance equation:

Energy intake = Energy expenditure (± Stored energy)

In reality this means that in an ideal situation where energy intake and expenditure are equal there is no excess energy stored from food and no use of the body's energy stores. If energy intake is greater than energy expenditure the body stores energy in the form of fat. If energy expenditure is greater than energy intake then the body uses stored energy to top up its requirements. It is this principle that people wishing to lose weight must capitalise on.

For weight management, long periods of low intensity exercise are recommended. However, during exercise, the body will use dietary fat before it uses stored fat, so to make your exercise effective, you will need to reduce the amount of fat in your diet.

A balanced diet is one where you match the energy intake through your diet with the energy output of your lifestyle. Energy is measured in calories and is provided by a combination of carbohydrates (glycogen) and fat. For each gram of glycogen we get just over four calories of energy and for each gram of fat we get nine calories. If you exercise at high intensity, you will burn more calories, but they may not be the ones you want to burn, and just counting calories may not take into account the energy source you are using.

To achieve and maintain your weight goals you need to have realistic expectations and not seek a quick fix. Many people have unrealistic expectations, want swift results and give up if these fail to occur. Here are just a few of the weight loss myths exposed:

- Crash diets do not work. Low calorie diets may result in a quick weight loss, but studies show this is usually temporary and that the body gets accustomed to a low calorie intake and slows down the metabolism. On return to a normal diet the metabolism will not be able to speed up sufficiently to burn off the extra food and will store it as fat.
- Skipping meals makes the body famished and causes overeating. It is better to space calorie intake over the course of a day. To lose weight it is best to eat 25% of calories at breakfast, 50% at lunch and 25% at dinner.
- Hard workouts are not the answer. In order to burn fat, slow down and exercise longer to get the body to use its own fat cells for fuel, rather than the glycogen stores in the muscles.

It is very important when dieting in order to lose weight that a sustainable lifestyle is created. Losing more than 1% body weight per week can be detrimental to health and is often caused by dehydration and not actual loss of body fat. In order to successfully lose weight, there are three areas that you need to pay equal attention to for a successful outcome. Two of these are a reduction in the calorific value of the food you eat and an increase in the calories burned via exercise, while the final element is the mental commitment needed to stick to the regime. All three elements are covered in detail within the Training Guide. The four stage programme illustrated in Table 6.1 increases the exercise duration to a maximum of 90 minutes. It is also worth looking at the weight training programme for rowers in Section 7 which, utilises low weights and high repetitions. It is high in energy costs and would be beneficial to anybody seeking to reduce their weight. Finally, make sure you read Section 9 : Sports Psychology. This contains important information on target setting and enforcing success along with a chart to fill in, laying out your goals. This process helps you to measure your successes and failures, and is highly motivating.

Before you start the programme you should take measurements of your waist, hips, chest, neck, biceps, wrists, thighs and calves. It will then be possible to tell if you are making progress towards your ideal body shape. The reason for doing this and not simply relying on your body weight as an indicator of your progress is that as you progress through your training you will increase your muscle bulk. Muscle weighs significantly more per unit volume than fat as it is denser so your weight may not appear to change, or may even go up, but in fact you are losing body fat, and your body shape will indicate this more clearly than your weight.

Table 8.1

Weight Management Programme			
Session	**Light Week**	**Medium Week**	**Hard Week**
	PHASE 1		
1	10′ UT2 18-20spm	15′ UT2 18-20spm	15′ UT2 18-20spm
2	15′ UT2 18-20spm	20′ UT2 18-20spm	20′ UT2 18-20spm
3	2 x 10′ UT2 18-20spm	2 x 10′ UT2 18-20spm	2 x 15′ UT2 18-20spm
4	15′ UT2 18-20spm	15′ UT2 18-20spm	20′ UT2 18-20spm
5	20′ UT2 18-20spm	20′ UT2 18-20spm	25′ UT2 18-20spm
	PHASE 2		
1	20′ UT2 18-20spm	20′ UT2 18-20spm	2 x 15′ UT2 18-20spm
2	25′ UT2 18-20spm	25′ UT2 18-20spm	30′ UT2 18-20spm
3	2 x 15′ UT2 18-20spm	2 x 20′ UT2 18-20spm	2 x 20′ UT2 18-20spm
4	20′ UT2 18-20spm	30′ UT2 18-20spm	30′ UT2 18-20spm
5	30′ UT2 18-20spm	35′ UT2 18-20spm	40′ UT2 18-20spm
	PHASE 3		
1	30′ UT2 18-20spm	40′ UT2 18-20spm	2 x 25′ UT2 18-20spm
2	40′ UT2 18-20spm	45′ UT2 18-20spm	50′ UT2 118-20spm
3	2 x 20′ UT2 18-20spm	2 x 25′ UT2 18-20spm	2 x 30′ UT2 18-20spm
4	30′ UT2 18-20spm	35′ UT2 18-20spm	40′ UT2 18-20spm
5	40′ UT2 18-20spm	50′ UT2 18-20spm	60′ UT2 18-20spm
	PHASE 4		
1	50′ UT2 18-20spm	60′ UT2 18-20spm	75′ UT2 18-20spm
2	3 x 20′ UT2 18-20spm	3 x 25′ UT2 18-20spm	2 x 30′ UT2 18-20spm
3	40′ UT2 18-20spm	50′ UT2 18-20spm	60′ UT2 18-20spm
4	2 x 25′ UT2 18-20spm	2 x 30′ UT2 18-20spm	2 x 40′ UT2 18-20spm
5	60′ UT2 18-20spm	75′ UT2 18-20spm	90′ UT2 18-20spm

Notes for Table 8.1

i. This weight management programme is set out with the sedentary person in mind. If you find that you are feeling fine after completing the session we suggest that you either rest and repeat the session, or rest then repeat half the session. As with any of these training programmes this is left at your discretion and should be dependent on how you are coping.

ii. The programme sets an upper training intensity limit of 65% of maximum heart rate (MHR). You should comfortably be able to maintain a conversation at this intensity.

iii. 2 x 10' UT2 18-20spm means row for ten minutes in your UT2 heart rate band at 18 to 20 strokes per minute, take a short break and then repeat.

iv. The training programme increases in volume through each training period and from one period to the next. If you feel you need more time to recover a short rest of three to four days after each three week training cycle should suffice.

v. When rowing for long periods, you may experience some stiffness in the back. If this is the case check that you are using the correct technique and if necessary get off the machine every 20 minutes and carry out a stretching routine including extension stretches (for example see the rectus abdominus stretch shown in Stretching in Section 1 : Before and After Exercise). Exercises that strengthen the abdominal and back muscles, which control the posture, will also help to alleviate this problem (see Core Stability Training in Section 7 : Weight Training).

vi. The effects of energy consumption are cumulative - the effect is the same whether you complete one hour continuously or break it down to 3 x 20 minutes.

vii. Phases 3 & 4 are certainly not for everybody; many will find Phases 1 & 2 quite adequate. We recommend you seek professional medical advice before embarking on Phases 3 & 4, even if you have completed Phases 1 & 2 and experienced no problems.

Section 9 :

Sports Psychology

Psychological Preparation

by Chris Shambrook

Introduction to Mental Fitness

There is a great deal that could be written about the mental side of exercising and competing. However, rather than overload you with ideas and instructions, the following will simply highlight some of the more important points that relate to helping you get the most out of your Indoor Rower from the psychological perspective. If this information raises your interest, and you want to get more detailed insights in the psychology of sport, then *The Mental Game Plan: Getting Psyched for Sport* is a really useful starting point (available from www.sportsdynamics.co.uk). All of the information in the book, and set out below is designed to be simple, practical ideas that can be integrated into the training that you might already be doing.

Here is what we are going to introduce you to:

- Why Bother with Psychological Training?
- Setting Targets and Goals - the Basic Tips.
- Concentration Tips for Use on the Indoor Rower.
- Building your Confidence/Monitoring Progress.
- Competition Specific Psychology - Performance Reviews.

All of the information you will read here should be common sense, but unfortunately, it is not commonly applied. Therefore, the biggest challenge you will have, as with all advice, is sticking with the recommendations, and giving them enough time in order that they can start to have a real benefit for you.

Why Bother with Psychological Training?

The mind is the athlete… the body simply the means to performance.

We spend a great deal of time warming the body up, stretching, fuelling it, and generally ensuring that the body is going to endure the stresses of our work-outs. How much attention do we pay to warming-up mentally for exercise? Usually very little! Why don't we do this? Usually because no-one has told us how to! Therefore, this section will show you how you can make the most of your mental muscles to help you have the best impact on your physical muscles!

On the most simple level, what you think influences what you actually do. So if you are wanting to have really high quality, consistent training on your Indoor Rower, you will have to exert some mental effort to ensure that this is what you get. A period of planning, some occasional reviewing, and a lot of self-talk while you are exercising need to be natural elements of your training programme. The more you can be strong in your thinking, approaching your training with purpose and conviction, the more you will get out of every session you do. Most people get maximum enjoyment from seeing that they are making good progress, so you need to make sure that you set up your training in such a way that you allow your mind to see how well you are improving session by session.

You will be exerting a good amount of physical effort during your training, and we are sure you will get added benefits from the time you invest if you are able to make sure that you get the appropriate psychological impact too.

Before we get into specific advice, it's worth highlighting a couple of useful principles that you need to keep checking you are successfully achieving from time to time.

First, managing your expectations of the progress you are going to make is really important. Too often people expect too much of themselves too quickly, and are therefore disappointed in the progress they make. People tend to focus on what they have not achieved, rather than the progress they have made. So, make sure you are keeping the progress you have made very much in the forefront of your thinking. You can make progress every day, and if you achieve that a few days per week, after several weeks that will be adding up to a good overall achievement.

Another important mindset tip to keep focused on is that your attitude is a choice. Therefore, how you perceive your exercise and training, and what you believe you can achieve, is very much based down to the attitude you chose to adopt. Don't expect to alter negative attitudes into positive ones immediately, but work on developing a more positive attitude over time as you build up evidence from the efforts that you are making. You are taking on a great challenge with your training, so look forward to it and see how far you can push yourself. Also, keep an eye on your attitude and monitor it so that you can keep making positive choices with it so that it keeps working for you on your quest for fitness.

It is very clear in all types of performance that if you can get your mind right, it is much easier to get the body right. It's therefore important that you think about the key mental elements that need to be in place in order for you to get your body as prepared as possible. There are key factors such as confidence, concentration and motivation that need to be constantly checked to help you understand differences in your training performance. Equally, when it comes to actually racing, you would need to think about controlling nerves, maintaining belief, and managing pain responses. Within your exercise and training time, if you can include some focus upon your developing mental fitness it will be of great help to your short-term and long-term success.

At the simplest level, it is critical that you identify some personal outcomes that will be important to you when you achieve them. Starting with your final aims clearly in mind will undoubtedly make a big impact for you. This is the first step of the goal-setting process that you will be introduced to, and you should take some time working out this key first step. Along with this, you will need to make sure that you regularly look back at what you have already achieved, and aim to learn as much as possible about how you get the most out of your training, as quickly as possible. With learning, you will be able to make strong choices relating to the type of training you really get a buzz from, and which training sessions you find a struggle. You can then plan accordingly to work out ways of keeping the fun sessions fun, and the tough sessions as enjoyable as possible for you. The main focus of staying switched on to your training is to ensure that it remains your training programme. Too often people believe they are carrying out something that they should do when it comes to regular training, rather than doing something that they completely want to do. This subtle, but important difference needs to be constantly focused upon in order that you maintain ownership of your programme and keep really enjoying your training, week in, week out.

Setting Targets and Goals - the Basic Tips

Goals and targets are essential for getting motivated and keeping motivated. Without targets, there is nothing to aim for specifically, and little chance of you maintaining training over a prolonged period. The more meaningful you can make your goals to you, then the more they will keep you striving to achieve

those things that are really important to you. You have already taken the step of exercising on the Indoor Rower, or perhaps even purchasing one, so there must be some pretty important goals that you want to achieve. At the start of your training, it is well worth spending a small amount of time getting these goals into sharp focus so that you can maximise their impact for you, short-term, medium-term and long-term.

Goal Guides

Whether your goal is to control weight, improve general fitness levels, or be able to break eight, seven or even six minutes for a 2,000m row, there are some basic rules that you need to follow.

First, you need to start the goal-setting process with the finish point in mind. This makes it a lot easier for you to take the appropriate steps to set effective goals along the way. Try to make this end goal as specific as possible. For example, a goal of losing weight is pretty non-specific. How much weight? By when? And how? Your goal will be much more helpful if you give yourself detailed aims, such as: "By three months from today, I aim to have lost 5kg. I will do this by rowing four times a week and by working on improving my diet."

When we have a specific goal like this, you can then begin to calculate what you need to do on a day-to-day basis in order to achieve your long-term success. Therefore, if you want to achieve the 5kg weight loss in three months, this actually means that you will be aiming to lose 1.6kg per month, which in turn means you are trying to lose 0.4kg per week, or 0.06 kg per day! And what does 60 grams feel like? Well, if you have an average apple available, pick this up, and 60g is about half the weight of this apple! So, from a large goal of 5kg, that might seem quite daunting, you might hopefully be able to be more optimistic that you can little by little make the 60g daily progress that would add up to your desired total.

Think of the ultimate goal as the top of a staircase, and in order to successfully reach the top of your stairs, you need to take each step with maximum efficiency, allowing you to tackle each step with equal enthusiasm. So, apply the staircase principle to any goal you set. See what is at the top, and then break the ultimate aim down into manageable daily or weekly chunks. If you adhere to the following rules along the way, you will be sure to get maximum satisfaction out of your goals:

- Make sure your goals are realistic, but challenging. Getting the balance right here is essential. Too easy, and the goals will not motivate or create a sense of urgency. Too hard, and the goals will de-motivate as you will not get any positive feedback that you are getting close to achieving your ideal outcome. Therefore, keep asking yourself, does this goal challenge me, and do I believe it is realistic?
- Progress towards goals is never smooth - sometimes you make quicker progress than expected, other times you are hindered in your efforts. Therefore, make sure that you allow the time frames and the goals to be adjustable. Allowing flexibility is critical as goal setting is often like an experiment, and as we know with most experiments, the scientists seldom get the method perfect first time round.
- As much as possible, make sure you measure your progress. In the weight loss example, there is a good objective progress check in terms of actual weight measurement. Use times, distances, frequency of training, or your performance rating scales to keep you focused on measuring your successes. If you can see the end goal getting closer, then the more motivated you will be.

- Review, review, review! Check your progress along the way. Don't set long term goals and only review progress once you get to the end point. Keep reviewing progress regularly so that you can learn what is working for you and what is not. The world's best sports performers get their goals really working for them through the way that they review and learn, so take a tip from the best, and review as well as you set goals. Later in this section, there is an example of a race review system, and you might want to work out how this might be adapted to help you review your goals effectively along the way, even if you have no intention of racing.

There is a lot more detail on the kind of goal setting you can go through in The Mental Game Plan. One area that may help you though is to think about working out in more detail what your starting point is as an individual beginning a programme of training. The Concept 2 Profile (see below) is a great way to get some more specific targets for your training that are personalised to your particular needs.

The profile is relatively easy to fill in. Under the training focus, complete a list of all of those specific areas that you might want to work on. For instance, you might identify that you want to work on: stamina, muscle tone, weight control, back strength, enjoyment, concentration and motivation. If this was your list, you would then need to score yourself out of ten on each item for how good you believe yourself to be right now on each quality. Once you have identified the scoring range, look at the lowest scores, and start to put in place a plan for the next few weeks of what you will do to improve the scores of those specific areas. This process is much more subjective than using the goal highlighted before, but it can be equally helpful as it really gets you in touch with the areas to work on that are most important for you. This process allows you to tell yourself what is important to you… and from a motivation point of view that is much better than someone telling you what to do and how to do it.

Once you've completed the profile you should have a clear picture of what you want to improve, what score you want to improve it to, how you will improve it (while keeping other areas at least at the same level), and when you will review your progress to score yourself on each other areas again.

The time spent on this planning stage will have a big impact on the quality with which you are going to carry out your training. So take out your insurance policy and spend a bit of time thinking about what you need to think about!

Concept 2 Profile

Date: _____ **Stage of Season:** _____

Current aims: _____

Long-term aims: _____

Progress so far: _____

Training Focus (Mental, physical, technical)	**Ideal** (1-10)	**Current Level** (1-10)	**Priority**
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		

Fill in the various areas that you are trying to improve upon. The list can be as long or as short as you like. Fill in what you would score yourself out of ten for your current ability on each area. Look through the scores, work out your strengths (the things you should keep reminding yourself are good about you), and identify which areas score lower. These are going to be your priority areas to work on. Pick only two to three areas to work on at a time and rescore yourself on each area in five to six weeks time.

Once you've worked out what your priorities are, make a plan as to what you are going to do through your exercise that will particularly help you improve on these specific areas. Make sure you work out how your strengths are going to help you bring up the priority areas.

To help set some goals for each of these areas refer to the goal setting advice in this section.

Concentration Tips for Use on the Indoor Rower

One of the biggest challenges that people face in sport and exercise is staying concentrated on the right things at the right time. The Indoor Rower presents some unique concentration challenges that you need to prepare for so that you can control your machine, and not let it control you!

The most important thing to focus on in any training session that you carry out is the process of rowing effectively. The more you can be aware of what it feels like to row effectively, and be in touch with your body's reactions, the more you will get out of the session. It is important therefore, that you have an aim of concentrating on your body and the various bits of feedback it gives you through the course of a session. The more you concentrate on these variables, the more you will be able to regulate your performance, become more efficient, and take advantage of your developing fitness. Therefore, for the first few training sessions, you will need to pay attention to what it takes to produce an efficient and effective work-out. Pick out the concentration cues that help you to feel relaxed, strong and get you into a good rowing rhythm. This might mean concentrating on a specific part of your body as you go through the stroke, it might mean concentrating on a particular sound that indicates the rhythm you are creating, or it might mean concentrating on saying something to yourself, or watching yourself in a mirror. Different people have different concentration preferences, so experiment a little and work out which works best for you, and how you prefer to concentrate. Set yourself the challenge of seeing how much of a session you can concentrate on the right things for. In time you should be able to concentrate more and more effectively on the processes that really work for you.

The other important concentration challenge with the Indoor Rower is how you concentrate on the information being displayed on the monitor during your work-out. It is important that you make some decisions about how you will use the information on the monitor during your work-out. If you concentrate too much on the numbers alone, you are probably diluting the amount of concentration you are using to row efficiently. In competitions, this can be particularly important as a small decrease in concentration might make an impact on your final performance. Be prepared to experiment with the monitor to see how it influences your concentration. If it helps to have the constantly updated feedback of how you are doing, then you should play to that need, but if the numbers distract you too easily, and result in you decreasing effort, then try putting tape over the monitor to cover those areas that you find most distracting or simply turn the whole thing over.

You'll really improve the quality of your work-outs if you get the right concentration focus. The most important thing is to try to stay in the present as much as possible. If you can take each session one stroke at a time, and concentrate on carrying each stroke out really well, then you will find the sessions much more rewarding, and likely to be over more quickly! If you are concentrating on how long or how far you still have to go throughout a session, then your focus will not be helping you as much. If staying in the present becomes really important, from time to time turn the monitor over, and set an alarm to sound when you want your session to finish. With no visual feedback all the way through the workout, you will be able to concentrate much more on taking one stroke at a time, and concentrating on getting the most out of your body.

Concentration is really all about having specific things to focus on throughout a workout. The more you have clear goals of what you want to think about for each training session, then the more effectively you will be able to concentrate. This idea is certainly made more compelling when thinking of carrying out a 2,000m race. As you can see below with the blank ideal race plan, you have the opportunity with a race to clearly decide ahead of time what you want to be concentrating on throughout the whole 2,000m. The idea

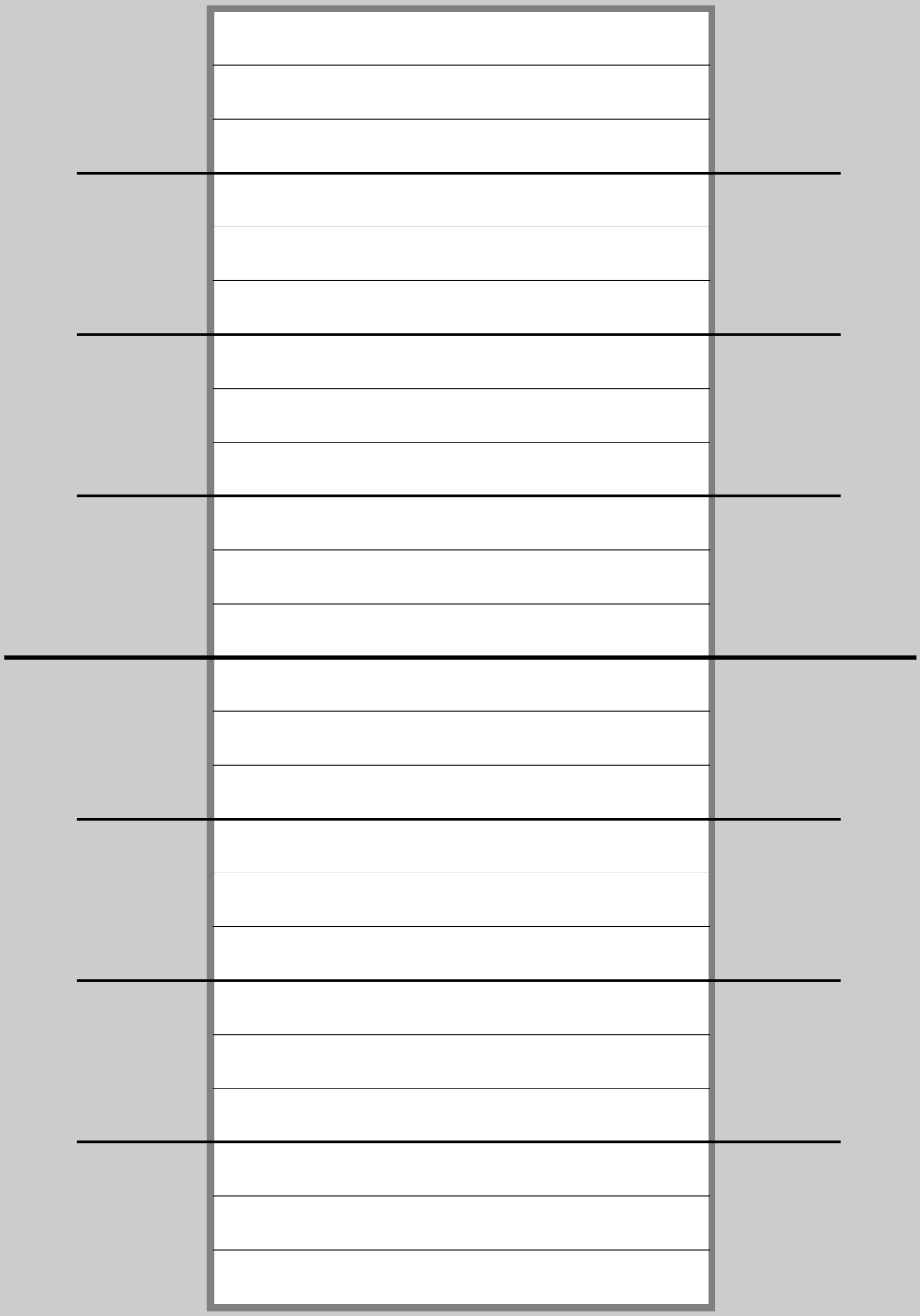
of the race plan is to decide what the things are that you want to be focusing on through the specific parts of the race. Once you know how you like to concentrate, and what makes you really stay in the present, you can fill in your ideal set of concentration cues for the whole race. Your job then is to see how effectively you can stay concentrated on these cues for the whole race. The concentration cues identify the process that you want to go through in order to produce the best outcome that you are capable of at that time. And, if you get the process right, the outcome will take care of itself. For those of you competing, I would recommend using the race plan approach and testing out how good your concentration abilities are. For those of you not competing, you can use the same principles to help you to identify the general kinds of things that you need to think about in order to have an enjoyable and effective work-out.

In time you will get better and better at concentrating your way through training sessions, and as a result you are bound to get more benefit. Your brain is going to want something to think about while you are rowing, so as often as is right for you, make sure you tell it what it needs to think about! There will be other times when you just want to switch off completely and let your body go through the work-out. Having time to just think about the day's events while your body gets a good work-out is a great stress relief, so if you need this kind of approach to thinking while you are on your Indoor Rower, make sure you take advantage of the time you schedule in for yourself!

Ideal Race Plan

Fill in the ideal concentration cues for you that will keep you focused on thinking the right things for you at the right time.

START



Think about what you need to think about!

Review... did you keep thinking the right things?

Building your Confidence/Monitoring Progress

Confidence with anything is the best kind of motivation. The more that you perceive that you are benefiting from something and growing in confidence, the more likely you are to keep doing that activity. Therefore, having set your goals, it is important you use these to help build your confidence as your fitness improves.

The key confidence tips are very simple ones, but maybe not as easy to stick with! First, it is really important to have a simple outlook that forces you to always value what you have achieved already. Too often, when people are exercising, they only see what they have not achieved, and how far they are from their end goal. If you have set your goals well, and are reviewing regularly, you will be giving yourself a great opportunity to be proud of the progress you have made on each of the days carried out so far, or evaluate your programme if you are not making progress. Make sure you keep looking back to see how far you have come, and really take pride in this. If you can maintain that outlook it will be much easier for you to approach the next session full of the confidence you have built from making such good progress to date. You should use all of the positives around you to help build confidence. Focus on when someone tells you that you are looking fitter; notice how much fitter you feel as you climb stairs; be aware of how good your body feels as a result of regular exercise; be confident that your body is in better shape than many of the people you know. All of these kinds of little things begin to add up over time. Within your training sessions, take confidence from the small steps forward you take - more distance covered in your usual time; feeling fitter even though you have produced the same scores; being more consistent in your rhythm when rowing. Again, there are many small things you can focus on, so make sure you pat yourself on the back for all of them.

As you set goals and achieve them, build a foundation of confidence. Don't just ignore the achievement of the goal - take the time to enjoy it! The more goals you can set, the more opportunity you have to build confidence.

Some people like to see progress, so you might want to keep graphs, or wall charts that show your progress over time, or how many metres you have rowed every week. Other people like to test themselves out from time to time with a specific session to see how far they have moved on. Whatever your preferred method of monitoring progress, make sure you do it! And importantly, work out how you have made the progress. If you know what you have achieved and how you have achieved it, then you should be confident that you can do more of the same. Simple ideas, simple to implement, but again you just have to build it in as part of your exercise time.

The more confidence you can take from your regular exercise, the more benefit you will get from your training programme, and many people report how they feel more confident in other areas of their life as a result of training regularly, so set yourself the challenge to see how far you can make your confidence epidemic spread!

Competition Specific Psychology - Performance Reviews

If you are training with the intention of competing, the psychology of racing is a critical performance influence that you need to consider. Your thoughts and feelings on the day of your race will certainly influence how effectively you are able to perform to your potential. Although there are a great many different elements of psychology that you can consider from a preparatory point of view perhaps the most useful element of racing psychology that you can engage in is that of reviewing your performance effectively.

Below you will see a very simple Race Review System that revolves around the idea that you need to answer the question:

"How well did I do what I said I was going to do?"

In order to be able to answer this question, you obviously have to have some intended targets for the performance in the first place. Without these, the question cannot be answered after you have completed the race. So, unless you are taking the goal-setting ideas and concentration cue ideas from earlier, and putting them into action for races, you will not be able to make use of the review section.

The importance of the review question cannot be overstated, as it really helps you to develop the idea that confidence needs to be all about "how much do I believe that I can put into action what I say I am going to do?". If you can answer this "100% belief" then you will truly be a confident competitor. You will be able to develop this belief over time by going through the goal-setting and performance reviewing process, so that more and more you will be able to decide on race strategies that play to your strengths, and you will be increasingly confident that you can race to your potential by identifying the right concentration and motivation cues for you.

Race Review System

Name: _____ **Event:** _____

Date: _____ **Competition** _____ **Start Time:** _____ am/pm

Finish Position: _____ **Finish Time/Winning Time:** _____

Environment: _____

Key Warm-up/Preparation Details: _____

_____

Key Race Objectives	Positive Outcomes	Negative Outcomes

Training pointers: _____

Future racing reminders: _____

Overall satisfaction level of performance (not result): _____ %

A very important part of the race review is to include a review of your preparation prior to the race. It is well accepted that consistent preparation for races will lead to consistent performances, so you need to learn from what you do before the race to make sure that you are able to do the right things before starting, as well as during the race. You should view your race as beginning a couple of hours ahead of the actual start time. If you can get in control, and stay in control of your preparation all the way up to the start time, then it is significantly easier to maintain this theme of being in control once you start to execute your race plan. So, make sure you review the whole race, and not just the result.

The review system helps you to focus on both the process of the race and the outcome of the race. It is important that you take your confidence from your ability to execute the process, and trust again that the outcome will take care of itself. If you review the process in detail, focusing on how well you did and what you said you were going to do, then you will learn much more about what influences your performance, and you will be able to identify the things that you need to focus on in training that will make a big difference next time around.

The positive outcomes and negative outcomes element of the review system are very simple concepts and also have some simple rules to guide their use. With the positive outcomes, make sure you list all of the positives that emerge. We tend to overlook many positive things in performance, and you should be looking to have your review heavily weighted in the positive direction. With the negative outcomes, these are usually easier to identify, but from a confidence and motivation perspective you need to ensure that you consider the negatives and make some strong decisions relating to what you will do to combat this negative happening again, or how you can make use of existing strengths to eradicate the problem totally. If you like, it is often useful to decide on positive action to take relating to the negative outcomes, and then discard the negative list totally. With this approach, you are only left with positive reminders of the performance, and positive action that you have taken to bring about improvements. Dwelling on negatives is unlikely to be a useful response!

As I have said before, these ideas are full of common sense, however, they are not easy to apply. If you are going to make the most of the review process, you do have to use it regularly, and really follow through with the things that you believe are most important to you. As you race more and more, the number of reviews that you will build up will become a really useful resource, and will help you learn the key lessons that will help you improve your level of performance as quickly as possible, but more importantly, help you to develop consistency in your racing performances.

The mental side of your racing and training is worthy of consideration. The Indoor Rower is a great way to develop mental fitness as well as physical fitness, so make sure you are getting the maximum benefit from it. Using a little mental effort will certainly help you enjoy the physical effort that much more!

Recommended Reading

- **Stephen J. Bull, John G. Albinson, Christopher J. Shambrook : *The Mental Game Plan: Getting Psyched for Sport***
  Sports Dynamics, 1996
  ISBN: 951954326

Section 10 :

Training Considerations

Ageing and Performance

By Harry Welsh

Physiological Decline

Irrespective of fitness level, physiological decline starts after maturity has been reached. For the highly trained athlete, however, the process can be held off until approximately forty years of age. These physiological changes take place in both the cardiorespiratory (CR) and cardiovascular (CV) systems and in muscular size and strength. There are other changes that will hamper performance but these are the ones dealt with here.

Respiratory Changes (cardiorespiratory)

The primary function of inspiration is to provide oxygen for the lungs to play their part in the cardiorespiratory process, while the purpose of expiration is to rid the body of waste products such as carbon dioxide. Within the lungs, a gaseous interchange takes place by way of the air sacs (alveoli). The efficiency of the lungs plays a vital part in aerobic endurance. The capacity of the lungs is physiologically divided into three areas:

- Residual air, which is air that is left in the lungs after full expiration.
- Tidal air, which is the ebb and flow of normal breathing.
- Vital capacity, which is the total amount of air that can be exhaled from full inspiration to full expiration.

With ageing the vital capacity of the lungs is reduced as residual air is increased. However, the total capacity of the lungs is not decreased, just the degrees of residual and tidal air. Between the early 20s and 50 years of age, the residual air within a person's lungs could increase from an average of 20% to around 30%, reducing the vital capacity of the lungs and consequently aerobic endurance. Other factors that reduce efficiency are to be found in the loss of elasticity in the lung tissue, and inflexibility of the rib cage. These changes contribute considerably to decline in lung function. For an inactive person, these changes are not detrimental to an ordinary life style.

In the case where regular endurance training is undertaken by the middle aged and older enthusiast, these losses are greatly reduced. There is only a slight decrease in pulmonary ventilation capacity in older endurance athletes. Some authorities consider that the losses in VO_2 max, as seen in older athletes could be, in part, the result of a reduction in the effectiveness of oxygen transportation, as with ageing, muscular tissue becomes less efficient in the extraction of oxygen.

Circulatory Changes (cardiovascular)

A notable feature of ageing is reduction in maximum heart rate (MHR). Irrespective of effort, the heart rate reaches a limit during exercise. The 220 minus age formula that is widely used for "guesstimating" MHR, can only be a rough guide, with a possible plus or minus of 15/20 beats per minute (bpm). A 60 year old would be estimated with a MHR of 160 bpm and work aerobically up to 80% of that (128 bpm), hence they would be working at a much lower heart rate than a 20 year old working at 80% of maximum (160bpm).

Reduction also comes about from the increased resistance offered by the peripheral blood vessels. Both the arteries and arterioles lose their elasticity and a reduction in their lumen (duct, or diameter). The circulatory system is responsible for the transportation of oxygenated blood to muscle tissue, and the removal of lactate from the tissues. Any deficiency in its function will adversely affect the aerobic level or oxygen uptake. Circulatory decline does equate with decline in endurance, with an estimated sedentary endurance rate loss of slightly less than 1% per annum, or 10% per decade, in sedentary people. The VO_2 max of the regular elderly trainer far exceeds that of the non-active person.

The elderly person who is actively engaged in exercise and training is not following a natural behaviour pattern; with ageing, the tendency is to reduce physical stress and effort. Animal studies confirm this inclination. Nonetheless, this deviation from the accepted pattern of activity does have a beneficial spin off in quality of life and health. Reactions to ageing that occur within the CV system affect the ability of the body to adjust the pressure within the arterial system. Inefficiency can result in restriction of blood flow to muscle tissue as can any restriction to the pumping action of the heart.

The heart is a muscle and responds beneficially to aerobic work. Though there are no claims for longevity, continued training into old age helps to delay considerably the onset of many of the problems that beset the aged and improves the quality of life.

Strength & Muscle Mass

With age there is a gradual decline in the ability to perform everyday tasks. Infirmity can be extremely physically demanding. One clear example of strength loss is weakness of the extensors of the knee joint, which results in difficulty in rising from a low seat and negotiating stairs. The increased participation in exercise groups and classes amongst the elderly does give rise to the assumption that they are becoming aware of the debilitating effects that inactivity in old age can bring. There is then much to be said for the continuation of exercise and activity in order to increase the quality of life.

Over the years there is a natural loss of muscle mass and a likely increase in subcutaneous fat (adipose tissue). Though a person may appear to have retained the same body weight, it is more possible that the balance between fat and muscle mass has changed. Weight training or progressive resistance exercise can be of great help in retaining a degree of muscle mass and tone in the middle aged and elderly.

Reduction in muscle mass can be viewed as being in two phases. The slow phase occurs between the ages of approximately 25 years and 50 years. This stage is hardly discernible in its early stages in those in hard training and the estimated loss is around 10%. The second stage is much more rapid, and by the age of 80 there is a possible 50% loss of muscle mass. Changes also occur between the fast and slow twitch fibres found in muscle tissue, with a loss of fast twitch fibres and an increase in the slow twitch fibres.

This change in the muscle composition helps to explain how performances requiring speed and reactions deteriorate with age. It could also explain the noticeable shift of the older athlete into sports and activities like distance running, rowing and swimming, where reaction and speed are not the prime requirement. Losses in muscle strength and mass are not confined to old age. Muscle tissue is highly elastic and will respond to use and disuse. This is seen in the disuse atrophy (decay) occurring after trauma, such as knee injuries and limbs encased in plaster. With judicious remedial treatment, losses can be rectified with recovery, success being relative to age.

Ageing itself does not prevent skeletal muscle gaining in tone and strength. Elderly people who take up regular training can and do show relatively good improvement. Regular training cannot completely eliminate age related losses, however, regular exercise and training can increase aerobic capacity and strength in the elderly. If practical proof of this was needed, the British and World Indoor Rowing Championships showcase elderly athletes who portray the benefits of continued exercise and training.

Training

A positive state of mind, and a considerable degree of self discipline and sacrifice may be required to adopt a fitness training regimen into old age. Providing one is physically sound, the benefits that can be accrued will be well worth the efforts. Quality of life is important at any age, but never more so than in old age. It is always prudent to have a regular medical check up and elderly participants in exercise and training must always be aware of their limitations, and constantly adjust aims and objectives.

VO_2 max decreases by 0.4ml/kg/minute/year on average. A man aged 25 who is at the peak of his fitness and weighs 80kgs has a VO_2 max of approximately six litres/min. If his weight remains the same and he continues to train, at the age of 50 his VO_2 max will have dropped to five litres/min. If, at his peak, his 2,000m best time is six minutes, this would fall to around six minutes 40 seconds by his 50th birthday as a direct result of the decline in VO_2 max.

This rate of decline is an average figure and includes sedentary people, but there are steps that can be taken to arrest decline. One of the first things is weight management. As explained above, muscle is lost through atrophy with increasing age. If you maintain your weight, then the ratio of body fat to muscle mass increases. Rather than just watching your weight, control your percentage body fat.

Muscle tissue burns oxygen while body fat reduces the VO_2 per kilo bodyweight. A correct nutritional calorie balance, which is adequate in carbohydrates and protein and low in fat, is essential (see Diet by Majorie Hagerman in Section 8 : Nutrition and Weight Management) and allied to strength retention (see Section 7 : Weight Training). Exercise is the best way to manage your percentage body fat.

Training still needs to be varied and should aim to cover all the energy systems from low intensity aerobic work, through lactate threshold training up to high intensity anaerobic workouts. It is also important to continue to carry out the core stability exercises (see Core Stability Training in Section 7 : Weight Training).

Older rowers should take care to maintain the wave training principle to reduce the risk of over-training whilst still looking for progressive increments. By sticking to non-weight bearing, non-impact exercises like the Indoor Rower you will reduce the risk of muscle and joint damage.

Training, Performance and the Menstrual Cycle

by Kareen Larkin

Women have always carried out heavy physical activity, but only relatively recently have they been allowed to compete in sporting activities to any great degree. As a result of this during the last 30 years increasing numbers of women have taken up regular participation in sport at a recreational and competitive level.

We have, thankfully, come along way from the times of Pausanias, 2nd century AD. He wrote 'On the road to Olympia…. there is a precipitous mountain with lofty cliffs…. the mountain is called Typaeum. It is a law of Elis that any woman who is discovered at the Olympic Games will be pitched headlong from this mountain.' Indeed women had a festival of their own at Olympia, Heraia, which were games held in honour of Hera. At these games there was only one event, the foot-race. Religious conservatism has been stated as the probable reason why no other competitions were ever introduced for women at Olympia, but by the Christian era, most of the major Greek Games incorporated women's events. Spartan women were said to have undertaken the same athletic exercises as boys, for the reason that tough, strong mothers were believed to produce good Spartan soldiers.

There were no female events at the first modern Olympiad in 1896, they were first included in 1900 with tennis. Since then there has been a steady increase in participation by women (zero women participants in 1896 to 4,069 in the 2000 summer Olympics). With this increase in participation from women the level of interest in the effects of the menstrual cycle on performance have also grown, and some of the earlier myths regarding detrimental effects of exercise on the female reproductive system have been dispelled.

The Menstrual Cycle

Girls tend to start their adolescent growth spurt around the age of 11 years, about two years before boys. Menarche (the beginning of menstruation) generally occurs between age 12 and 14.

A normal menstrual cycle varies between 23 and 35 days, the average being 28 days. The cycle represents a complex interplay of hormones and typically has three phases; the follicular phase where the follicle matures, the ovulatory phase in which the egg is released, and the luteal phase where the lining of the womb prepares for implantation of the fertilised egg. If implantation does not occur, the womb lining comes away and menstruation begins.

This cycle is regulated by luteinzing hormone (LH) and follicle stimulating hormone (FSH), secreted from the pituitary gland in the brain. This in turn is under the control of another pulsed hormone. Any disruption to this delicate balance of hormones can cause hypothalamic pituitary axis suppression (HPA) and result in oligmenorrhoea or amenorrhoea (irregular, or absence of, periods).

Menstrual Irregularities Associated with Exercise and Training

Menstrual abnormalities are extremely common in both athletic and non-athletic adolescents and women. Physically active females increase the likelihood of experiencing changes to their menstrual cycle such as delayed menarche (onset of menstruation), oligomenorrhoea (irregular menstruation occurring with only three to six cycles per year), and amenorrhoea.

Irregular menses have been reported to range from 1 to 66% among athletes, compared with 2 to 5% in the general population. The higher levels have been seen in groups such as distance runners. The wide

range of reported menstrual abnormalities stems from the different groups studied and the different criteria used to define the condition. Exercise related menstrual abnormality is linked with HPA dysfunction.

Many theories involving this hypothalamic pituitary axis suppression have been suggested as the cause of exercise-induced menstrual irregularities:

- Critical body weight.
- Critical body fat.
- Endogenous opioids.
- Nutritional deprivation.
- Rapid body weight changes.
- Training intensity/volume.

The interplay between nutrition, exercise intensity and volume, body mass index, and psychological stressors contribute to normal menstrual function. Individuals vary greatly in their ability to tolerate changes in these factors, which explains why two athletes of similar body composition may have different menstrual responses to the same training volume and diet, or why athletes of 'normal' weight may still experience menstrual dysfunction.

HPA is a diagnosis of exclusion i.e. other potential causes should be ruled out first. Apart from HPA suppression, other conditions that might cause oligomenorrhoea or amenorrhoea include pregnancy, thyroid abnormality, prolactinoma, polycystic ovary syndrome and premature ovarian failure.

Many athletes find that not having periods is convenient and may not be concerned about this. However, the lack of oestrogen associated with HPA suppression can lead to osteopenia and osteoporosis i.e. bone thinning. There is much evidence to show that bone mineral density directly correlates with the duration and severity of menstrual dysfunction. Therefore, if you suffer from menstrual abnormalities you should seek medical assessment and advice. This should include a thorough evaluation for the 'female athlete triad' i.e. amenorrhoea, osteoporosis and eating disorders.

Bone mineral density assessment should be considered for any athlete who has been amenorrhoeic for more than a year or has had a stress fracture.

Exercise related menstrual irregularity is not a reason in itself to stop training and regular exercise, however, it should trigger an evaluation of one's training schedule and diet. There are various treatment options depending on the abnormalities found, such as reducing training volume, increasing weight and maintaining an adequate energy intake until normal menses occur. Some studies advocate the benefits of the oral contraceptive pill.

Effects of the Menstrual Cycle on Training and Performance

The female sex hormones exert a range of physiological effects on many metabolic, thermoregulatory, cardiovascular and respiratory parameters that may influence athletic performance. For example, oestrogen has been shown to have:

- Effects on the cardiovascular system:
    - altered blood stickiness.
    - cholesterol level changes.
    - vascular smooth muscle changes.
    - regulation of substrate metabolism (body fuel).

- Effects on regulation of substrate metabolism:
  - increased liver and muscle glycogen storage and uptake - possibly increasing endurance performance.
  - glycogen-sparing through increased lipid (fat) production, muscle lipid breakdown, and greater use of free fatty acids.
  - decreased insulin-binding ability-decreased glucose tolerance and insulin resistance.
    i.e. Low levels of oestrogen (in the follicular phase) favour the break down of the muscle glycogen for high intensity training and racing, whilst high levels of oestrogen (in the luteal phase) favour fat burning, lower lactic acid concentrations and glycogen sparing. For this reason during the follicular phase high intensity work may feel slightly easier whilst long low intensity sessions may be more difficult. During the luteal phase long low intensity workouts may feel easier whilst high intensity workouts will feel harder. This does not mean that you should avoid long duration low intensity training during the follicular phase and high intensity training in the luteal phase but you should be aware that there is a reason that you may not feel as good as usual whilst training.

Other effects:

- Deposition of fat in breasts, buttocks and thighs.
- Increased blood pressure.
- Increased calcium uptake in bone.
- Changes in neurotransmitters (brain chemicals) - possible improved cognitive function and memory.

Progesterone has been shown to have the following actions:

- Increased core body temperature 0.3 to 0.5°C.
- Increased minute ventilation, and enhanced ventilatory response to low blood oxygen and high blood carbon dioxide i.e. During the week before menstruation and the week after ovulation increased levels of progesterone stimulate the brain's respiratory centre and cause an increase in breathing rate making exercise feel more strenuous, but not necessarily affecting performance.
- Post-ovulatory fluid retention via effects on the kidneys' hormone system.
- Actions on insulin receptors leading to peripheral insulin resistance.
- Metabolic effects, resulting in a greater dependence on fat as a substrate.

Although the above physiological effects have been shown to occur, results from studies so far varies, and there is, as yet, no convincing evidence that performance is significantly affected, positively or negatively, at any particular stage of the menstrual cycle. Some anecdotal evidence from athletes on differences in performance, particularly in the pre-menstrual or menstrual phases, has not been confirmed by scientific studies. World best performances have been recorded at all stages of the menstrual cycle.

Dysmenorrhoea (Painful Periods)

Painful periods is a common phenomenon, most prevalent in the teenage years and later 30s age group. For most women the symptoms are mild and easily treated with the use of simple painkillers if needed. For some women the painful cramps, and often heavy blood flow, can adversely affect training or competition. There are beneficial treatment options available that can be discussed with your doctor.

The Pre-Menstrual Syndrome (PMS)

'The presence of emotional and/or physical symptoms occurring cyclically, commencing some days prior to menstruation and disappearing with the onset of menstruation', may include anxiety, depression mood swings, headaches, fluid retention, breast soreness/enlargement. Exercise may indeed reduce the severity of PMS. These should be discussed with your doctor and careful consideration of the International Olympic Committee (IOC) list of prohibited substances should be adhered to if training and performing at a high level.

Manipulation of the Menstrual Cycle

Those women/competitors who are, or perceive that they are, adversely affected by the pre-menstrual or menstrual phases may wish to manipulate the menstrual cycle to avoid that stage of the cycle coinciding with a major event. This should really be reserved for major events. This can most effectively be done using the oral contraceptive pill in a particular pattern, under the guidance of a doctor.

References and Recommended Reading:

- **G Harmon Kimberly MD, *Evaluating and Treating Exercise-related Menstrual Irregularities***
  The Physician and Sportsmedicine 30 (3):, 2002
- **RJ Frankovich and CM Lebrun, *Menstrual Cycle, Contraception, and Performance***
  Clinical Sports Medicine 19 (2): 251-271
- **K Bennell, *The female athlete***
  Clinical Sports Medicine by P Brukner and K Khan
  McGraw-Hill Education - Europe
  ISBN: 0074711083
- **Judith Swaddling, *The Ancient Olympic Games***
  British Museum Press, 1999
  ISBN: 0714121614
- **Elzi Volk, *Planet Estrogen Part III: The Menstrual Cycle and Athletic Performance***
  http://www.thinkmuscle.com/articles/volk/planet-estrogen-03.htm

Training During Pregnancy

by Kareen Larkin

Many pregnant women enjoy regular exercise/training in pregnancy and, for most women, regular exercise during pregnancy is beneficial. The majority of pregnancies are normal. As a general rule, regularly exercising women are able to continue exercising at a mild or moderate level during pregnancy as long as the pregnancy is uncomplicated. The information in this section is carefully researched but does not replace the need for personal guidance from your physician or midwife who know your medical and obstetric history. This is very important, as there are some risks as well as benefits of exercise in pregnancy, and exercise is not recommended for women with serious or potentially serious complications of pregnancy. Some examples of the conditions that are "absolute" contraindications to exercise are; active heart disease, uterine bleeding/ruptured membranes, high blood pressure, history of pre-term labour, incompetent cervix/cerclage, intrauterine growth retardation and suspected foetal distress. Some examples of the conditions that are "relative" contraindications to exercise in pregnancy are; anaemia, thyroid disease, diabetes, excessive obesity or excessively underweight, breech presentation in the last trimester. Relative contraindication means that after full medical assessment of the individual case patients may be engaged in medically supervised exercise programmes.

Some examples of risks/theoretical risks of maternal exercise to the foetus (baby) are:

- Direct trauma to the foetus. This is very rare. Contact sports should be avoided.
- Changes in foetal heart rate may occur in response to exercise, depending on the stage of pregnancy, and the exercise intensity, duration and type. This may relate to decreased uterine blood flow during exercise, causing blood to be shunted away from the foetus to the working muscles. The clinical significance of these changes in foetal heart rate observed is uncertain.
- Intense exercise by the mother during pregnancy has been noted in some studies to result in a small decrease in average birth weight of their babies. There are no reports of any adverse outcomes on pregnancy.
- There is a "theoretical" risk of premature labour associated with the level of certain hormones causing uterine irritability, but these have not been seen in practice.
- One particular area of concern for the health of the foetus is hyperthermia (overheating). Data on animals has shown abnormalities with maternal core temperatures above 39°C. Some studies in humans however have shown an increase in the incidence of neural tube defects (early developmental abnormalities) with maternal high fever. This goes along with the general pregnancy advice of avoiding saunas, steam baths, hot tubs etc.

Risks of exercise to the mother include:

- Prolonged standing, or exercising in the supine position (lying on ones back), can lead to hypotension (low blood pressure).
- There is a potential increase in susceptibility to musculoskeletal injuries such as lower back pain. Relaxin, a hormone produced in pregnancy, loosens ligaments and this, along with an alteration in the centre of gravity and an increase in the lumbar lordosis (arch in the lower back) that occurs in pregnancy, predispose to this problem.

Research has shown the following benefits are common:

- An improved general physical and psychological well being in the mother.
- Women who exercise prior to pregnancy and continue to do so in pregnancy weigh less, gain less weight and deliver slightly smaller babes than sedentary women.
- The discomfort of pregnancy and labour may be more easily handled.
- It may be easier to get back into pre-pregnancy shape and weight after the birth.

Once you have the all clear from your doctor to exercise the following guidelines should help you to ensure that no damage to mother or baby occur whilst training.

Remember there will always be time to do another 2,000m test after the pregnancy. If you need time off take it - there is nothing more important than the safety of mother and baby. Not even your result at BIRC!!!

General Guidelines

- Drinking plenty of fluids is very important during pregnancy and especially during the first trimester. The baby has no way to control its own temperature so over heating should be avoided at all cost. This can be done by ensuring adequate hydration and avoiding training in hot humid conditions. Remember that if swimming you still sweat but might not notice, so stop regularly to rehydrate.
- For women who trained regularly before pregnancy regular exercise is preferable to sporadic sessions. As a general rule, mild to moderate exercise for 20 to 40 minutes, three times a week, at a heart rate up to approximately 140 beats per minute, has been recommended. Prescriptive guidelines however can be unhelpful (producing frustration, rebellion and guilt in many physically active women), and now it is generally considered as important to encourage pregnant women to modify the intensity of their exercise according to their own feelings of fatigue. Exhaustive exercise should be avoided. Unfortunately, there is a lack of clear scientific evidence to rely on at higher exercise intensities and further research is needed. Pregnancy is not the time to commence anything other than a very mild exercise programme (those serious athletes who wish to continue intense training should be individually and carefully counselled as to the best approach for them).
- You should always be aware of the reduced oxygen availability during pregnancy and moderate your training accordingly. We recommend using a heart rate monitor to ensure the correct intensity, and not to rely on your pre-pregnancy pace as a guide. Above all, even if your heart rate appears to be within your normal range, listen to your body and stop exercising if you do not feel comfortable.
- Pregnancy requires approximately an extra 300 calories per day. These requirements are greater for women who exercise regularly. This should be carefully observed and training should be stopped if there is an insufficient weight gain (less than 1kg per month) during the last two trimesters.
- Avoid exercise where a loss of balance or physical contact could occur, especially in the third trimester.
- Dress for exercise wearing loose fitting clothing, with a good support bra and comfortable shoes. You can keep the one-piece row-suits in the cupboard for a few months!
- Avoid exercising in the supine position (on your back) after the first trimester since this is the time that the uterus grows out of the pelvis and this position causes the uterus to weigh down on the vena cava so reducing the blood and oxygen flow to the baby.
- Non-weight bearing exercise like swimming, cycling and indoor rowing are recommended, but, if doing weight bearing exercise, avoid bouncing and jerking exercises and deep knee bends as the

hormone relaxin released during pregnancy softens the ligaments and this can increase the likelihood of injury. For the same reason, be careful when stretching during warm up and cool down, especially avoiding excessive and ballistic stretches.

- Avoid standing stationary for long periods of time.
- Weight training may be continued by experienced athletes but avoid heavy weights. Concentrate more on high repetitions with low weights. Avoid the valsalva manoeuvre (holding breath until half way through the lift) at all times.
- Exercising at altitudes of greater than 3,000m (10,000ft) may be unadvised, as rates of pregnancy complications are higher, and birth weights are lower, at high altitudes. In comparison, there have been no reports of problems associated with exercise at moderate altitudes.

Indoor Rowing

If you are a regular user of the Indoor Rower pre-pregnancy there is no reason why you should not continue rowing throughout your pregnancy, subject to the following guidelines:

- Be aware that as your pregnancy progresses you will need to re-evaluate your goals - more in line with staying fit than trying to work towards a personal best.
- Be particularly careful with the intensity of your workouts in the first and last trimesters. For example, whilst Professor Clapp (see below) concludes that continuing aerobics and running during the first trimester does not increase the incidence of miscarriage, it is important to remember that, to some degree, indoor rowing utilises the abdominal muscles. Given this crucial time in the development of the foetus, it is therefore vital that the rower adopts the correct technique, utilising predominately the leg muscles with less emphasis on the upper body and abdominal region. If in doubt ask a Concept 2 instructor or personal trainer to review your technique.
- In relation to training throughout pregnancy Professor Clapp recommends stationary cycling, swimming and walking but he suggests that other forms of exercise are either contraindicated, or require modification. Indoor rowing would fall into the latter category and, apart from ensuring correct technique, the appropriate modifications could involve the lowering of your damper setting/drag factor to a minimum and, as above, ensuring that there is a minimum amount of stress placed on the upper body/abdominal region at the conclusion of the Drive phase of the stroke.

Warning Signs

Stop training immediately and seek medical advice if you experience any of the following symptoms:

- Vaginal bleeding or leaking of amniotic fluid.
- Swelling of the ankles, hands or face.
- Persistent headaches or visual disturbances.
- Shortness of breath when not exercising.
- Dizziness, faintness, pins and needles or numbness.
- Nausea and vomiting.
- Excessive fatigue.
- Palpitations or chest pains.
- Persistent contractions (more than six per hour) or unexplained abdominal pain.

Post-Delivery

Pre-pregnancy exercises should be resumed gradually and gently after birth, based upon your doctor's advice and your physical capabilities. The body changes that occur during pregnancy take time to return to normal, so care should be taken, particularly in the first six weeks after delivery. Breast-feeding women should take care regarding adequate fluid and calorific intake (breast feeding requires an increased calorific intake of approximately 500 calories per day). In relation to caesarean birth, current medical opinion would suggest that you do not resume gym-based activity until you have been given the all clear from your medical practitioner at your six to eight week check up, weight training may be deferred for longer.

Recommended Reading

For more information please see the following websites and publications:

- **American Collage of Sport Medicine, *www.acsm.org***
- **James F Clapp, *Exercising through your Pregnancy***
  Addicus Books, 2002
  ISBN: 1886039593
- **Dr Karen Nordahl, *Fit to Deliver: Prenatal Fitness Program***
  Fit to Delivery Intl, 2000
  ISBN: 0968730507, and
  Warne Books, 1999
  ISBN: 0446673986
- **Thomas W Hanlon, *Fit for Two; the Official YMCA Prenatal Exercise Guide***
  Human Kinetics, 1995
  ISBN: 0873228286
- **Renee Garrick (Foreword), Greg Waggoner, Doug Stumpf, *From Baby to Bikini: Keep Your Midsection Toned Safely During Pregnancy and Flatten Your Abdominals Fast After You Have Your Baby***
  Warner Books, 1999
  ISBN: 0446673986
- **Kim Bennell, *"The Female Athlete" in***
  P Brukner P and K Kaln, *Clinical Sports Medicine*
  McGraw Hill Education - Europe, 2002
  ISBN: 0074711083
- **Carl DeCrée, *Safety Guidelines for Exercising During Pregnancy in***
  The Lancet
  Volume 351, Issue 9119
  Page 1889

Adaptive Rowing

Concept 2 can now provide a range of products to help disabled rowers use the Indoor Rower, including the Adapt 2 Row Seating System. The two types of seat allow rowers with a range of disabilities, from those who require a little more support than the standard seat can offer to those who require full postural support, to exercise on the Indoor Rower.

Adaptive rowing, both on-water and on the Indoor Rower, has grown in popularity greatly in the last decade and in 2002 for the first time the World Rowing Championships incorporated adaptive rowing events. Indoor rowing is a fully inclusive sport and, while the British Indoor Rowing Championship does not have separate adaptive categories, a wide range of disabled athletes regularly compete.

Training Opportunities

For anyone interested in or currently working with people with physical, sensory and learning impairments the YMCA Fitness Industry training programme offer a course - 'Exercise & Fitness for Disabled People'. This is a 3 day course covering general disability awareness training.

Further details may be obtained from:

Customer Service
YMCA Fitness Industry Training
111 Great Russell Street
London WC1B 3NP

Telephone: 0207 343 1850

Section 11 :

Training Interruptions & Holiday Training

Training Interruptions

A training programme is a map that guides you from where you are physiologically to where you want to be. Like any journey there is more than one way to get to your destination. Training programmes are written in advance and are designed to elicit an appropriate response, but in all programmes there is an element of guess work. Don't regard the programme as cast in stone. If you depart from it don't be discouraged or tempted to give up as, within reason, lost time can be recovered.

Illness

If you have lost time through illness and it has required you to see a doctor then you should resume training under his/her guidance. If you were just under the weather with a cold, once your resting heart rate (RHR) has returned to normal, complete two days of general low intensity training and, if there are no bad reactions, pick up the programme as if there had been no break.

Injury

If you have lost time because of injury you must resume training under the strict supervision of your doctor or physiotherapist. You should not take it upon yourself to resume training as you may aggravate the injury and lose more time.

Holiday

If you lose up to two weeks training due to holiday or other commitments your training programme can be picked up again at the appropriate point, as you will actually have lost little or no fitness during that time. For example, if you take a two week holiday after week 5 of a 12 week pre-competition programme, pick up on week 7 when you return. If you train just three times a week and miss one session you should make it up. However, you must not try to make up more than one or two missed training sessions as you will not have enough rest and recovery days to allow your body to adapt to the exercise. You should just carry on your programme as though there has been no break.

After three weeks lost training complete two days of general low intensity training then pick up the programme as if there had been no break. After four or more weeks lost training you should consider starting your programme again.

Holiday Training

Many people like to continue their training regime while away on holiday and as a result some hotels have a fitness room available. However, if you would like to continue training but there are no facilities available, here are some tips that you may find useful.

First of all, if you are going on a normal two week holiday, then the loss of fitness will range from none at all to very little indeed. However, there is a psychological element that in some requires them to continue to train. They can suffer a loss of confidence that is as important and will have the same effect as a real loss of physical performance.

The first thing to do is to look at what is available. All hotels have an emergency stairwell and this can be the first piece of training equipment.

Stair climbs can be used in two ways, firstly as an aerobic exercise. Divide the stairs into flights and climb the stairs one step at a time. Run up and down one flight then up and down two flights and so on until you get to the top floor. If you book into a skyscraper, stop after 30 minutes.

As a strength exercise, climb the stairs two or three steps at a time making sure you do not support your legs with your hands.

There are a number of strategies that can be employed to maintain fitness when away from your normal training environment. The first is proper preparation. In the last few days before travelling we would recommend that you increase your training load by a factor of one and a half to three depending on how much you feel you can cope with. The advantage of this is that you are then in a position to take a good break of up to four to five days of complete rest. This serves two purposes. It allows you to settle into your holiday and also allows your body to settle into the new time zone, eating habits and lifestyle without adding the extra stresses of training. This four to five day break should also help prevent catching any illness from the plane. Airplanes are notoriously unhealthy places, as there are hundreds of people in an enclosed space breathing the same recycled air, often for hours at a time, so any infections are easily transferred between people. A few days of complete rest should allow you to stave off these infections and leave you healthy for the rest of your holiday.

After your four to five days of complete rest it is time to start training. The focus of this training is not to improve your strength, CV fitness or anaerobic threshold, rather to simply keep your body ticking over and not losing any fitness. There are three sessions set out below. Choose the one that is most suited to you or rotate between them to give some variety.

The Three Circuits

Prepare for your training session as usual with a warm up followed by stretching.

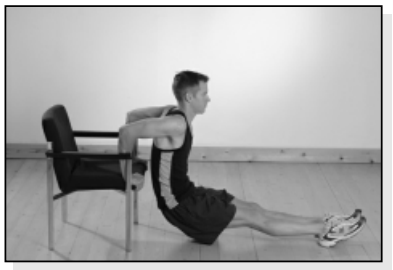
Circuit 1

If there are twin beds, or a chair, then they can form the second piece of exercise equipment.

Table 11.1

Circuit 1 - Suggested Bedroom Circuit		
Exercise	**Reps**	**Sets**
Triceps Dips	20	3
Dorsal Raise	30	3
Inclined Press Up	20	3
Crunchies	30	3

Tricep Dip

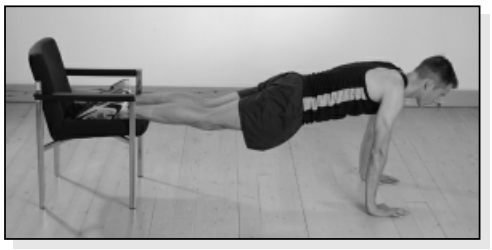


Method: Place your heels on the floor and support yourself with your hands behind you on either a chair or the side of the bed. Lower your body slowly until your upper arms are horizontal, keeping your legs straight. Return to the starting position. To make this more difficult put your feet on another chair or bed.

Dorsal Raise

Method: Lying on your front on the floor or bed raise your feet and chest, hold for three seconds and then lower slowly. To make this less difficult put your hands behind your back. To make it more difficult hold your arms straight in front of you.

Inclined Press Up



Method: Place your feet on a chair or bed and hands on the floor underneath your shoulders. Lower your chest slowly to the floor keeping your body straight. Straighten your arms to return to the start position.

Crunches

Method: Lay on the floor on your back, holding your calves horizontal and at right angles to your thighs. With your arms crossed on your chest lift your shoulders off the ground, then return slowly to the starting position. To make this easier put your arms by your sides. To make it more difficult hold your fingers to your temples, but do not pull on your head or neck with your arms.

These exercises do not involve any impact and so should not bother other guests.
One set consists of 300 exercises at the end of which you rest until your pulse rate drops to around 140, then repeat.

Circuit 2

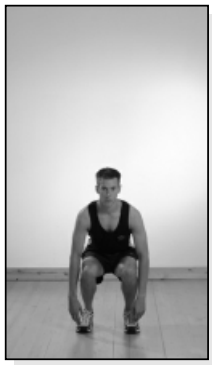
This is another body weight circuit that does not need any equipment and very little room and is good for general fitness as it involves most major muscle groups.

Table 11.2

Circuit 2		
Exercise	**Reps**	**Sets**
Star Jumps	20	3
Press Ups	20	3
Sit Ups	30	3
Burpees	30	3

The format is the same as the bedroom circuit.

Star Jumps


Method: Start in a standing position, squat down until you can touch the floor then in one action jump into the air opening your arms and legs into a star. You should land with your feet together and hands by your sides ready to start again.

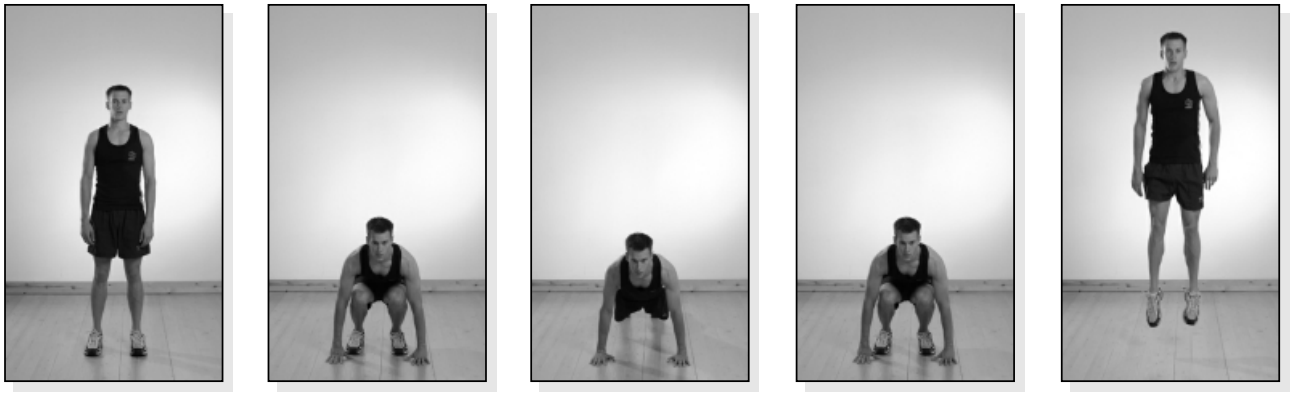
Press Ups


Method: Start lying on your front with your palms below your shoulders, fingers pointing forwards and on the balls of your feet. Straighten your arms keeping your trunk in a straight line. Return to starting position.

Sit Ups

Method: Lie on your back with your feet flat on the floor and your arms crossed on your chest. Lift up your shoulders and back until your body is off the floor. Return slowly to the starting position.

Burpees



Method: Start standing, squat down and place your palms on the floor with your fingers pointing forward. Straighten your legs, taking your weight on your hands until you are in a press up position. Bring your legs back so your feet are between your hands, then jump as high as you can into the air.

Circuit 3

The third circuit is separated into two sections, a lower body section and an upper body section.

Lower Body

If your hotel has stairs then this is ideal for you. Counting the stairs it takes to get from one floor to the next as one flight, climb 20 flights as fast as possible. This may mean going up two flights and then down to repeat. This is very hard work but instead of stopping it is recommended that you simply turn and go downstairs if you feel you cannot carry on.

Note: the speed that you do this session should be determined by your fitness, not your bravado. If you need to take a break do so, but make it active recovery by walking down stairs as you do.

If you do not have access to stairs you can replace the stair climbing with the following circuit.

Table 11.3

Circuit 3 - Lower Body		
Exercise	**Reps**	**Sets**
Star Jumps	15	4
Squat Thrusts	15	4
Lunges (each side)	15	4
Burpees	15	4

This rotation should be repeated four times as continuously as possible.

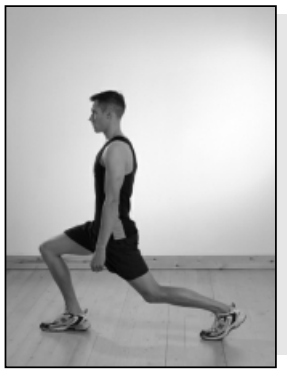
Star Jumps

Method: Start in a standing position, squat down until you can touch the floor then in one action jump into the air opening your arms and legs into a star. You should land with your feet together and hands by your sides ready to start again.

Squat Thrusts

Method: Start squatting down with your feet between your hands. Take your weight on your hands and straighten your body to the press up position. Bring your feet back between your hands.

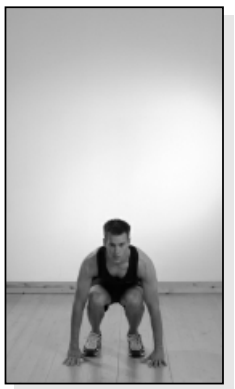
Lunges

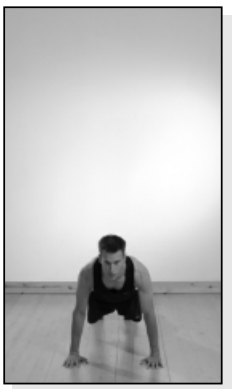


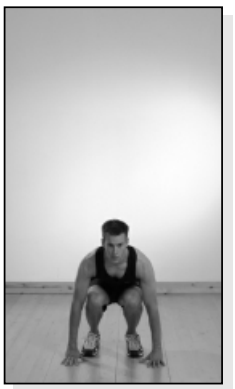
Method: Start standing with your weight evenly on both feet. Step forward with one leg and bend the front knee, keeping your back vertical. Then straighten the front leg, returning to the standing position.

Note: when starting this exercise begin with small steps until you are familiar with the action.

Burpees







Method: Start standing, squat down and place your palms on the floor with your fingers pointing forward. Straighten your legs, taking your weight on your hands until you are in a press up position. Bring your legs back so your feet are between your hands, then jump as high as you can into the air.

Upper Body

This is a circuit of body weight exercises.

Table 11.4

Circuit 3 - Upper Body		
Exercise	**Reps**	**Sets**
Press Ups, Normal Grip	25	4
Sit Ups	25	4
Triceps Dip	25	4
Dorsal Raise	25	4
Press Ups, Close Grip	25	4
Crunches	25	4
Angels (each side)	25	4

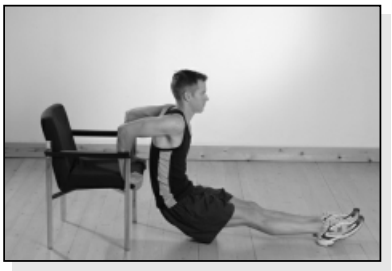
Press Ups, Normal Grip

Method: Start lying on your front with your palms below your shoulders, fingers pointing forwards and on the balls of your feet. Straighten your arms keeping your trunk in a straight line. Return to starting position.

Sit Ups

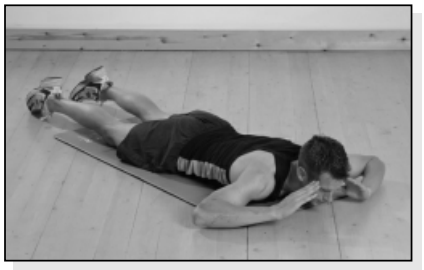
Method: Lie on your back with your feet flat on the floor and your arms crossed on your chest. Lift up your shoulders and back until your body is off the floor. Return slowly to the starting position.

Tricep Dip



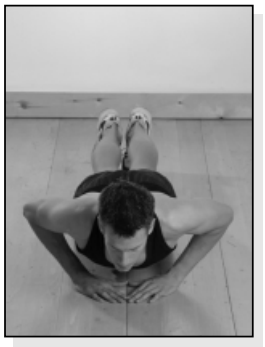
Method: Place your heels on the floor and support yourself with your hands behind you on either a chair or the side of the bed. Lower your body slowly until your upper arms are horizontal, keeping your legs straight. Return to the starting position. To make this more difficult put your feet on another chair or bed.

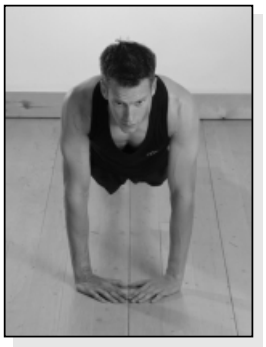
Dorsal Raise

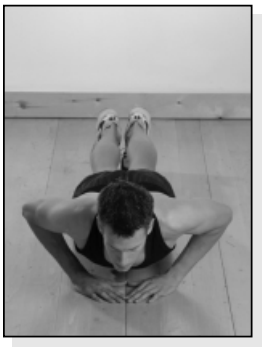


Method: Lying on your front on the floor or bed raise your feet and chest, hold for three seconds and then lower slowly. To make this less difficult put your hands behind your back. To make it more difficult hold your arms straight in front of you.

Press Up, Close Grip







Method: Start lying on your stomach, resting on the balls of your feet. Your hands should be under your chest, the thumbs and forefinger of each hand making a diamond. Straighten your arms keeping your trunk in a straight line. Return to starting position.

Crunches

Method: Lay on the floor on your back, holding your calves horizontal and at right angles to your thighs. With your arms crossed on your chest lift your shoulders off the ground, then return slowly to the starting position. To make this easier put your arms by your sides. To make it more difficult hold your fingers to your temples, but do not pull on your head or neck with your arms.

Angels

Method: Start lying on your front and raise the opposite arm and leg, trying to keep hips and lower back as still as possible. Return to lying flat then repeat using the other leg and arm. Alternatively this can be done in the four point kneeling position as shown in Section 7 Core Stability.

This circuit should be repeated four times.

Complete this session with a cool down of light intensity exercise like jogging or a swim followed by stretching.

As your body's ability to complete the circuit improves you can progress from one circuit to one and a half to two and so on until you are doing 40 to 60 minutes of exercise.

It is recommended that you do this session a few times before going on holiday as you will probably feel sore after the first few times you do it.

Frequently Asked Questions on Injuries

answered by Terry O'Neill

I have recently injured my shoulder swimming front crawl. Will using the Indoor Rower aggravate my injury?

Unfortunately, it is impossible to tell whether using the Indoor Rower will aggravate your injury without knowing exactly what it is. If you are being treated you should seek advice from your physiotherapist but you should note that the rowing action is very different from the arm action when swimming front crawl. If you are given the all clear to train from your physiotherapist then you should proceed cautiously, starting with 15 minutes of gentle rowing, stopping immediately if you feel any twinges. If you manage 15 minutes without any problems then you should add five minutes per day until you are up to one hour. You may then begin to increase the intensity of the sessions.

I have trapped a nerve in my back and have had to stop rowing. How and when should I start training again?

When you injure your back in this way the muscles surrounding the area go into a spasm and immobilise the area. This spasm often continues after the problem has been cured and becomes a problem in itself. If you have been seeing a doctor or physiotherapist then you should seek their advice about when to begin training again. When you are able to start again you should follow a recovery programme. This will involve starting with ten minutes a day and building up slowly as long as there is no associated pain.

What sort of exercise regime do you recommend for a 39 year old indoor rower who is not overweight and, for a variety of reasons can only usually exercise once a week? My main aim is to avoid physical atrophy.

A one day a week training programme has many limitations. One of the laws that applies to training is reversibility. This means that any improvement that you acquire as a result of training leaves you when you stop training. Therefore, on day one you train, on day two you recover and then on day three you have adapted to training and are ready to train again. If you don't then train you begin to lose the training benefit over the next four days until you train again, meaning that the overall benefit is small. If at all possible you need to come up with two more sessions a week. Even if they only add up to a further hour of training the effect will be much greater.

I am recuperating after heart surgery and my physiotherapist has recommended the use of the Concept 2 Indoor Rower as it will give the best workout with the least stress. What sort of training would you suggest?

When recovering from an operation it is very important to heed the advice of your physiotherapist and doctor who should be able to recommend a training regime that is designed to suit your individual needs, and will cater for your physical limitations. The main recommendation is that you do not over do it. It is a long process returning to fitness after an operation and it should not be rushed.

With the agreement and supervision of your medical team we would suggest a low intensity programme as laid out in Weight Management in Section 8 : Nutrition and Weight Management.

Section 12 :

Tests

Baseline Tests

Whatever your training goals you will want to know how you are progressing. A simple way to keep a check on your progress is to do some baseline tests at regular intervals during your training. Every two or three months is generally sufficient, though you may wish to update information more frequently, say every six weeks.

Outlined below are a series of monitoring tests. The first four can be done by anyone who is in good health and reasonably fit, but Test 5 - The Step Test is very demanding and intended for those who are fit and in serious training for competition. There are also a series of physiological tests that can be used to monitor training. These can be found in Physiological Tests in Section 3.

Test 1 - Check Your Heart Rate

Record your resting heart rate (RHR) first thing in the morning before you get out of bed. As your fitness improves, your RHR should progressively come down. A sudden increase of around five to ten beats per minute could signal the onset of illness before other symptoms appear. It may also indicate that you may not be coping well with the training load. In this instance, suspend training and seek professional advice.

Test 2 - Timed Pieces

Select a set piece - time or distance (i.e. four minutes or 1,000m) - and record your performance as indicated on the Performance Monitor. Intervals of no less than six weeks are recommended between test pieces.

Test 3 - Anaerobic Capacity Test

This is a 20 second test which monitors the ability of the athlete to produce a lot of power in a short period of time. Set the damper at 5, the monitor on 20 seconds and row at maximum power and high rate. Record the distance covered.

Test 4 - Maximum Power Test

This is a five stroke test which measures the peak power produced. Set the damper at 5, the monitor on 500m Pace and build the intensity and stroke rate over three strokes, then row at maximum power and speed for five strokes. Record the fastest pace (lowest 500m split). Make sure you row full length strokes during this test.

Test 5 - Step Test (for competitors only)

This is an incremental step test used to determine the athlete's current anaerobic threshold. It is physically **very** demanding, but does give a lot of information. You will need a heart rate monitor linked to the Indoor Rower.

Step Test

Test Protocol

For any given load, there is an energy cost known as the metabolic equivalent, measured in Mets. An increase of 25 watts on the Indoor Rower is approximately equivalent to one Met and will bring about an increase in oxygen consumption of 3.5ml/kg/min.

The steps used for this test are displayed in Table 12.1 in terms of Pace/500m and approximately relate to 25 watts/1 Met increments. The test consists of five four minute pieces, each rowed at a consistent 500m pace. The load is increased for each step as shown in Table 12.1.

The first four minute step should be set at a level which will allow you to complete the four minutes comfortably with no signs of distress. Rest for 30 seconds between each step and record the details as illustrated in Tables 12.2 and 12.3. Note: if the monitor is set for four minutes work and 30 seconds rest, all information is stored for recording at the end of the test (see The Performance Monitor in Appendix). During each step, the heart rate will rise, but should stabilise after around three minutes. This is called steady state.

In subsequent tests, improvement in endurance is indicated when you find that your heart rate is lower for any given step; your heart is doing less work for the same pace/effort.

Table 12.1

Model C 500m Pace/Watts Conversion Table												
500m	4:01.0	3:11.3	2:47.1	2:31.8	2:20.9	2:12.6	2:06.0	2:00.5	1:55.9	1:51.9	1:48.4	1:45.3
Watts	25	50	75	100	125	150	175	200	225	250	275	300
500m	1:42.5	1:40.0	1:37.7	1:35.6	1:33.7	1:32.0	1:30.3	1:28.8	1:27.4	1:26.0	1:24.7	1:23.6
Watts	325	350	375	400	425	450	475	500	525	550	575	600

How to Select Steps for the Step Test

To determine the appropriate start level, you will need to know your current 2,000m time. Using Table 12.1, select the nearest step to your 500m split time for 2,000m. To determine your Step 1, count back six steps. After rowing 4 minutes at Step 1 move up to the next step, and so on, until Step 5 which should be performed flat out to elicit a predicted 2,000m time. If your 2,000m time is slower than 9:30 you must select 4:01 as your Step 1 as this is the lowest starting point for the Step Test.

The following is an example of an athlete who rows 2,000m in 6:32. Average 500m split = 1:38. Nearest split below this figure is 1:39. Starting level (Step 1) is six steps back = 1:59. Step 2 = 1:54. Step 3 = 1:50. Step 4 = 1:47 (just above anaerobic threshold). Step 5 is done flat out to give a predicted 2,000m time.

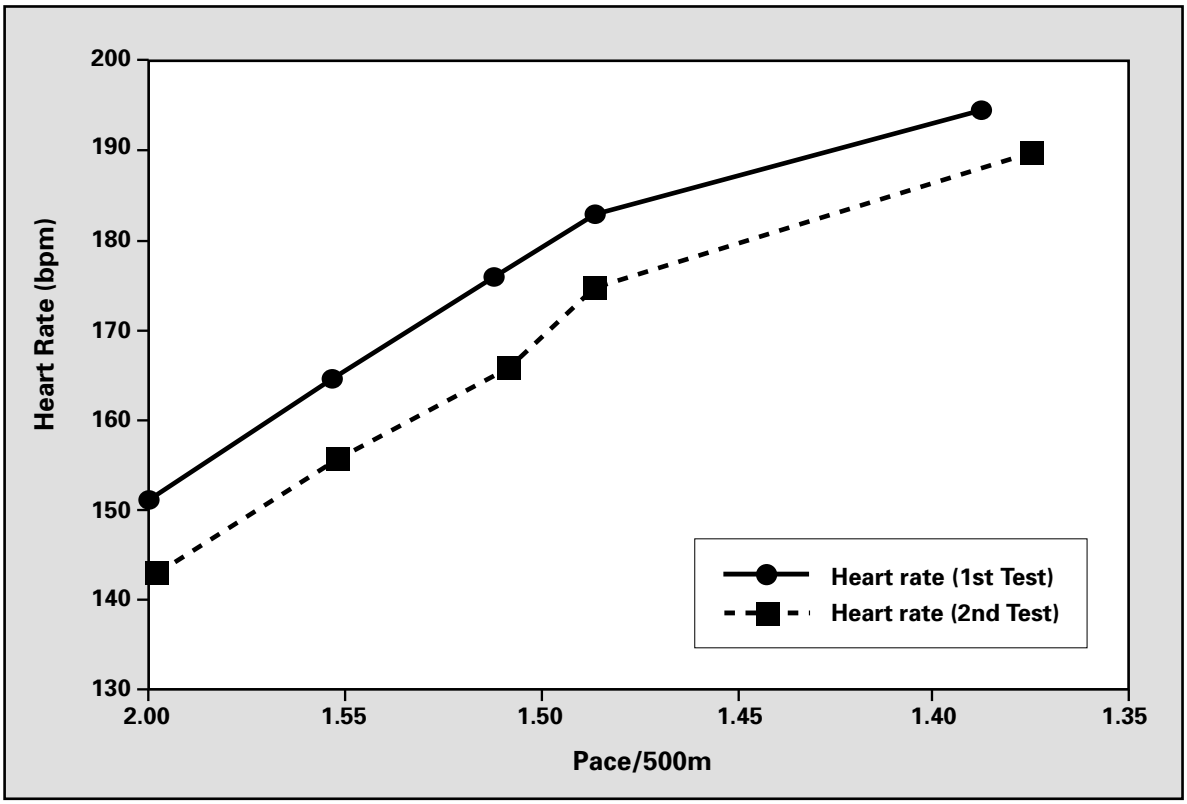
Table 12.2

First Test Results					
Date: 18th Nov	**Step 1**	**Step 2**	**Step 3**	**Step 4**	**Step 5**
Set Pace/500m	2:00.5	1:55.9	1:51.9	1:48.4	MAX
Distance (m)	1000	1035	1074	1107	1221
Stroke Rate (spm)	23	24	25	26	31
Heart Rate (bpm)	151	165	177	183	194
Actual Pace/500m	2:00.0	1:56.0	1:51.8	1:48.4	1:38.2

Table 12.3

Second Test Results					
Date: 23rd July	**Step 1**	**Step 2**	**Step 3**	**Step 4**	**Step 5**
Set Pace/500m	2:00.5	1:55.9	1:51.9	1:48.4	MAX
Distance (m)	1001	1037	1076	1108	1232
Stroke Rate (spm)	22	24	25	25	32
Heart Rate (bpm)	143	154	166	175	189
Actual Pace/500m	1:59.9	1:55.8	1:51.6	1:48.4	1:37.4

The graph below shows how the plotted line for the second test indicates heart rate is lower at each point. This indicates that the training programme has had a positive impact in terms of increasing the athlete's ability to perform at a lower heart rate for a given work load.



Frequently Asked Question on the Baseline Test

answered by Terry O'Neill

Should I look to carry out a baseline or step test before starting a new cycle of training?

It is always a good idea to take a baseline test at the start of a programme to see where you are. However, there are a couple of things you need to take into consideration.

If you are starting from scratch then the baseline data is relevant. If you are pretty fit at the moment and have competed recently you may find that the training in the preparation period may actually cause a drop in your test performance. This is nothing to worry about and is a reflection of the high intensity work completed recently. What you are doing is going back to basics and building a stronger foundation in the hope that you can go higher than before.

Appendix

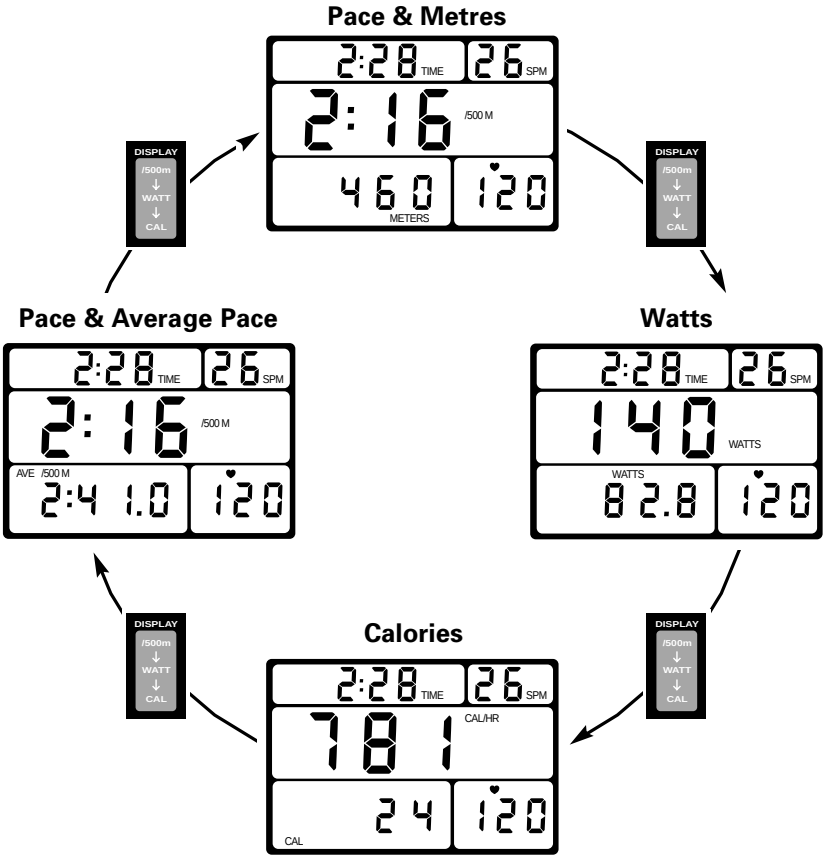
The Performance Monitor (PM2)

Getting Started

When you begin rowing the monitor starts automatically, displaying information about your performance. Here is what it shows:

- **Elapsed Time.** How long you've been rowing.
- **Stroke Rate.** In strokes per minute (spm), updated every stroke.
- **Output for each stroke.** How hard you pulled on the last stroke. This is displayed in a choice of three units: pace/500m, calories/hour and watts.
- **Total or cumulative output.** Your cumulative output since you started rowing. Displayed in a choice of four units: average pace, metres, calories and watts.
- **Heart Rate.** If a heart rate interface is attached to the Indoor Rower and you are wearing a chestbelt transmitter, this display will show your heart rate in beats per minute.

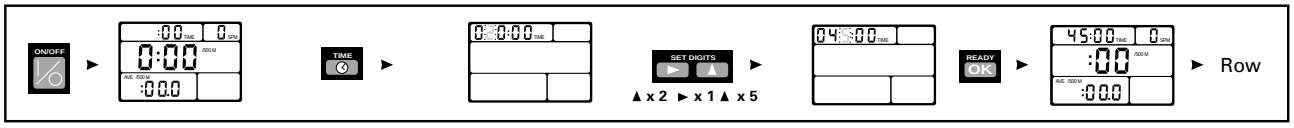
Display Modes



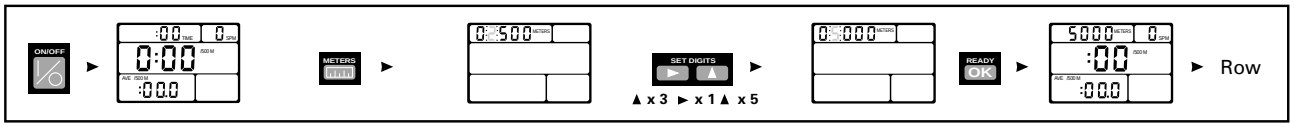
Preset Workouts

You can set up four different types of workout on the monitor: pre-set time duration, pre-set distance, timed intervals and distance intervals. After you have finished a workout, you can use RECALL to view your performance. The sample workouts below are designed to help you become familiar with the monitor. We recommend you set them up as you read through each example. You may change the display mode before, during or after your workout.

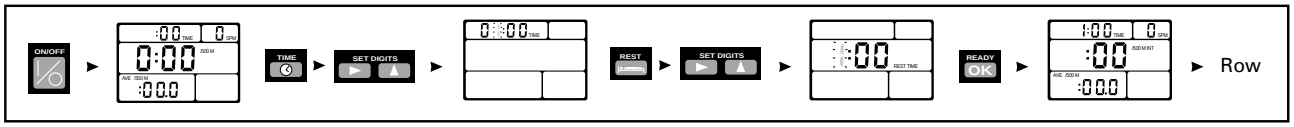
Example 1: Pre-set Time (45 minute row)



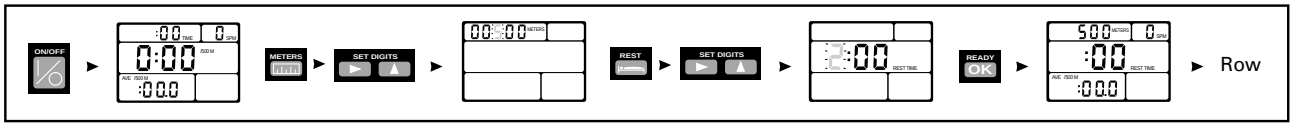
Example 2: Pre-set Distance (5,000 metre row)



Example 3: Time Intervals (10 x 1 minute hard/1 minute easy)



Example 4: Distance Intervals (5 x 500 metres with 2 minutes rest)



During Examples 3 and 4 the interval number will be displayed in the upper right corner during the rest interval.

Your workout results will remain in the monitor's memory until another workout is started, even if it is turned off.

Recall

After you have finished a workout, you can use RECALL to view your performance during each split or interval of your workout.

The first press of the RECALL button displays the end of workout information. Each successive press of the RECALL button shows the next earlier split or interval until either the last split has been displayed or there is no more memory available (maximum storage is 20 splits or intervals).

The word SPLIT will appear on the screen to indicate that you are viewing split information as opposed to end of workout information. Default splits are two minutes for timed workouts and 500 metres for distance workouts.

The side arrow button works the same as RECALL. It shows the next earlier split or interval.

The up arrow button shows the next later split or interval.

The DISPLAY button can be used during split recall to view splits in different modes: /500m split pace, watts or calories.

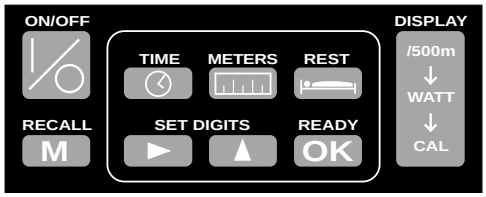
Pressing REST during split recall shows splits in cumulative mode. This is indicated to the user by "CU" in the centre display field. Press REST again to exit CU mode.

The heart rate box shows your heart rate at the end of each interval or split.

The SPM box shows your average strokes per minute for each interval or split.

Extra Functions

All of the monitor buttons except the ON/OFF button have extra functions which are activated when you press and hold down the READY button.



Splits

The monitor can record a maximum of 20 splits for a set time or distance.

OK + ⏲

Custom Splits (time). READY/TIME: To set custom splits (time) press READY and TIME together, then use the SET DIGITS buttons to set the split time. Press READY when done.

OK + ▭

Custom Splits (distance). READY/METERS: To set custom splits (distance) press READY and METERS together, then use the SET DIGITS buttons to set the split distance. Press READY when done.

OK + M

Splits On/Off. READY/RECALL: To display the split performance press READY and RECALL together. The split score will hold for five seconds in the lower left display window, and then return to the normal display. When the monitor starts up the splits option is off by default.

Drag Factor

OK + ▭

READY/REST: To display the drag factor press READY and REST together and then row a few strokes. The drag factor is useful if you use Concept 2 Indoor Rowers in different locations and want to be sure the resistance level is the same. The typical range for the drag factor is 100 (damper setting 1) to 220 (damper setting 10). When the monitor starts up the drag factor option is off by default.

Odometers

OK + ▲

Resettable. READY/SET DIGITS ▲ : Displays cumulative distance rowed and is resettable. At 99,999m it rolls over to 00,000. Press RECALL to reset to 0. Press READY or ON/OFF to get out of this function.

OK + ►

Non resettable. READY/SET DIGITS ► : Displays cumulative distance rowed and is not resettable. Distance is in kilometres and is only displayed when READY and SET DIGITS ► are being pressed together.

Display Test

OK + /500m ↓ WATT ↓ CAL

READY/DISPLAY: Press READY and DISPLAY together and the monitor will perform a self-test displaying all segments. Press ON/OFF to end the test.

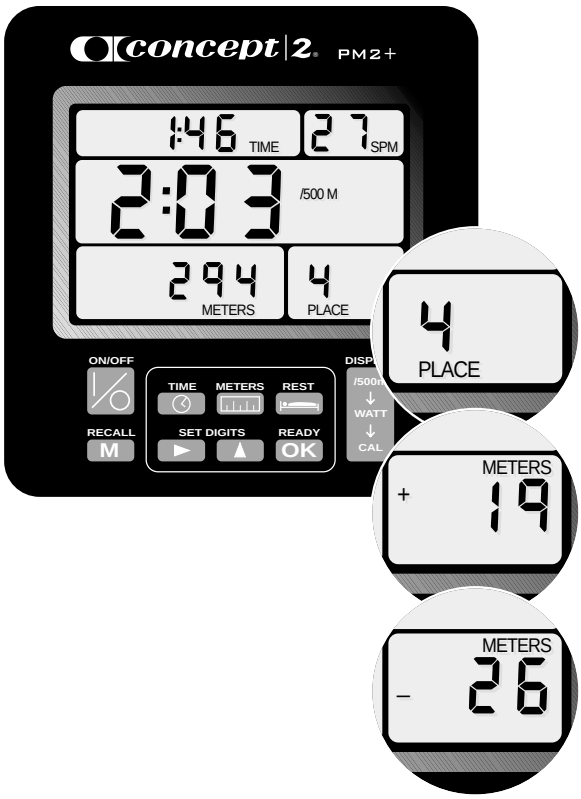
The Performance Monitor (PM2+)

The PM2+ is the second generation of the PM2 and as such has the same standard features. There are additional serial ports on a PM2+ that allow you to link to a computer and therefore to other rowing machines, either directly, or over the internet. The e-Row software you need to do this is available to download free from the concept 2 website at www.concept2.co.uk. With e-Row you can create, save and modify races and workouts, connect to other PM2+s over the internet for racing, display races and workouts in 'Race', 'Spreadsheet', 'Powerplot', and 'LCD Monitor' views, and store data.

When using the PM2+ connected to either the internet or another machine the area of the monitor that normally shows the drag factor or heart rate shows your current position with meters ahead displayed with a + sign, and meters behind displayed with a – sign (see below). The number of meters shown indicate how far in front or behind you are. If you are not using the race facility then the PM2+ acts the same as the PM2. It will display heart rate when used in conjunction with a heart rate interface, or the drag factor if not.

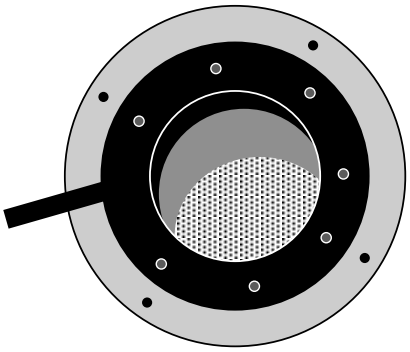
Standard display showing heart rate:

Toggling race displays:



The Damper Lever and Drag Factor

The load on the Concept 2 Indoor Rower is unlike any normal resistance training equipment. There is no pre-set load; what is measured is the ability of the user to accelerate the flywheel overcoming the frictional force of the air opposing the flywheel rotation. The monitor display of the flywheel is a numerical calculation using the acceleration, speed of rotation and moment of inertia.



The damper lever on the side of the fan cage controls the drag factor. With the damper set to level 10 more air can pass across the fan increasing the rate of deceleration (drag). The monitor detects the increase in drag and an adjustment is made to the pace readout.

The monitor displays the drag factor as a number in the order of 100 at level 1 and around 220 at level 10 on a new machine. If the perforations on the fan cage become clogged, then to achieve the same drag factor the damper lever will need to be put on a higher setting. The monitor detects the effect on the flywheel not the position of the damper lever so although the setting on different machines may not be the same, the drag factor reading will always be correct.

Rowers on water use the machine in the range of 130 to 140 or level 3 to 4. The reason for this is that at this level the feel is closest to that of a racing boat therefore making the training rowing specific. Non-rowers using the machine for cross-training or as a sport in it's own right may benefit from a damper setting outside of this range.

As a general rule, bigger heavier and stronger users would tend towards level 10 while smaller lighter users would benefit from a lower setting.

It is a question of trial and error to find the most suitable setting for each individual. Once you have found the ideal set up note the drag factor rather that the damper lever setting, as this will remain constant across different machines.

Recommended Drag Factor Settings

International rowers train and test with the drag factor setting at a level of resistance that enables them to replicate their rhythm and rate from the water. Good rowing technique is about speed of application of power and not just brute strength.

The table below illustrates the settings recommended by the Amateur Rowing Association and used by Great Britain's international rowing teams for testing and training.

Recommended Drag Factors

User	Drag Factor
J11/12 beginner	95-105 approx
J12/13	105-115
J13/14	110-120
J14/15	115-125
Junior Women	125-135
Junior Men	130-140
Lightweight women performance athletes	125
Heavyweight women performance athletes	130
Lightweight men performance athletes	135
Heavyweight men performance athletes	140

500m Split Time to Watts Conversion

To convert your 500m split time to watts either use the following equation or refer to the table below.

$$\text{Power (Watts)} = \frac{2.8}{(\text{pace})^3}$$

where pace is given as: $\text{Pace} = \frac{\text{time (seconds)}}{\text{distance (metres)}}$

Model C 500m Pace/Watts Conversion Table

500m	4:01.0	3:11.3	2:47.1	2:31.8	2:20.9	2:12.6	2:06.0	2:00.5	1:55.9	1:51.9	1:48.4	1:45.3
Watts	25	50	75	100	125	150	175	200	225	250	275	300
500m	1:42.5	1:40.0	1:37.7	1:35.6	1:33.7	1:32.0	1:30.3	1:28.8	1:27.4	1:26.0	1:24.7	1:23.6
Watts	325	350	375	400	425	450	475	500	525	550	575	600

Pace Guide

This pace guide will give you your finishing time for a variety of different workouts, provided you maintain an even pace for the duration of the row.

1,609m = 1 Mile

21,097m = 1/2 Marathon

42,195m = Full Marathon

Pace Guide							
500m	1,609m	2,000m	5,000m	10,000m	21,097m	42,195m	100,000m
1:10	3:45	4:40	11:40	23:20	0:49:14	1:38:27	3:53:20
1:12	3:52	4:48	12:00	24:00	0:50:38	1:41:16	4:00:00
1:14	3:58	4:56	12:20	24:40	0:52:02	1:44:05	4:06:40
1:16	4:05	5:04	12:40	25:20	0:53:27	1:46:54	4:13:20
1:18	4:11	5:12	13:00	26:00	0:54:51	1:49:42	4:20:00
1:20	4:17	5:20	13:20	26:40	0:56:16	1:52:31	4:26:40
1:22	4:24	5:28	13:40	27:20	0:57.40	1:55.20	4:33:20
1:24	4:30	5:36	14:00	28:00	0:59.04	1:58.09	4:40:00
1:26	4:37	5:44	14:20	28.40	1:00.29	2:00.58	4:46:40
1:28	4:43	5:52	14:40	29:20	1:01.53	2:03.46	4:53:20
1:30	4:50	6:00	15:00	30:00	1:03.18	2:06.35	5:00:00
1:32	4:56	6:08	15:20	30:40	1:04.42	2:09.24	5:06:40
1:34	5:02	6:16	15:40	31:20	1:06.06	2:12.13	5:13:20
1:36	5:09	6:24	16:00	32:00	1:07.31	2:15.01	5:20:00
1:38	5:15	6:32	16:20	32:40	1:08.55	2:17.50	5:26:40
1:40	5:22	6:40	16:40	33:20	1:10.20	2:20.39	5:33:20
1:42	5:28	6:48	17:00	34:00	1:11.44	2:23.28	5:40:00
1:44	5:35	6:56	17:20	34:40	1:13.08	2:26.17	5:46:40
1:46	5:41	7:04	17:40	35:20	1:14.33	2:29.05	5:53:20
1:48	5:48	7:12	18:00	36:00	1:15.57	2:31.54	6:00:00
1:50	5:54	7:20	18:20	36:40	1:17.22	2:34.43	6:06:40
1:52	6:00	7:28	18:40	37:20	1:48.46	2:37.32	6:13:20
1:54	6:07	7:36	19:00	38:00	1:20.10	2:40.20	6:20:00
1:56	6:13	7:44	19:20	38:40	1:21.35	2:43.09	6:26:40
1:58	6:20	7:52	19:40	39:20	1:22.59	2:45.58	6:33:20
2:00	6:26	8:00	20:00	40:00	1:24.24	2:48.47	6:40:00
2:02	6:33	8:08	20:20	40:40	1:25.48	2:51.36	6:46:40
2:04	6:39	8:16	20:40	41:20	1:27.12	2:54.24	6:53:20
2:06	6:45	8:24	21:00	42:00	1:28.37	2:57.13	7:00:00
2:08	6:52	8:32	21:20	42:40	1:30.01	3:00.02	7:06:40
2:10	6:58	8:40	21:40	43:20	1:31.25	3:02.51	7:13:20
2:12	7:05	8:48	22:00	44:00	1:32.50	3:05.39	7:20:00
2:14	7:11	8:56	22:20	44:40	1:34.14	3:08.28	7:26:40
2:16	7:18	9:04	22:40	45:20	1:35.39	3:11.17	7:33:20
2:18	7:24	9:12	23:00	46:00	1:37.03	3:14.06	7:40:00
2:20	7:31	9:20	23:20	46:40	1:38.27	3:16.55	7:46:40
2:22	7:37	9:28	23:40	47:20	1:39.52	3:19.43	7:53:20
2:24	7:43	9:36	24:00	48:00	1:41.16	3:22.32	8:00:00
2:26	7:50	9:44	24:20	48:40	1:42.41	3:25.21	8:06:40
2:28	7:56	9:52	24:40	49:20	1:44.05	3:28.10	8:13:20
2:30	8:03	10:00	25:00	50:00	1:45.29	3:30.59	8:20:00
2:32	8:09	10:08	25:20	50:40	1:46.54	3:33.47	8:26:40
2:34	8:16	10:16	25:40	51:20	1:48.18	3:36.36	8:33:20
2.36	8:22	10:24	26:00	52:00	1:49.43	3:39.25	8:40:00
2.38	8:28	10:32	26:20	52:40	1:51.07	3:42.14	8:46:40
2.40	8:35	10:40	26:40	53:20	1:52.31	3:45.02	8:53:20
2.42	8:41	10:48	27:00	54:00	1:53.56	3:47.51	9:00:00
2.44	8:48	10:56	27:20	54:40	1:55.20	3:50.40	9:06:40
2.46	8:54	11:04	27:40	55:20	1:56.45	3:53.29	9:13:20
2.48	9:01	11:12	28:00	56:00	1:58.09	3:56.18	9:20:00
2.50	9:07	11:20	28:20	56:40	1:59.33	3:59.06	9:26:40
2.52	9:13	11:28	28:40	57:20	2:00.58	4:01.55	9:33:20
2.54	9:20	11:36	29:00	58:00	2:02.22	4:04.44	9:40:00
2.56	9:26	11:44	29:20	58:40	2:03.46	4:07.33	9:46:40
2.58	9:33	11:52	29:40	59:20	2:05.11	4:10.21	9:53:20
3.00	9:39	12:00	30:00	60:00	2:06.35	4:13.10	10:00:00

Weight Adjustment Factor (WAF)

When using an Indoor Rower the results that you can achieve are dependent on the power output you can maintain for the distance or time required. Heavyweight rowers are able to maintain a higher level of power output due to their increased weight. In order to enable you to compare your time/distance to someone of a different weight we have included a weight correction formula.

The formula for weight correction is:

$$\left[\frac{weight}{77.27}\right]^{\frac{2}{9}}$$

Using the Weight Adjustment Factor

For timed pieces: Corrected time = actual time x WAF

For distance pieces: Corrected distance = $\frac{\text{actual distance}}{\text{WAF}}$

Weight Adjustment Factors

Weight (kg)	Factor	Weight (kg)	Factor	Weight (kg)	Factor	Weight (kg)	Factor
50.0	0.908	67.5	0.971	82.5	1.015	97.5	1.053
52.5	0.918	70.0	0.979	85.0	1.022	100.0	1.059
57.5	0.937	72.5	0.987	87.5	1.028	102.5	1.065
60.0	0.946	75.0	0.994	90.0	1.035	105.0	1.071
62.5	0.954	77.5	1.001	92.5	1.041	107.5	1076
65.0	0.963	80.0	1.008	95.0	1.047	110.0	1.082

Training Log

Target/Goal: _____

Name & Address: _____

_____ Postcode: _____

Contact Tel: _____ T-shirt Size: _____ Date of Birth: _____

Email: _____ Page No.: _____

Date	Time				Distance (metres)	Cum. Total (metres)	Comments
	Hrs	Min	Secs	Tens			

Verified by: Print Name: _____ Position: _____

Signature: _____ Date: _____

Concept 2 Incentives

Distance Award Scheme

The Distance Award Scheme provides a range of progressive distance incentives appropriate for each age group. When you reach each of your distance goals, send us a copy of the first and last pages of your training log signed by a witness for verification, and we'll send you your well-deserved Distance Award Scheme Certificate and T-shirt.

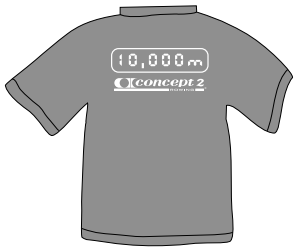
There is no time limit within which the distances have to be completed, so you may take as much or as little time as you wish.

Classification

Junior - For anyone aged twelve or under, there are four Awards; 10,000m, 25,000m, 50,000m and 100,000m.

Youth - For anyone aged between thirteen and eighteen, there are again four Awards; 100,000m, 250,000m, 500,000m and 1,000,000m.

Senior - For anyone aged eighteen and over, the four Awards are: 1 million, 5 million, 10 million and 15 million metres.



Distance Award Schemes				
Junior (up to 12)	10,000m	25,000m	50,000m	100,000m
Youth (13 to 18)	100,000m	250,000m	500,000m	1,000,000m
Senior (18+)	1,000,000m	5,000,000m	10,000,000m	15,000,000m

Notes

When you reach each of your distance goals, send a copy of the first and last pages of your training log, signed by a verifier, and you will receive a certificate and T-shirt. The metres from each award count towards the next.

Concept Ranking

The Concept Ranking is published on-line at www.concept2.co.uk annually and includes personal best performances for rowers throughout the UK and Republic of Ireland. Entries close on the 30th of April each year and are open to anybody in the UK and Republic of Ireland. The tables below detail the events and the age categories available.

Concept Ranking Events								
Individual	500m	2,000m	5,000m	10,000m	-	21,097m (1/2 marathon)	42,195m (marathon)	100,000m
Team	-	-	-	-	1 hour	-	42,195m (marathon)	100,000m

Concept Ranking Age Categories for 500, 2,000, 5,000 and 10,000 metres														
Men	J13	J14	J15	J16	J17	J18	19-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Lwt Men	-	-	-	-	-	J18	19-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Women	J13	J14	J15	J16	J17	J18	19-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Lwt Women	-	-	-	-	-	J18	19-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99

Notes

i. Remember to use the pre-set distance to record your time to the nearest tenth of a second or else it will be defaulted to .9.

ii. 1 hour and marathon teams must not exceed four members. Mixed teams must consist of at least half women i.e. one woman and one man, two women and one man, three women and one man or two women and two men.

iii. 100,000m teams must not exceed ten members. Mixed teams must consist of at least one third women i.e. one women and up to two men, two women and up to four men, three or more women and up to six men.

iv. For complete Team Relay and Marathon Guidelines please contact Concept 2 or visit www.concept2.co.uk

v. For the Full Marathon Team Event each team member must row a minimum of 2,000m per leg.

vi. For the Half Marathon Team Event each team member must row a minimum of 1,000m per leg.

vii. For the Half Marathon, Marathon and 100,000m events the minimum age requirement is 16 years. For the 10,000m and 5,000m events the minimum age is 13 years and for the 2,000m and 500m events the minimum age is 10 years.

Indoor Races

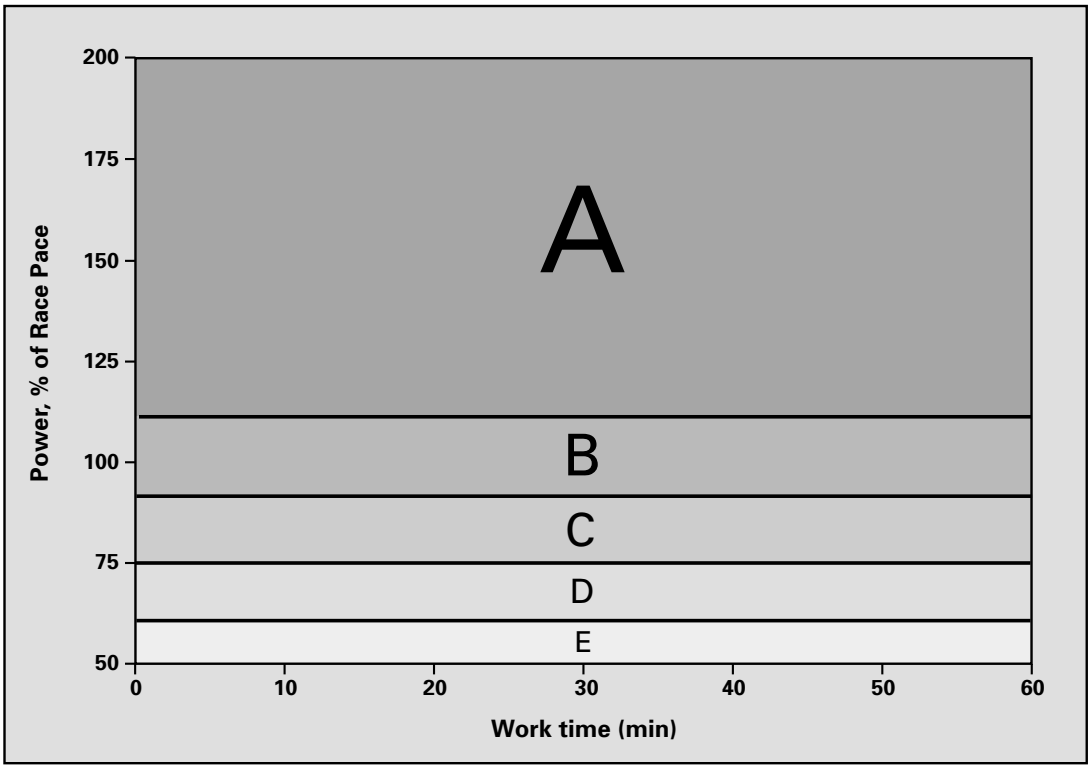
Indoor races come in all shapes and sizes. National and World Championships are staged annually over the 2,000m race distance. However, many other events choose different race formats. For an up-to-date race calendar check out the Concept 2 website (www.concept2.co.uk).

Table 10.6

Events Organised by Concept 2	
British Indoor Rowing Championship (2,000m)	UK, each November
World Indoor Rowing Championship (2,000m)	Boston USA, each February
British Indoor Rowing Grand Prix	UK, each winter; October to March
European races	National and regional races throughout Europe, October to April

Personalising Your Programme - the Danish Programme

These sheets relate to Section 4 : Creating a Bespoke Training Programme and can be used to plot your personal results.



Training Intensities				
Training Intensity	**Level**	**Split**	**Power (Watts)**	**Heart Rate**
Anaerobic Capacity/Power	A			
Aerobic Capacity	B			
Aerobic Capacity/Endurance	C			
Endurance	D			
Recovery/Technical Improvement	E			

Notes

Complete the table using the information from your graph.

Psychological Preparation Sheets

The following three sheets relate to Section 9 : Sports Psychology and can be used to record your personal goals.

Concept 2 Profile

Date: _____ **Stage of Season:** _____

Current aims: _____

Long-term aims: _____

Progress so far: _____

Training Focus (Mental, physical, technical)	**Ideal** (1-10)	**Current Level** (1-10)	**Priority**
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		
	10		

Fill in the various areas that you are trying to improve upon. The list can be as long or as short as you like. Fill in what you would score yourself out of ten for your current ability on each area. Look through the scores, work out your strengths (the things you should keep reminding yourself are good about you), and identify which areas score lower. These are going to be your priority areas to work on. Pick only two to three areas to work on at a time and rescore yourself on each area in five to six weeks time.

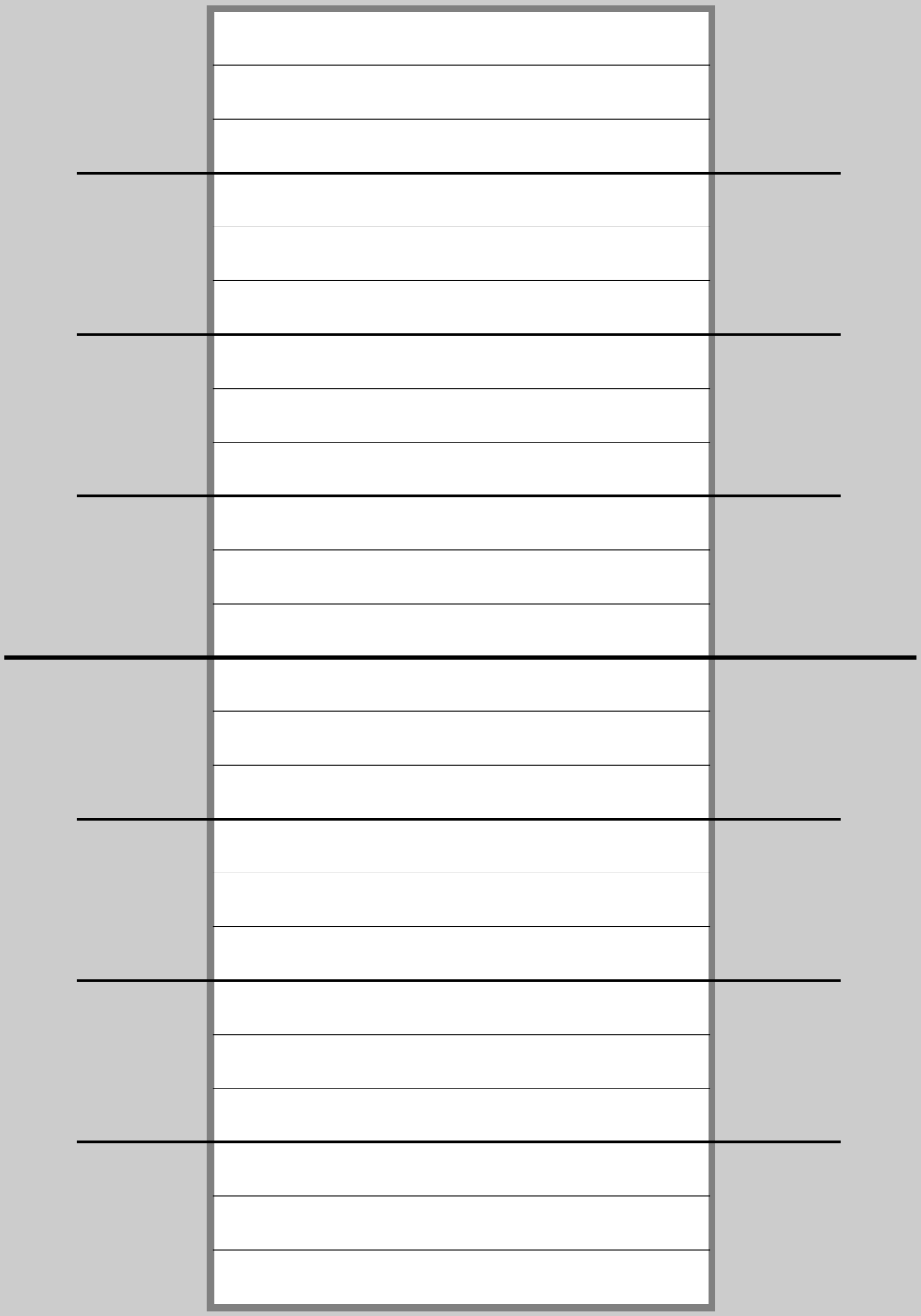
Once you've worked out what your priorities are, make a plan as to what you are going to do through your exercise that will particularly help you improve on these specific areas. Make sure you work out how your strengths are going to help you bring up the priority areas.

To help set some goals for each of these areas refer to the goal setting advice in Section 9 : Sports Psychology.

Ideal Race Plan

Fill in the ideal concentration cues for you that will keep you focused on thinking the right things for you at the right time.

START



Think about what you need to think about!

Review... did you keep thinking the right things?

Race Review System

Name: _____ **Event:** _____

Date: _____ **Competition** _____ **Start Time:** _____ am/pm

Finish Position: _____ **Finish Time/Winning Time:** _____

Environment: _____

Key Warm-up/Preparation Details: _____

_____

Key Race Objectives	Positive Outcomes	Negative Outcomes

Training pointers: _____

Future racing reminders: _____

Overall satisfaction level of performance (not result): _____ %

Glossary

Glossary

A	
Adenosine Triphosphate (ATP)	The molecular fuel used in energy generation in all cells. There are different methods of regeneration of ATP depending on exercise intensity and the availability of oxygen.
Actomyosin	The system of actin and myosin fibres that is responsible for muscular contraction.
Adolescence	Between childhood and adulthood.
Aerobic work	Exercise which uses oxygen. Low to moderate intensity activity that can be sustained for long periods. It is the foundation of most training.
Alactic system	The initial stage of energy production. Lasting up to ten seconds, relying on the fuel creatine phosphate.
Amenorrhoea	Absence of menstruation after menarche.
AN	See Anaerobic Work.
Anaemia	A condition characterised by weakness and pallor, due to a lack of red blood cells, caused by low iron intake or blood loss.
Anaerobic Alactate	See Alactic System.
Anaerobic system	The energy system that operates in the absence of oxygen. This includes the alactic system and the lactic acid system.
Anaerobic threshold	The maximum intensity of exercise that is sustainable via the aerobic system, i.e. without a build up of lactic acid.
Anaerobic work	Exercise without oxygen. Hard work done over very short periods which cannot be sustained.
Anorexia Nervosa	A psychological illness, most common in young women, characterised by an obsessive desire to lose weight/look thin.
Arthritis	A disease causing pain and stiffness of the joints.
AT	Abr. See Anaerobic Threshold.
Atrophy	Wasting away through lack of correct nourishment or use.
Autonomous stage of learning	Reached when the athlete demonstrates the ability to complete a complex action with decreased conscious control.
B	
Basal Metabolic rate (BMR)	The sum of all of the chemical reactions that take place within the body at rest.
Beats per minute (BPM)	The number of heart beats each minute.
Beginning	The point where the load is taken at the beginning of the stroke.
Blood pooling	This occurs when high intensity exercise is stopped suddenly and the increased volume of blood due to exercise pools within the muscles.
Blood washout	Low intensity exercise which raises the metabolism, increasing blood flow through tired or damaged muscles and preventing blood pooling.
Body adaptation	Regeneration of the body during rest following exercise.
Breech presentation	When a baby is positioned in the womb so that feet or buttocks are delivered first.
C	
Caesarean birth	An operation for delivering a baby by cutting through the mothers abdomen.

Calorie	A measurement of the energy in food. Defined as the amount of heat energy required to raise the temperature of 1kg of water by 1°C. **Please note:** Throughout this guide we have used the commonly accepted term calorie whereas technically the correct term is kilocalorie.
Carbohydrates	Food fuels whose molecules consist of carbon, hydrogen and oxygen. i.e. sugars, glycogen and starch.
Cardiorespiratory	Heart and lung functions during exercise.
Cardiovascular	Heart and circulatory functions during exercise.
Cardiovascular endurance	The ability of a person to sustain exercise without undue fatigue.
Cirrhosis	A chronic disease of the liver where there is a degeneration of the cells.
Cognitive stage of learning	This involves the person achieving an understanding of the action they are performing and creating a mental picture.
Cognition	An individual's own thoughts, beliefs and attitudes.
Complex carbohydrate	Long chain carbohydrates like starches and glycogen, examples of food high in complex carbohydrates are potatoes, bread, brown rice and pasta.
Contraindicated	An indication against the use of, for example, a particular treatment, drug or activity.
Cool down	A period of low intensity exercise at the end of a training session to allow the body to cool down gradually and prevent blood pooling.
Core stability	The ability to use the postural muscles to maintain the stability of the spine.
Creatine monohydrate	A supplement taken to increase the concentration of Creatine Phosphate in the muscles, especially useful for vegetarians.
Creatine phosphate	A high energy phosphate molecule stored in the muscle and used to resynthesise ATP during high intensity exercise.
CV	Abr. See Cardiovascular.
D	
Damper setting	The positioning of the damper lever mounted on the side of the fan cage to give a desired drag factor.
Diabetes	A disorder of the metabolism, caused by a deficiency in the production of insulin that results in the body being unable to metabolise sugars correctly.
Drive	Application of power during the rowing cycle.
DYNO	The Concept 2 strength training machine.
Dysmenorrhoea	Painful periods.
E	
Enzymes	Biological catalysts used to control the rate of chemical reactions in the body. These operate at a specific temperature and level of acidity (pH).
F	
Fast twitch muscle fibre	The type of muscle fibre suited to high speed and power activities. Fuelled mainly by the anaerobic system.
Fat	An organic lipid compound formed from glycerol and fatty acids. The highest energy storage available to the body.
Finish	The end of the Drive phase and the beginning of the Recovery phase of the rowing stroke.

Follicular phase	The phase of the menstrual cycle where the follicle matures.
Follicle stimulating hormone	One of the hormones that regulates the menstrual cycle.
Free weights	Weight training using a barbell or dumbbells where the small fixator muscles are used to control the position of the bar whilst the prime movers lift it.
G	
Glucose	Sugar, the simplest form of carbohydrate.
Glycogen	The stored form of glucose or sugar. A complex carbohydrate.
H	
Haemoglobin	The iron based molecule found in red blood cells that allows oxygen to be transported in the blood.
Heart rate monitor	Electronic device that measures heart rate. Consists of a strap to go around your chest and a watch or interface to display the heart rate.
Heart rate range (HRR)	The difference between the resting and maximum heart rates.
Hernia	The displacement or protrusion of an organ through the wall of the cavity containing it. e.g. the protrusion of the intestines through the wall of the abdomen.
Homeostasis	The process by which the body maintains its physiological state constant e.g. the control of internal body temperature and acidity.
Hormone	A regulatory substance produced by the body and transported in the blood to the area required.
Hypertension	High blood pressure.
Hyperthermia	Excessively high internal body temperature.
Hypertrophy	Enlargement of a muscle or organ normally due to training.
Hypotension	Low blood pressure.
Hypothalamic Pituitary Axis (HPA)	The menstrual cycle's hormonal control system, located in the brain.
Hypothermia	Excessively low internal body temperature.
Hypoxia	Insufficient oxygen reaching the cells.
I	
Indoor rower	The Concept 2 rowing machine.
K	
kCal	1,000 calories.
L	
Lactic Acid	The by-product of anaerobic exercise. Lactic acid causes the muscular pain associated with high intensity exercise.
Luteal phase	The phase of the menstrual cycle where the lining of the womb prepares for implantation of the fertilised egg.
Luteinzing hormone	One of the hormones that regulates the menstrual cycle.
M	
Macro-cycle	This is the longest of the training cycles and can last a year or more.
Maximum heart rate (MHR)	Highest number of heart beats per minute achievable by an individual.

Menarche	The onset of menstruation, usually occurs between age 12 and 14.
Meso-cycle	Macro-cycles are broken down into six to ten week training blocks called meso-cycles which are further broken down into micro-cycles.
Metabolic equivalents (Met)	Equivalent to 3.5ml of oxygen per kilogram of body weight per minute.
Micro-cycle	The shortest of the training cycles these are usually designed around the days of the week.
Minerals	Elements obtained from foods that are used to create structures in the body e.g. calcium in the bones.
Minute Ventilation V_E	The amount of air moved by the lungs in one minute. This is dependent on the intensity of exercise.
Mmol	Measurement defined by the mass of a specific number of atoms. Used to measure the amount of lactic acid in the blood.
Monounsaturated fatty acids	See unsaturated fats.
Multi gym	A piece of training equipment that combines a number of fixed weights exercises.
Musculoskeletal	Relating to both the muscles and bones.
Myosin	The protein in muscle fibres responsible for the elastic and contractile properties of muscle. It combines with actin to form actomyosin.
N	
Neurological	Of the nervous system.
Non-weight bearing	Exercise where the weight of the user is not supported by the user, but by the training equipment or water.
O	
Obesity	A condition that accompanies a sedentary lifestyle, where men have greater than 25% body fat and women greater than 35% body fat.
Olimenorrhoea	Irregular menstruation, cycles occurring only three to six times per year.
One rep max (1RM)	The maximum weight that can be lifted for one repetition only.
Ovulatory phase	The phase of the menstrual cycle where the egg is released.
P	
Palpitations	Throbbing or tremblings.
Periodisation	Dividing the training programme into small manageable sections called training cycles that can be varied in order to train different energy systems and offset boredom.
Pituitary gland	Gland at the bottom of the brain that secretes hormones essential for growth and other bodily functions.
Phospho-creatine	See creatine phosphate.
Polyunsaturated fatty acids	See unsaturated fats.
Pre-Menstrual Syndrome (PMS)	The presence of emotional and/or physical symptoms occurring cyclically, commencing some days prior to menstruation and disappearing with the onset of menstruation.
Protein	Energy providing nutrient made up of a chain of amino acids. Available from meat, fish, dairy products and in small quantities from nuts and grains.

R	
Recommended daily allowance (RDA)	The amount of a substance (usually a vitamin) recommended each day.
Recommended daily intake (RDI)	The amount of a substance (usually a vitamin) that should be taken each day.
Recovery	The time between the finish of the Drive and the beginning of the next Drive.
Respiratory system	The system consisting of the lungs and airways.
Resting heart rate (RHR)	The number of heart beats per minute when the body is totally at rest - measured first thing in the morning, before getting out of bed.
Ruptured membrane	A tear in the membrane.
S	
Saturated fats	Fat where the carbon chains are completely filled with hydrogen atoms. These are solid at room temperature.
Shunt mechanism	The process where lactic acid is re-synthesised via the aerobic energy system.
Simple carbohydrate	A short chain carbohydrate or single carbohydrate molecule e.g. sugar.
Sit fit	A small flat inflated disk used for core stability training.
Stretching	The process where the length of a muscle is increased beyond its resting length.
Stroke rate	Number of complete rowing strokes per minute.
Stroke volume	The volume of blood pumped in one heart beat.
Strokes per minute (spm)	Number of complete rowing strokes per minute.
Swiss ball	Exercise ball inflated to between 40 and 80cm high for core stability training.
T	
Taper	Period of reduced training prior to competition.
TR	See Transportation.
Training bands	The division of intensities into bands to help define how hard training should be done.
Training cycle	A limited period of training that is directed at a specific objective.
Training intensity	How hard you train, dependent on duration, stroke rate and the heart rate this elicits.
Training load	The quantity and intensity of the work done.
Training log	A diary where goals, objectives and training are recorded.
Transportation (TR)	The process of carrying oxygen to the muscles, trained at 85-95% MHR.
Trimester	A period of three months, normally referred to as one third of the gestation period.
U	
Unsaturated fat	Fats containing a double bond between two carbon atoms, monounsaturated fats have only one double bond, polyunsaturated fats have a number of double bonds. Oleic acid is an example of a monounsaturated fat. Fats containing a high proportion of oleic acid are liquid at room temperature and are called oils.
UT1	Utilisation Training 1, 70 to 80% MHR, used to develop the efficiency of the muscles.
UT2	Utilisation Training 2, 60 to 70% MHR, developing efficiency of the muscles.

Uterine bleeding	Bleeding from the uterus.
Utilisation	The efficiency of the muscles to use the available oxygen during exercise.
V	
Valsalva manoeuvre	Holding breath during the beginning of a lift in weight lifting.
V_E	See Minute Ventilation
Vitamins	Metabolic catalysts that are normally not made by the body and so need to be included in the diet.
VO_2 max	The maximum amount of oxygen that can be used by the body in one minute.
W	
Warm up	A period of low to medium intensity exercise that may include some high intensity bursts designed to increase body temperature and prepare the body for exercise.
Weight bearing	Exercise where the weight of the user is supported by the user.
Wave principle of training	Variation of the training doses from light to hard.

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