COACHES´ MANUAL

RaceRunning

PARASPORT DENMARK

A close finish in the RR3 women's 100m at the 3rd. CPISRA Open European Championship, July 2016.
Photograph: Ditte Ravn Aare Petersen

Introduction

This RaceRunning manual is a tool for coaches, parents and others who are coaching para athletes and want to plan a well-structured and diverse RaceRunning training.
RaceRunning is one of the fastest growing para athletics disciplines and one of only few sports for the most severely disabled and athletes with an impaired balance. It is our hope that this manual will inspire coaches and athletes and provide them with some fundamental know-how about training and para athletics in general and about RaceRunning specifically.

With this manual new RaceRunning clubs and countries will not have to start from scratch. They will be able to draw on the knowledge gathered by experienced RaceRunning coaches and athletes for more than 20 years. In this way the Coaches' Manual might help the sport of RaceRunning to become even more popular on an international basis and give the most severely disabled athletes an opportunity to compete on a high international level.

The Coaches' Manual might be read from a to z as a coherent manual for RaceRunning track training. But it might also be used as a work of reference in order for the coach to pick and choose the specific training elements needed. In this way the coach can ensure that the training programme suits the individual athlete perfectly.
The manual is the first of it's kind and it is therefor to be considered a pioneer's work by the Danish authors.
We hope that this manual will inspire you to develop your RaceRunning training to the benefit of the RaceRunning athletes in your country.

Mansoor Siddiqi

Head Coach of the national
Danish RaceRunning Team

RaceRunning
- a sport in movement...

Sandra Semedo from Portugal wins a preliminary heat in the RR2 women's 100m at the 3rd. CPISRA Open European Championship, July 2016.
Photograph: Ditte Ravn Aare Petersen

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The History of RaceRunning

Marianne Hornbæk Jensen

The Beginning of it All

The RaceRunner was invented in Denmark in 1991 and the sport of RaceRunning has been developing ever since. It was originally developed for people with CP.
The RaceRunner was invented by the famous Danish wheelchair athlete Connie Hansen and Mansoor Siddiqi. Mansoor, being a wheelchair user due to his spasticity (CP), had been participating in backward wheelchair racing for 8 years but he was unsatisfied not being able to perform 100 percent in this way.
Connie suggested that he instead of going backwards began running forwards and with her experience as an occupational therapist, she designed a three-wheeled running chair. This worked out very well with Mansoor being able to run faster and better.

In 1991 Mansoor participated – out of competition – in Robin Hoods Games in Nottingham. This was an eye opener to the CPISRA,23 the international sports organization for spastics. One of the classifiers made the following comment the first time he saw Mansoor running: "This is definitely the most natural way to run: When you are going backward you are trying to escape something, but when running forward you are attacking it!"

The new piece of running equipment was originally called The Walking Machine, later on a Petra and today it is called a RaceRunner.
Connie Hansen continued developing and perfecting various prototypes in the following years.

The 100m backward wheelchair racing competition, Class CP2L, at the CPISRA World Games 1986 in Gits, Belgium.

Mansoor Siddiqi and the very first custom-made RaceRunner at the Athletics Federal Championships at Esbjerg Athletics Stadium in 1993.
Photograph: Karin Møller-Olsen

The Development of RaceRunning in Denmark

The first RaceRunning club in Denmark was founded in Hvidovre in 1992. Connie Hansen was the coach and almost instantly RaceRunning became popular among young spastics. The sport was challenging the young athletes and they experienced a new kind of freedom being able to run. In 1993 Mansoor Siddiqi founded Parasport Frederiksberg and RaceRunning was the main sport.
During the following two decades, RaceRunning spread all over Denmark and today (2017) there are 10 RaceRunning clubs in Denmark (www.dhif.dk/idrætter/atletik) organized through NPC Denmark (Parasport Denmark). We have RaceRunning athletes competing at all levels, elite and non-elite. There are many competitions and activities in the Danish RaceRunning clubs and every year the national championships (Forbundsmesterskaberne) are being held. Also a national Danish RaceRunning team with its own staff of coaches has been established. In 2011 a RaceRunning elite strategy plan, RaceRunning Elitekoncept 2012–2016, was developed.

Ever since 1997 Parasport Frederiksberg has been the host of an annual RaceRunning Camp & Cup with a one-week summer camp for RaceRunning athletes, a three-day children's camp and two competition days. The first five years the annual RaceRunning Camp & Cup was Danish athletes only but since then the Camp & Cup has been open to athletes from all nations and it has been growing rapidly ever since. In 2016 83 athletes from 11 different countries participated in the 20th Camp & Cup.
The Camp has been an important factor getting recognition from the international sports organizations and since 2009 the Camp has also been the setting for some EC and WC through the years.

International Development and Recognition

The international development of RaceRunning already has a long history and the following is only a brief summary. Throughout this history the Danish NPC and the RaceRunning pioneers from Denmark have played an important role.
The international sports organization for spastics, CPISRA, took interest in RaceRunning already in 1993 and in 1995 RaceRunning was a part of the programme as a show discipline at the Robin Hoods Games in Nottingham.
Other countries became very interested in this new sport and at the CPISRA World Games in 1997 RaceRunning was an official athletics discipline with 3 participating nations. Also in 1997 an international workshop was held at the CPISRA general assembly in Prague. The general opinion was that RaceRunning was a great sport for the most severely disabled CP's. On the other hand CPISRA did not want to support the development of the sport financially.
Instead NPC Denmark and RaceRunning Denmark in 1997 initiated a three-years development project in three European countries: Portugal, Ireland and Belgium. This project was a great success and from here on the international development of the sport sped up with recruitment and workshops in many more countries.

In 2001 Mansoor Siddiqi was appointed CPISRA RaceRunning responsible and had the opportunity to develop a new recruitment plan. Later on the International RaceRunning committee was founded. Today there are RaceRunning athletes in 25 different countries.

Competitions

Ever since 1997 RaceRunning has been an official competition discipline at the CPISRA World Games and European Games. At the World Games in athletics in Birmingham 1998 under the IPC25 RaceRunning was a show discipline. Ever since 1998 there have been held EC and WC in RaceRunning. In 2011 the IWAS24 became a new international partner (the chairman of Parasport Denmark, Karl Vilhelm Nielsen, being the vice president of IWAS), and CPISRA and IWAS collaborated in order to promote RaceRunning internationally.
Together with other athletics disciplines for spastics RaceRunning became a part of the IWAS Games.

A classification system specifically for RaceRunning was developed, adjusted and approved by the CPISRA in 2013. Today there are three classes for men and for woman.[23]
The overall aim for RaceRunning is to become a Paralympic sport under the IPC. This requires some demands regarding results and number of countries with RaceRunning to be fulfilled in the years to come.
Learn more about the history of RaceRunning at: ww.RaceRunning.org.

The four Danish participants at the IWAS Games 2011 in Sharjah, Dubai.
From left to right: Jacob Birkbak, Helle Ladefoged, Lasse Bang-Thygesen, Michael Thyregod Jensen.
Photograph: Leif Nielsen

The RaceRunner and its Possibilities

Signe de Place Knudsen

The following section aims at giving especially new RaceRunning coaches a general view of the wonderful world of RaceRunning.

It is guided by my own experiences as a physiotherapist and RaceRunning coach. It is important for me to point out that all athletes and coaches are different from each other and that they have different needs and talents. The article is only for guidance and inspiration.

What is a RaceRunner

A RaceRunner is a customized three-wheeled "running bike" without pedals, gears and a chain and when using this bike balance is no problem. That is why RaceRunning is an obvious sport for spastics, amputees and rheumatics.
Using a RaceRunner has many advantages. The most important thing is that the athlete himself/herself is actively running. Also the RaceRunner is a great piece of equipment for getting around. The three wheels are making the RaceRunner most stabile and an athlete with poor balance and motoric control, even a poor sight or hearing, may move freely on a RaceRunner.
When placed on the saddle, with a firm grip on the handlebars and with support from the chest plate the athlete gets the opportunity using the legs and getting around. The RaceRunner might be used for transport means going to the office or to school but it is especially a great tool for training purposes and exercising. It is easy to get the RaceRunner to roll, which enables people with severe disabilities to use it.

"It is important for me to point out that all athletes and coaches are different from each other."

Physical activity is good for almost all people and RaceRunning is especially good for building up the muscles in the thighs and buttocks and this improves the fitness level of the athlete in turn. These muscle groups are often inactive among wheelchair users. By activating these muscle groups standing up and sitting down will also gradually become easier. At the same time the running position will strengthen the abdominal muscles and the muscles in the back. This will in turn improve the balance when sitting and standing upright.

Who Might Use a RaceRunner

The RaceRunner is primarily for people with impaired balance, e.g. amputees or people with CP. Many different people though might find the RaceRunner a useful piece of equipment disregarding their kind of disability (big or small, hidden or not, physical or mental, or a mixture of it all). The RaceRunner should be considered a tool for doing sports – just like soccer balls are for playing soccer and a racing bike is used for bike racing. RaceRunning is generally a sport for children and grown-ups with impaired balance or movement pattern. It is important to put norms and rules aside and solve the challenges as they arise. It is almost only the imagination that sets limitations to who might use a RaceRunner. Children need to

have a certain height though. In general they need to be 3-4 years of age before starting up with RaceRunning.

> "It is almost only the imagination that sets limitations to who might use a RaceRunner."

In general the specific type of disability is not that important. This said the coach should always be aware of the fact that some athletes might have issues that could worsen due to a hard and repetitive physical training, e.g. muscular pains, wrong positioning of joints or rheumatism in feet, knees, hips or back or problems arising after surgery.
Also CP athletes might suffer from heart problems that are normally no hindrance being physically active, but the coach still needs to take this into account. Some athletes are getting a lifelong medical treatment and it might be useful for the coach to know which medicine the athletes are using.

How to maintain a RaceRunner

It is important to maintain the RaceRunner during the whole season but this is actually not that complicated. Typically it is enough to check and make everything ready at the beginning of the season. During the season try to keep the bike relatively clean, tighten the bolts and pump the tires.
It is good idea to dry the bike with a cloth after running in rainy weather and to store the bike in a dry place. Doing so prolongs the life of the RaceRunner. As a coach you will typically be the one taking care of at least some of these practical things and the most basic tools should always be available at the sports club.

The following is a general introduction and guide to the maintenance of the RaceRunner:

Brakes

Most RaceRunners have rim brakes with brake blocks. The brake blocks are gradually worn down and must be replaced when needed, especially if the RaceRunner is also used during wintertime. Brake blocks are available at regular bike shops and they are relatively easy to replace. Be careful to adjust them correctly so they are worn down harmoniously and so they do not shriek.
The brake cables must be adjusted once in a while and turning the screw at the handbrake normally does this. Do this together with the athlete taking into account his/her strength in the fingers/hands.

Tires and rims

The tires of the RaceRunner are gradually being worn down. Replace the tires when the tread is worn down or if cracks start to appear at the sides of the tire. The tires should be pumped once in a while. A slightly decreased air pressure might compromise the comfort and speed of the athlete. The correct air pressure for the specific tire is written on the side.
If the RaceRunner is often used outdoors, in the forest or similar places, the need to keep rims and spokes clean is bigger. This can be done with a regular cloth, water, a regular cleaner and a dry cloth for drying the bike afterwards. Rims and spokes must always remain intact.

Bolts and screws

Most bolts and screws on a RaceRunner may be adjusted using hex keys or a spanner. The bolt

BASIC TOOLS

- *Adjustable spanner*
- *Hex keys*
- *Tire levers*
- *Spare tubes and tires for 28" wheels*
- *Air pump for racing bike valves – preferably with a pressure gauge*

and screws at the wheel, saddle, body plate, stem and brakes should always be re-tightened.

Fitting the Bike for the Individual Athlete

All athletes are different in their abilities and needs and the RaceRunner should be adjusted accordingly. It is important to take into account especially the anatomy and the running technique of the athlete. The coach has to be very patient in the process of adjusting the bike correctly.
Even small changes might have a big impact and a lot of experimenting and re-adjusting might be necessary.

Especially new and inexperienced athletes might need some time and re-adjustments in order to find the ideal setting of the RaceRunner.
Take your time to experiment and try out the various settings, e.g. adjusting the position of the saddle, tilting it up or down.
The ideal setting is not easy to find and it is typically necessary to compromise with either comfort or running speed. This compromise should be found together with the athlete and maybe also his/her parents or assistant(s). On a daily basis the coach needs to focus on the training sessions. Other persons in the club should take care of the practical assignments. The process of adjusting and fitting the bike is preferably placed before or after the training session.
There are a lot of different types of saddles, body supports and handlebars for the RaceRunner. Remember to check out all the many different possibilities and you might also consult an experienced RaceRunning coach for the best alternatives. It might also be necessary to have one or more devices custom built.

Saddle and body support

In general the RaceRunner should be adjusted in order for the athlete to run as freely and independently as possible.
Some runners prefer an upright running position. This position will in general improve the athlete's

Stretching out after warming up at the RaceRunners Camp & Cup. Photograph: John Clarke Russ

respiration, as the diaphragm is not pushed as hard against the body support plate. Girls with bosom often prefer a rather upright position. This position is also better for the neck that keeps its normal position.
If the position is lowered the neck muscles must work harder.

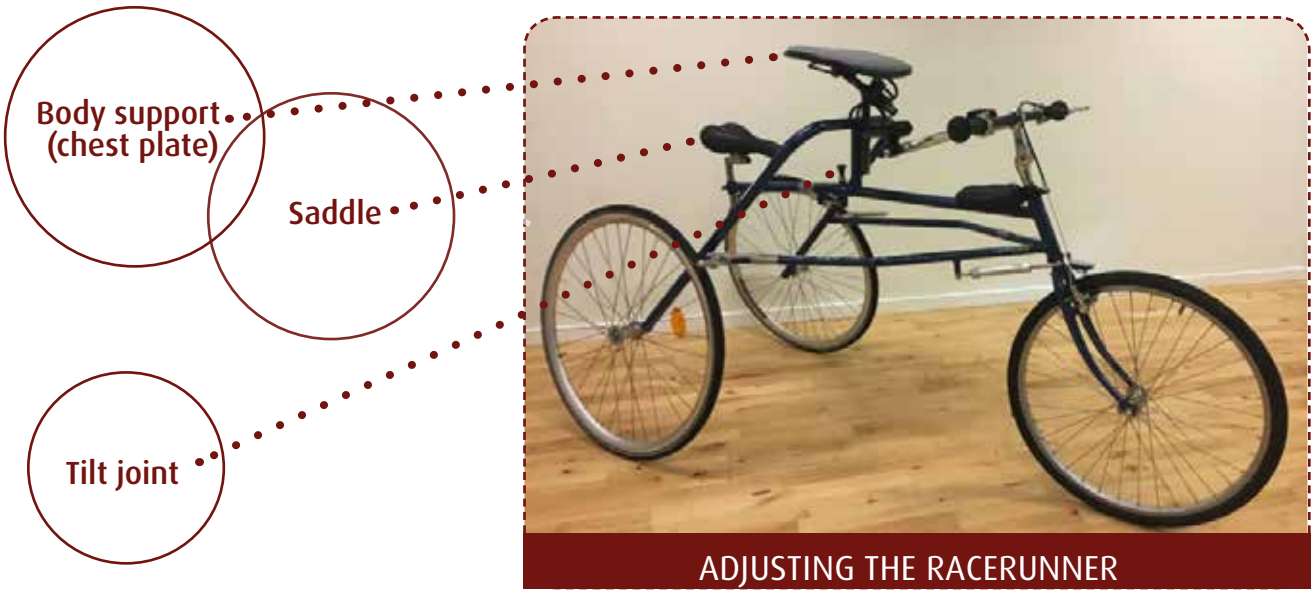
On the other hand a lowered position is more aerodynamic and the weight pressure on the crotch is reduced. This position also minimizes the risk of tilting the bike from one side to another, which is often seen in an upright position.

Pros and cons must be considered for the benefit of the individual athlete.
In general, an athlete with strong legs and

buttock muscles needs less support from the saddle and the body support plate. Heavy athletes and athletes with weak muscles need more support. Also, athletes with heavy thighs might get bruises from frictions with the bike but placing small pieces of some soft material on the relevant parts of the bike might solve this.

Extra support

Some athletes, especially CP athletes, need extra support. Some athletes might need more body support, e.g. a belt or strapping around the back, elbow supports or similar. No matter what kind of extra equipment used the overall aim is always to improve the conditions of the athlete.



ADJUSTING THE RACERUNNER

In other words the adjustment and fitting of the bike must always suit the individual athlete.

Handlebars

The handlebars come in many different sizes and shapes. The height of the handlebars and the distance to the body support plate should be set in order for the athlete to be fairly relaxed in upper body and shoulders.

CP athletes might experience difficulties stretching the arms enough in order to reach the handlebars and they might also have problems turning the handlebars themselves.

The handlebars therefore need to be adjusted according to these issues.

The power needed to turn the handlebars must be fitted to CP athletes with a poor arm muscle power. This might cause the athlete to turn the bike inadvertently and the right compromise might take some time to find.

The athlete should to be able to focus primarily on running and training instead of focusing on the RaceRunner as a piece of equipment.

> "The coach needs to focus on the training sessions. Other persons in the club should take care of the practical assignments."

Getting used to the bike

New and inexperienced athletes only running in the summertime have to be patient and spend some time getting used to the RaceRunner as well as being physically activity in general.

The athlete also has to get used to sitting on the RaceRunner and this might cause some pains in

the neck (keeping the head in an upright position), the arms and wrist (controlling the handlebar), the trunk or chest (resting on the body support plate), and also the crotch (pushed with great weight against the saddle).
Especially the strain on the crotch will bother many athletes in the beginning (see clothes and some practical issues).

Getting onto and off the RaceRunner

A basic rule is that the rear brakes should always be on when leaving the RaceRunner. In this way the brakes will also be on when the RaceRunner is being taken into use again. Due to its poor weight the RaceRunner might easily start rolling – even if the brakes are on. With heavy or motoric challenged athletes it might be a good idea to place the front wheel against a wall.

Some athletes might be able to get onto the RaceRunner without lowering the saddle.
Other athletes will require some assistance keeping the balance or by tilting the saddle section down. It is too difficult for most athletes to tilt the saddle section down and up again themselves when placed in a running position.
In general athletes with poor ability to stand up need more assistance to get on to the RaceRunner. Wheelchair users often need to have their wheelchair placed between the rear wheels of the bike and very close to the RaceRunner. It is also good to have an assistant on each side but try in general to make use of the athlete's own abilities to move when getting into the RaceRunner. It is rarely necessary to actually carry the athlete from the wheelchair and onto the RaceRunner.
It might be useful to use the different settings of an electric wheelchair. Lower the saddle section

The coach is instructing the athletes at the beginning of the training session.
Photograph: John Clarke Russ

of the RaceRunner in order to make room for the athlete. Athletes with a lot of spasticity in the thighs sometimes need help spreading the legs in order to get the saddle into position.
When the athlete is getting onto the RaceRunner hold on to the frame or the handlebars instead of the body plate in order not to squeeze your own fingers. Always make sure that the saddle section is properly locked so it does not suddenly unlock during a race.

Clothes and some practical issues

Clothes

Thermoregulation is most individual and the clothes should always fit the specific athlete and the weather conditions. A general rule is that the upper body needs more clothing than the lower body.

> "CP athletes might experience more spasms in cold weather and will often benefit from warmer clothes."

The upper body and especially the hands and the fingers may become very cold when running.
On the other hand a lot of athletes will experience getting way to warm at the torso section resting on the body support plate.
Moisture wicking as well as wind- and water breaking clothes are to be preferred. CP athletes might experience having more spasms in cold weather and will often benefit from warmer clothes. Bike shorts with padding is recommended.
Be aware that these shorts are gender specific in their design.
Bike shorts must fit tightly and give the right support to the crotch. It is often necessary to try on several different types to find the right kind of bike shorts. Do not use underwear or sanitary towel under bike shorts.
No matter the precautions taken many athletes will experience some discomfort due to the

> "Be aware of bruises on the skin that may gradually become worse. Even small bruises might develop and cause a big discomfort."

weight pressure placed on the crotch. The skin and tissue need slowly to get used to this pressure. Have some breaks during the training session and tilt the saddle section down to release the body from the pressure.

Be aware of bruises on the skin that may gradually become worse. Even small bruises might develop and cause a big discomfort. Do communicate with the athlete and his/her assistants about this. Athletes with verbal communication problems need extra tending regarding this. Wheelchair users also need to be especially aware of this issue as the skin on their buttocks and thighs often have problems breathing and healing in a sitting position.

Shoes

Many athletes have different leg lengths and some may have a wrong positioning of their

Spike shoes with enhancement.

Athletes at the RaceRunning Camp & Cup 2016.
Photograph: Ditte Ravn Aare Petersen

legs due to their disability. It is important to take this into account and if the athlete is using custom-built shoes in the everyday life he/she probably needs custom-built shoes when training as well. The tear and wear of these shoes (especially the tip) may suggest that a pair of shoes specifically for RaceRunning training is needed.
Unfortunately custom-built shoes are often heavier than regular running shoes and this may in turn cause a foot drag. To avoid this raise the saddle a bit.
In competitions the athlete might use a pair of spike shoes that are lighter in order to increase speed and grip. Be aware that spike shoes are often tight-fitted and the toes might not be able to move. Athletes with malposition and decreased proprioception need to be especially aware of this in order to avoid overstrain.

Helmet
Athletes should always be wearing a helmet as the RaceRunner might tilt over.

Competitions
There are often some specific competition rules that need to be obliged. Normally the athlete needs to wear team jersey and bibs. Helmets are compulsory at all competitions.

Food and drinks

The athlete should always bring along a water bottle for the training session. Normally regular drinking water is fine but on the longer distances some kind of energy drink supply is a good idea. The athletes should be advised to drink plenty of water before training and competitions in order not to dehydrate. If the athlete has a long way home after the training session tell him/her to bring a sandwich or a banana in order not to become too tired.
Further reading on this topic: Team Denmarks general advices on nutrition page 53.

Training in cold and hot weather

Leif Nielsen

Basically it is possible to train in all kinds of weather as long as the right precautions are taken. There are only two exceptions to this rule: in thunderstorms and freezing rain all training should be ceased immediately.

Training in Cold Weather

When planning a training session in cold weather it is advisable to begin the run in contrary wind in order to get the following wind on the way back home.

The right cloths are important and plenty of layers are better than a few thick jerseys. For the innermost layer a sport undershirt with a moisture transport system is needed. For the outer layer a breathable windbreaker is used.

The body must able to breath and get rid of the sweat while the wind and rain on the other hand do not get in. Running in wintertime and in the dark the athlete needs a reflective jersey so that other road users pay attention. You might be able to see the other road users but they might not be able to see you.

Use one or two pairs of running socks on the feet and one or two pair of gloves for the hands. Mittens are warmer than gloves. A warm cap for the head is a must.

Remember to bring some water for the run. Even if it is cold the body perspires.

It is often a challenge for spastics to train in cold weather. The coach should always be aware that the athletes are keeping warm. It might be necessary to change the training session, e.g. to do long intervals (5-10 min) or continuous run (e.g. 30 min without breaks) instead of short intervals.

Training in Hot Weather

It is also important to have the right sport dress for hot weather. On the upper body a running T-shirt or singlet is to be preferred, on the head a breathable helmet and sunglasses is a good idea to protect against strong sunlight. When training in sun light remember sunscreen for the most exposed areas – face, ears, lips, neck, legs – but do not use it on the rest of the body as the sunscreen prevents the body from perspiring properly. Remember to drink a lot of water in hot weather.

Training in cold weather and wearing mittens. Photograph: Leif Nielsen

Remember

- Beginning in contrary wind – and return in following wind
- No training sessions in thunderstorms or freezing rain
- Dress according to the weather conditions
- Remember to drink water – also in cold weather

Being a Coach

Signe de Place Knudsen

Being a coach is more than just taking care of the physical excercises. You will typically become engaged in various social arrangements and competitions and you will get to know the athletes intimately. Often you will become an important part of the athletes' everyday life.
Some athletes are in strong need of having persons that they meet regularly.

Typically the athletes' range of movement, disabilities and needs will vary a lot. Some athletes are easily able to walk by themselves and might live on their own while others are in a wheelchair and in great need of daily assistance. Some athletes are able to drive a car themselves while others need to have an assistant bringing them and helping them during the training session. Some athletes need a lot of practical help and motivation to be able to participate in the training sessions – others do not. This depends on their everyday situation and network, how they live etc.

Like in most sports clubs the level of the RaceRunning athletes' ambitions and talent will vary a lot. And maybe even more so since in most RaceRunning sports clubs there will be only relatively few athletes. It is thereforee important to plan the training session taking into account their various abilities and performance levels.
You need to know the abilities and ambitions of every single athlete in the team and most basically why the want to do RaceRunning at all.
Some athletes want to participate in international competitions others might only participate in order to get some exercise, fresh air and meet some new friends. All these different ambitions should be met; though it is often most challenging and it might take some time and experimentation to find the right combinations and adjustments.
A repetition of certain elements through the different training session is a good way to create confidence and recognition.

"Everyone could contribute to the club spirit to be positive and supportive - for trainers athletes and voluntears!"

Training at a stadium it is easier to supervise the athletes than if the training sessions are carried out in park or in a forest. The personal assistants and the volunteers might be helpful with carrying out the training session and picking up the athletes in the latter case. It is often very helpful that the coach and the assistants are able to call each other on the cell phone in order to coordinate the training.

Training for times or doing intervals instead of distances is a good way to get athletes at different performance levels to train together. Not all athletes though have a clear idea of time and distances and the athletes might need different instructions. Some athletes need exactly to know how far and how fast they are to run and might even need a person to follow them. Instructions should always be brief and simple – also in order not to have the athletes standing still for too long.
Wearing running shoes and sports cloth as a coach seems to motivate the athletes and also makes it

easier to keep track and follow the athlete around the track when needed. Of course, the coach might also use a RaceRunner to keep track with the athletes.

"Most people like to have a role and get responsabilities. Even if it´s just to bake a cake, collect cones or be the one who keeps up the good mood."

Doing racerunning in a sports club is basically like playing soccer or doing athletics in a sports club. The athlete becomes a member of a sports club and a fellowship. Most people love to get some kind of responsibility assigned; collecting the cones after a training session, baking a cake, keeping spirits high during the training session – or whatever responsibility the individual athlete is able to carry out. Always try to engage your athletes and encourage them to participate in different kinds of activities in the club in order to create the right atmosphere and promote the team spirit!

Concentration is important for Coordination training.
Photograph: John Clarke Russ

Coaching the CP Athlete

Maria Willerslev-Olsen og Jens Bo Nielsen

Physical Activity is Important

Earlier on people with brain damage was warned against being physically active and engaged in sports. Doctors were worried that the spasticity would increase and that the joints would be over-strained.
Let us once and for all bust this myth! Basically the same fundamental rules about physical activity and sports go for people with brain damage as for people without and this also applies for sport on elite level. Physical activity is healthy and should be a part of the everyday life for everyone.
Sport and especially elite sport might always cause some injuries though and it is important to train and plan the training according to ones own individual level, to know ones own body, and to know ones own limits and abilities.

Physical Activity and Spasticity

The research from the past 20 years clearly shows that physical activity has a whole range of positive outcomes for people with brain damage – just like it has for everyone else. The level of spasticity will not increase; actually it has a tendency to decrease.

Spasticity is characterized by hyperactive reflexes that cause an increased tension in the muscles. This is an adaption of the nervous system as a reaction to the brain damage. The nervous system basically tries to use the reflexes in order to activate the muscles because the brain in itself does not have the best conditions for doing so. The reflexes therefore contribute in a positive way in order to activate the muscles and they become an integrated part of the motoric program that the nervous system uses for movement.

Restraints of the reflexes will therefore only make moving more difficult. For the same reason it is not just simply good or bad if the reflexes – and so the spasticity – increases or decreases.
Also there are no reasons that the reflexes should increase or decrease as a result of physical activity. Instead, it all comes down to how the reflexes are used in the best possible way by the nervous system in order to conduct a movement.

The main reason why people with a brain damage often feel that their muscles are stiff is actually not the reflexes, but the structural changes in muscles and the tissue around the muscles. In the worst cases these changes restrains the movement of the joints drastically. Contractures may appear and make the joint completely rigid.
A lot of research studies indicate that the physical activity and movement of the muscles contribute positively to preventing these changes and the appearance of contractures.[1,2,3,4,5,6]. If contractures have appeared they are not easily treated but some studies may show that intense physical activity has a positive effect on contractures.
At least, there are no studies claiming the opposite, that physical activity has a negative effect on contractures.

Elite Sports and Injuries

Physical activity must be carried out according to the athletes' limits and abilities in order not to overstrain the joints. There are two reasons why athletes with neurological damage are more likely to get injuries in their joints.
Firstly the wrong positioning of joints may cause that joints are strained in a wrong way and this

may cause osteoarthritis. Lund H et al. 20088 have conducted a study of pain in relation to strength training for patients with osteoarthritis who also suffer from the same incorrect positioning of joints and a decreased joint movement. An increased workload on a smaller area of the joint caused an overstraining, which resulted in a feeling of pain. In this way strength training may contain some problems for athletes with an outspoken incorrect positioning of the joints. Secondly the strength of the muscles is often reduced and the muscles may not be able to protect the joints sufficiently – but on the other hand this may actually be improved when being physical active.

Only a few research studies have been made on disabled athletes but this focus has increased much over the last years. For now it can only be confirmed – not that surprisingly – that participation in sport causes an increased risk of injuries and overstraining.

An epidemiological study concluded that the frequency and types of injuries for normal athletes and disabled athletes were the same. A Greek study from 2011[9] inquired the injuries of 180 disabled elite athletes (disabilities in legs and feet, 33 with CP, 18 ambulant, 15 non ambulant). Regarding the CP group 81,3% of the injuries were muscle injuries (sprains, strains etc.); 9,4% were caused by scratches and cuts, and the rest were caused by illness, blisters and the breaking of bones.

Guidelines for Planning the Training

There are no studies indicating that it is necessary for disabled athletes to train in a radically different way. Disabled athletes may therefore in general use the guidelines worked out by Team Denmark[15] as well.

Like in all elite sports it is crucial to pay attention to the body's signals and plan the training according to these. A slow progression is important and it is crucial also to differentiate between good and bad pain. Pain is subjective and it is important that the athlete learns to evaluate the different feelings of pain and learns when to say stop.

If training and physical activity is something relatively new to the athlete a slow progression is even more important. In the beginning one or two training sessions per week is sufficient and

The 400m start, Herning Games 2016.
Photograph: Peter Kromann

At the national level there is class for athletes in need of assistance for steering. The assistant can only touch the RaceRunner when the RaceRunner is loosing direction. Photograph from the RaceRunners Camp & Cup 2016.
Photograph: Ditte Ravn Aare Petersen

only some months later a regular daily training can begin. For elite athletes there are no problems with having a daily training session as long as the athlete listens to the signals from his/her own body. Continuously training during the whole year is of great importance. There is no specific documentation regarding this in relation to the CP population. But because longer pauses in the training have a clear negative effect on the condition of the body and performance level it is likely that these breaks causes more injuries to appear.
Another important reason for avoiding long breaks is that it is mentally and physically hard to get back into shape every time it happens.
In case of longer pauses in the training season (e.g. between end of season and the next season) it is important to have training facilities at home. This is also a great idea if the athlete for some reason is not able to get outside the home in a period of time.

What Kind of Training is the Best?

The best training strategy is to train exactly the kind of sport you want to perform well in.
If you want to participate in Tour de France you have to bike a lot. If you want to swim across the English Channel you have to swim a lot. And if you want to become a world champion in RaceRunning you have to spend a whole lot of hours practicing RaceRunning.
If your goal is a long distance performance the training should be aerobic. If you want to become a sprinter the training should mainly consist of high intensity training. This does not mean that there are no benefits from the opposite kind of training and the training of movements that are different from the kind of competition the athletes wants to in. It simply means that the benefit is relatively bigger if the athlete practices exactly what the athlete wants to compete in.
Strength training has been proven to prevent injuries and strength training is also an important training element for para athletes in order for them to acquire the muscle strength needed around the specific joints being strained during the specific discipline. Fitness training on an exercise bike is a good way to acquire a basic fitness level for al kinds of sport. But seen from a 'training economical perspective' there is in general no doubt that the time is best spent practicing exactly what you want to compete in.

Ready for training after warming up at RaceRunners Camp & Cup
Photograph: John Clarke Russ

How do We Create a Fair Competition

Marianne Hornbæk Jensen

The Classification System

Elite sport competitions are never completely fair even not among non-disabled athletes. We often try to create a more fair competition, e.g. with the use of weight classes in boxing.

In para sports – and so in RaceRunning – we have a classification system in order to secure a fair competition among the athletes. The athletes are classified according to their disability and level of function in relation to the specific discipline.
This means that athletes with different kinds of disabilities are able compete against each other.

The RaceRunning Classification contains two parts: An assessment according to the Minimum Disability Criteria (MDC) and an assessment regarding the specific RaceRunning class. The MDC states the minimum of disability that it takes for an athlete to be allowed to compete in RaceRunning competitions. The evaluation may consist of a physical examination, tests and observations during training or competitions.
Both classification and MDC are specific to the sport of RaceRunning and even though the athlete has been classified in relation to another sport he/she needs to be re-assessed and classified for RaceRunning.

Once a year RaceRunning Denmark offers a classification. Certified classifiers are classifying the athletes. The Danish RaceRunning Committee and the Medical Board of Parasport Denmark are governing and facilitating this classification process. The Danish RaceRunning Committee is a part of the Danish Para Sports Athletics Committee.

Three Classes of RaceRunning
This is a brief description of the three classes of RaceRunning.
Men and women are competing in separate classes.

The RR1 athletes have major problems with the control and coordination of the RaceRunning movements. Severe difficulty in isolating individual joint movement in the lower extremities and poor control of the stride. Foot drag, severe asymmetry, or no alternating leg movement may be observed. May have limited hand and arm function as well as limited trunk function.	**The RR2 athletes** are characterized by asymmetry and limited range of motion. This group has moderate involvement in the upper extremities and trunk and moderate to severe involvement in lower extremities. The stride pattern may be short, asymmetrical or unilateral but more effective than RR1. Minimal or no foot frag. Bilateral, alternating, unilateral and simultaneous leg push will be effective but limited by weakness, range of motion, spasticity or athetosis.	**The RR3 athletes** will have moderate complications in the legs, symmetrical or slightly asymmetrical stride pattern with good push off. The ability to isolate lower extremity movements but hip and stride contractures may limit stride length. Moderate to good steering and trunk function, control of the upper body and an effective start (no startle reflex) with a good acceleration.[21]

Coaching Theory and Coahing Practice

Leif Nielsen

Warming-up and Warming-down

Warming-up is a gradual physical and mental process that prepares the athlete for the upcoming physical activity.

The purpose of Warming-up is:

- To improve the performance
- To minimize the risk of getting injuries

There are various physiological effects gained from warming-up, e.g.:

- *Increased body and muscle temperature*
- *Increased speed of the chemical processes in the body*
- *An improved transport of oxygen from the blood to the muscles*
- *An improved nerve conduction velocity*
- *Improvement of the synovial fluids*
- *A quicker adaptation of the respiration and the circulatory system for the upcoming physical activity.*

There are two ways of warming up:

A. The passive method is to take a hot shower or going to a sauna. Since it is only the outer layers of the muscles that are warmed up doing so this method is not efficient.

B. The active method is to use the muscles for physical activity. This method is way more efficient and in this way all the muscle layers are being warmed up.

In resting condition the muscle tissue and the connective tissue around the muscles are in a shortened condition. After thorough warming-up the length of muscle tissue and connective tissue are increased by up to 10%. During warming-up the temperature in the muscles are increased as well and this implies an increased speed of the chemical processes in the body.
Another important effect of warming-up is that it minimizes the risk of getting injuries.
In resting condition only 20% of our blood is in the muscles. During warming-up the percentage is increases to approximately 75%. The overall physical performance will thereforee also be improved.
Warming-up begins with running at a slow pace for about 10 min. Gradually the velocity should be increased and in the end the athlete can do a couple of increase runs (70-80 meters).
All together warming-up should last for 20 to 25 minutes.

Sayers Grooms (USA) is warming up at the Camp 2014. Photograph: John Clarke Russ

Just as important as the warming-up before the competition or training session is the warming-down process. By warming-down the session/competition ends just the same way as it started after a session/competition with a rather high intensity. Warming-down begins with running at a slow pace for about 5 to 10 minutes. The warming-down process ends with a couple of increase runs (60-70 meters) at a medium pace. Remember to do some stretching exercises after this.

Stretching out the upper body, at the Camp 2011. Photograph: Rohat Everløff

Remember

- Warming-up should last for at least 10 minutes
- Clothing should suit the conditions
- Warming-up should contain a general part and a sport specific part
- Gradually increased intensity
- Remember the stretching exercises (see page 46)
- Warming-up is also a way to prepare the athlete mentally
- Warming-up must be suited for the upcoming activity
- Warming-up must take place just before training or competition

Planning the Training

It is important that an athlete development plan for a certain number of years is made.
The golden rule says that it takes about 10.000 hours of training to reach the world elite.
Therefore a long-term plan that lasts for about 8-12 years is needed, including an outline for what there is to be trained every single year.
A long-term plan also needs to take into account how children and youngsters should be training at different age levels.
In the early years the pattern of movement and the most fundamental aspects of the sport should be in focus. Hereafter the main object is to learn how to train. Not before the age of 15 will the training sessions be focusing on competitions and on winning competitions. In order to assure the right kind of progress it is necessary for the training to be planned carefully. This regards not only the specific training sessions but also the long-term planning.

The main reasons for planning the training are:

- *To prevent injuries and that athletes are overtraining*
- *To assure a certain progression of the training*
- *To plan for the athlete to peak at the right time*
- *To always base the training on the previous experiences and the training programmes*
- *To assure a certain variation in the training programme*

When planning the training certain elements are always to be taken into account. The book Idrættens Træningslære lists 19 items for making a good training plan.

The first 7 items are about knowing the specific sport that is to be planned for – in this case RaceRunning – knowing the athlete and knowing oneself as a coach.

Items 8-19 regards the planning itself, evaluating and adjusting the training plan.

After item number 19 the coach returns to item number 8 and begin all over again as a new season is to be planned for.

Below is a summary of the so-called "Figure 6 plan" (it looks like the figure 6).

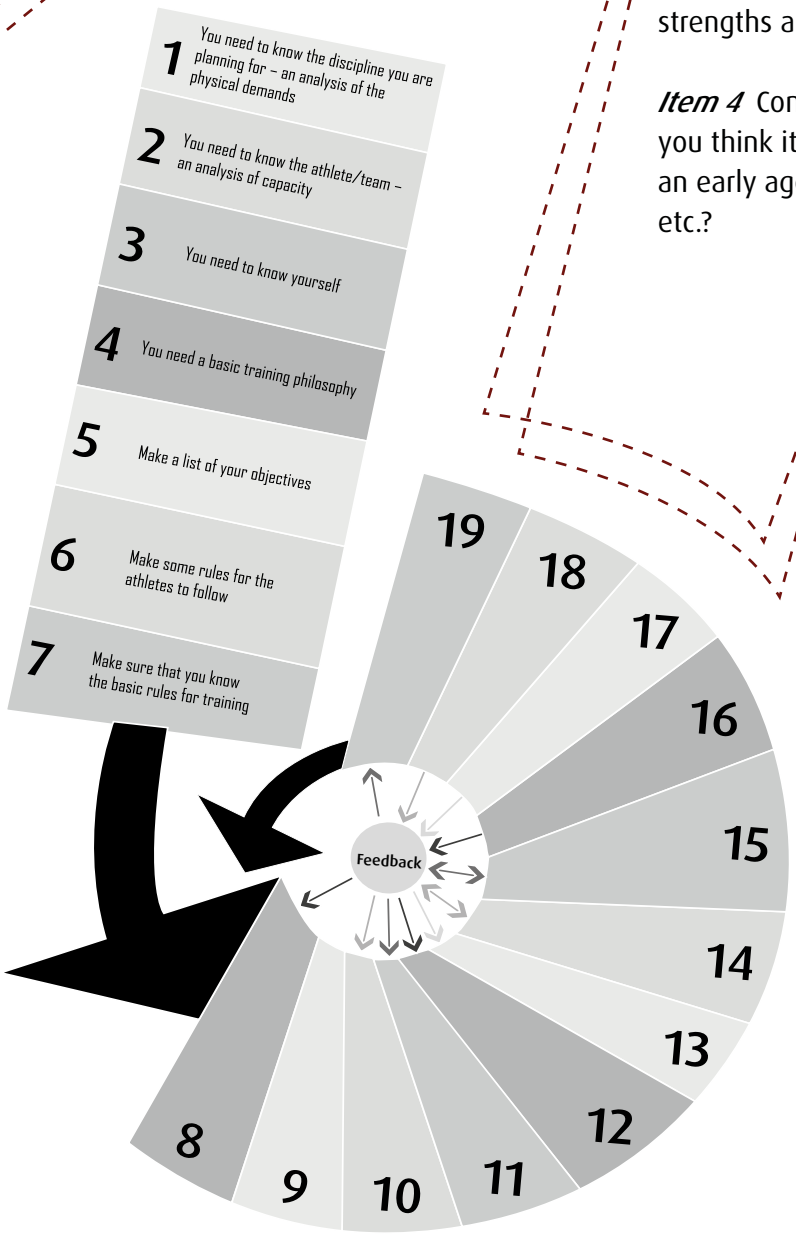
Item 1 First of all you have to find out what type of sport you are planning for. Is it running on the track or outside the stadium? If it is track running, is it then sprint, middle-distance or long-distance running? It is important to know the specific physical requirements for the discipline, in this case RaceRunning, in order to plan for and conduct the right kind of physical training. To sort out these specific physical demands the following should be made: 1. An analysis of the physical demands of the specific discipline; and 2. An analysis of Capacity.

Making an analysis of physical demands means to sort out the specific physical demands of the sport RaceRunning doing observations and measuring physical factors.

Item 2 Concerns the specific athlete who is to be planned for. This is called AN ANALYSIS OF CAPACITY. You need to analyse and describe the athletes' physical and mental condition and capacity.

Item 3 Concerns you as a coach. Find out who you are and what you stand for. What are your strengths and what are your weaknesses?

Item 4 Concerns your coaching philosophy. Do you think it is best for an athlete to specialize at an early age, what is your attitude towards doping etc.?



Planning the Training

8. Make a long-term plan
9. Make a plan for the whole year
10. Make a periodic plan
11. Make a week plan
12. Make a schedule for the training sessions
13. Make a plan for reaching the peak fitness conditions
14. Carrying out the plans
15. Adjustments during the process
16. Conduct an assessment
17. When something does not work properly
18. Do a summary of the training
19. Adjustments & new planning

Source: Idrættens træningslære[19]

Item 5 Performance objectives. You need to consider if you wish to coach regular athletes or elite athletes (and if so whether you are aiming at participating in the Paralympic Games or WC). A lot of consequences follow from this choice. As the former Norwegian marathon runner Grete Waitz once said: "I sat a goal for myself and took the consequences of this - sufficient training of a certain quality - a harmonic and meaningful way of life - relaxing and restitution - giving priority to training and restitution."

Item 6 In order for the social aspect of the training to work - so that everybody enjoys going to the training sessions - there need to be a few rules. Below is an example of a set of rule used in Herlufsholm Gymnastik (HG) athletics in Denmark in order to make everybody feel welcome:

1. *Everybody needs to feel safe and secure and as a part of the team.*
2. *Everybody should be supporting each other at the training session and at the competitions.*
3. *Everybody has to contribute and work hard in order to be rewarded (no pain, no gain).*
4. *The training should present to the individual athlete the right physical and mental challenges in order to create progression.*
5. *The coach needs to have knowledge of training, he/she needs to have coaching skills, he/she needs to take interest in all of the athletes, and he/she needs to be trustworthy.*

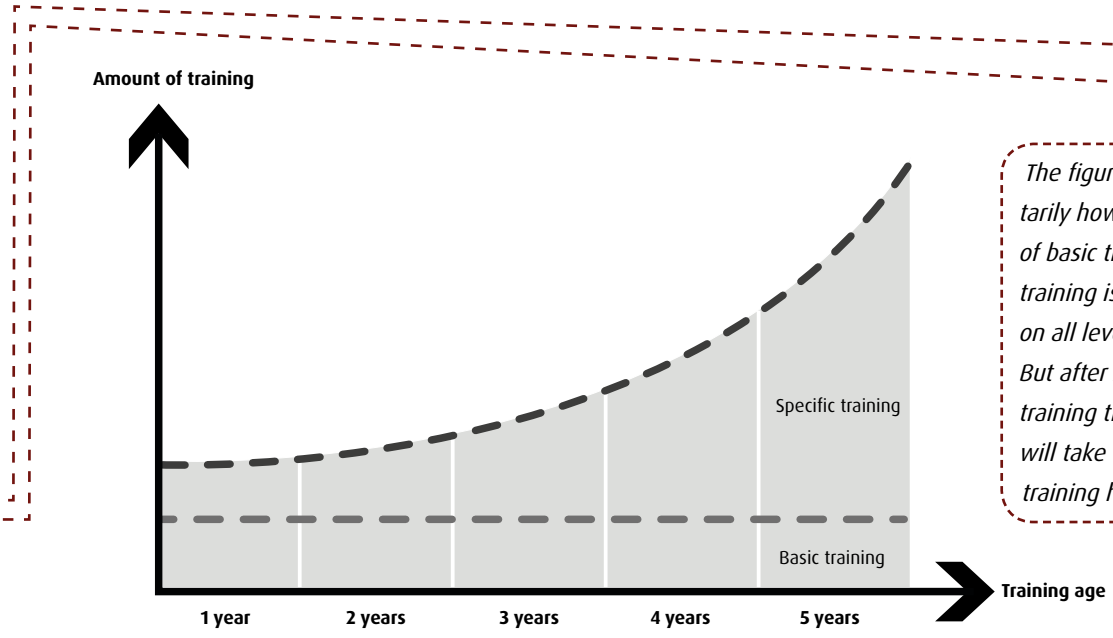
Item 7 As a coach you need to know the basic rules of training. It is import to plan for variations and for a balance between training and restitution. You also need to take into account external factors such as the athlete's education/work/life style etcetera.

Item 8 Together the athlete and the coach agree upon which competitions will be the main objectives in the time to come. This can be e.g. the club championships, the national championships, WC, PL, or basically any specific race or event.

As the Figure 6 plan shows the planning of the training is built up backwards:

- Planning for more than one year
- Planning one year
- Planning a period
- Planning a month
- Planning a week
- Planning a single training session

Basic training is training the basic skills, movements and general strength.



The figure shows rudimentarily how the distribution of basic training and specific training is. There will always, on all levels, be basic training. But after some years of training the specific training will take up still more of the training hours.

Specific training is the training of the specific elements that are important for the distance(s) that is (are) the main objective(s).

Item 9 When the long-term plans/objectives are agreed upon it is time to do the annual training plan.

The first things to mark in the annual training plan are the most important competitions during the year to come. Secondly these competitions should be prioritized as very important, important, or less important.
It is necessary to make some priorities since it is not possible to peak at every single competition. Just before a competition the training should be reduced and after the competition the athlete needs a few days of resting. In this way you typically 'trade' one week of training for a competition.

The specific phases of an annual training plan are:

The build-up phases
The progression is to develop the fitness.
This phase takes time and should be given priority in the annual training plan. The build-up period is the basis for the training the rest of the year.

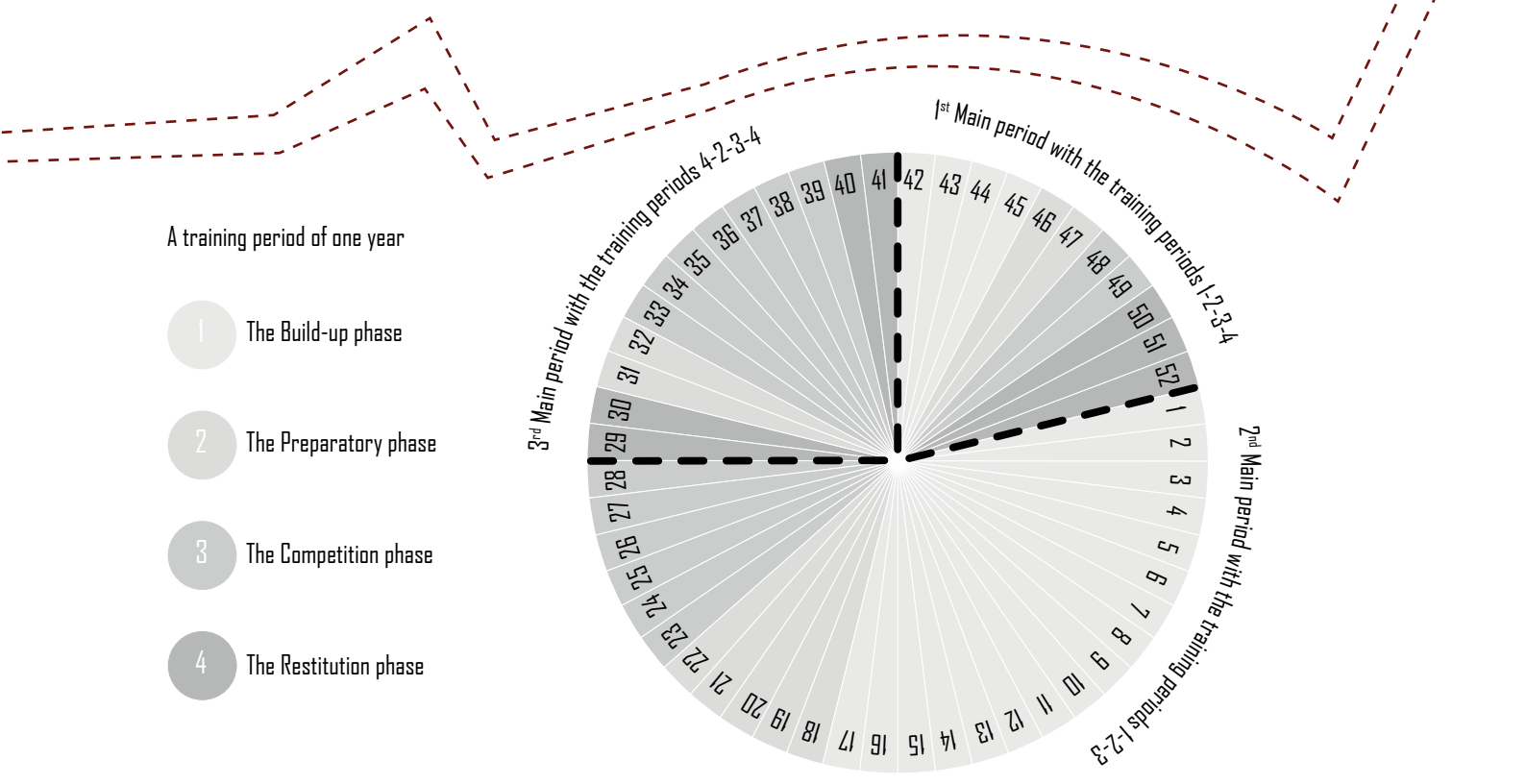
The build-up period is from November to the beginning of April.

The preparatory phases
The aim is to prepare for the competitions. The training sessions are of high intensity and simulate the competitions. The preparatory phase is placed after the build-up phase and leads to the competition phase.

The competition phases
The training sessions are shaped according to the competitions in the specific period and the importance of the competitions. Before a very important competition the training is markedly reduced, but before a secondary competition the training sessions are almost regular.

Restitution
The aim is to relax and to have time for restitution – physically as well as mentally – after a tough phase of training or a long season of competitions.

A rudimentary version of an annual training plan may look like this:



Phases and supercompensation

The physical training leads to a decomposition of the tissue and organs that are being used. The reinforcement and strengthening of the body takes place in the restitution phase and in this way the progress in fitness appears. The restitution phase is also of great importance in order not to break down the body in a long-term perspective.
Restitution is one of the two main reasons to plan the training in phases; the other reason is to create variations. The phases can be composed of micro- and macro-cycles. The micro-cycle describes the strenuous days, the easy days and the restitution days on a weekly basis. The macro-cycle describes the same phases but on an annual basis.
Each training session leads to a decomposition of the tissue and organs that are being used. But in the resting phase after the training the tissue and organs will be rebuilt on a higher level than before the training session. This is called supercompensation. But if a new training session does not take place during the following week the athlete will return to his/her original fitness level.
According to the amount of training carried out and the period of restitution (i.e. sufficient or to little) the following restitution curves shows some different scenarios of the micro-cycle.

Fig.1 shows the scenario of to little training, which will only keep the athlete at his/her original fitness level. No physical progress.

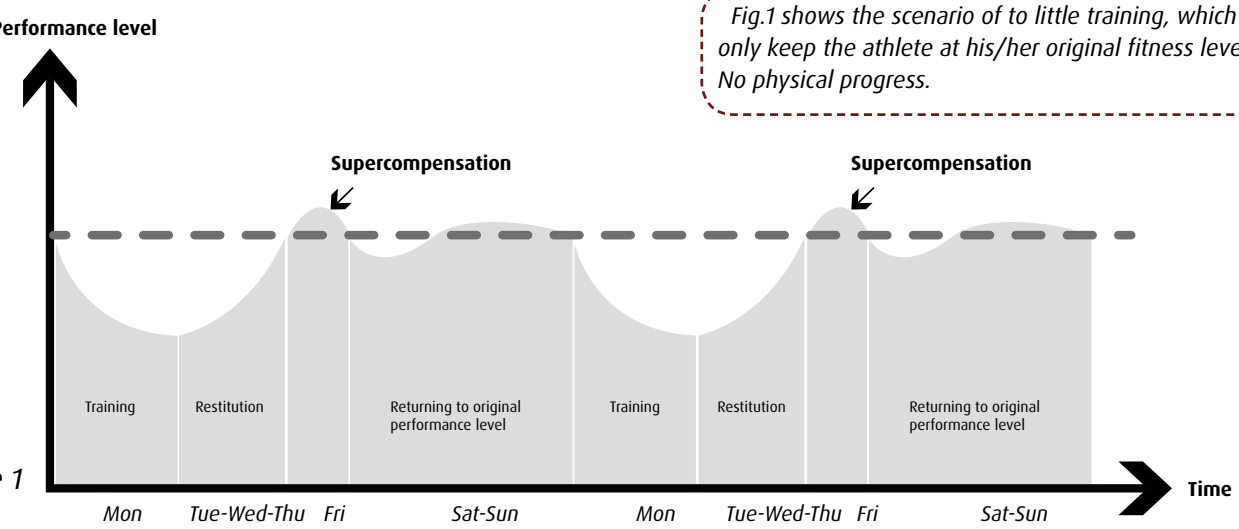


Figure 1

Fig. 2 shows the effect of counterproductive training. The restitution phases are to short. The body is overstrained and the risk of injuries is huge.

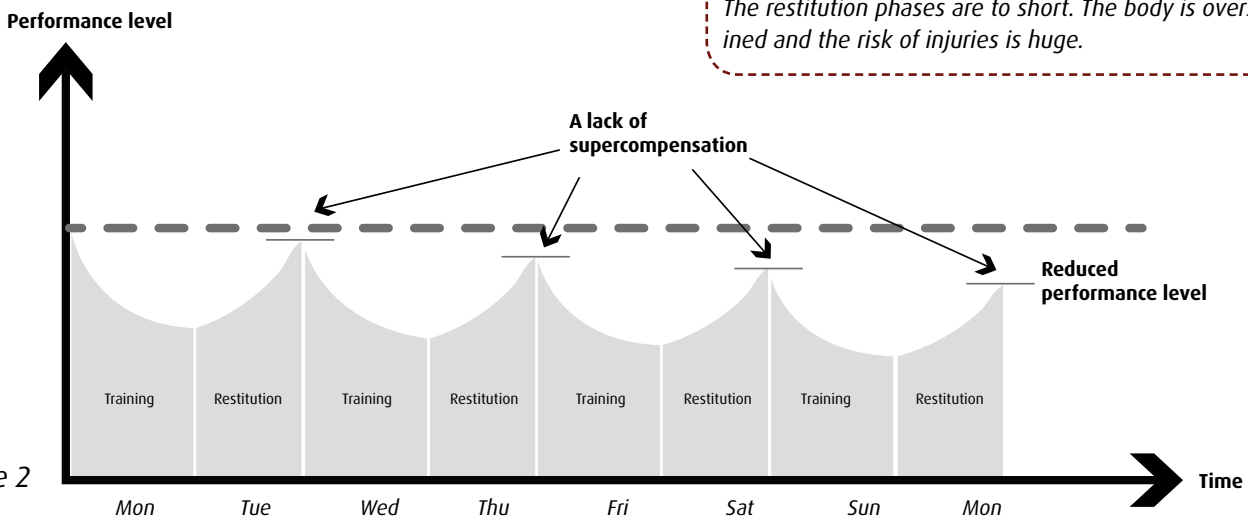


Figure 2

Source fig. 1 - 7: Idrættens Træningslære [19]

Fig.3 illustrates the correct distribution of training and restitution. This is the right way to be training; the body is strained but not overstrained and gets enough time to rest in order to increase the performance level.

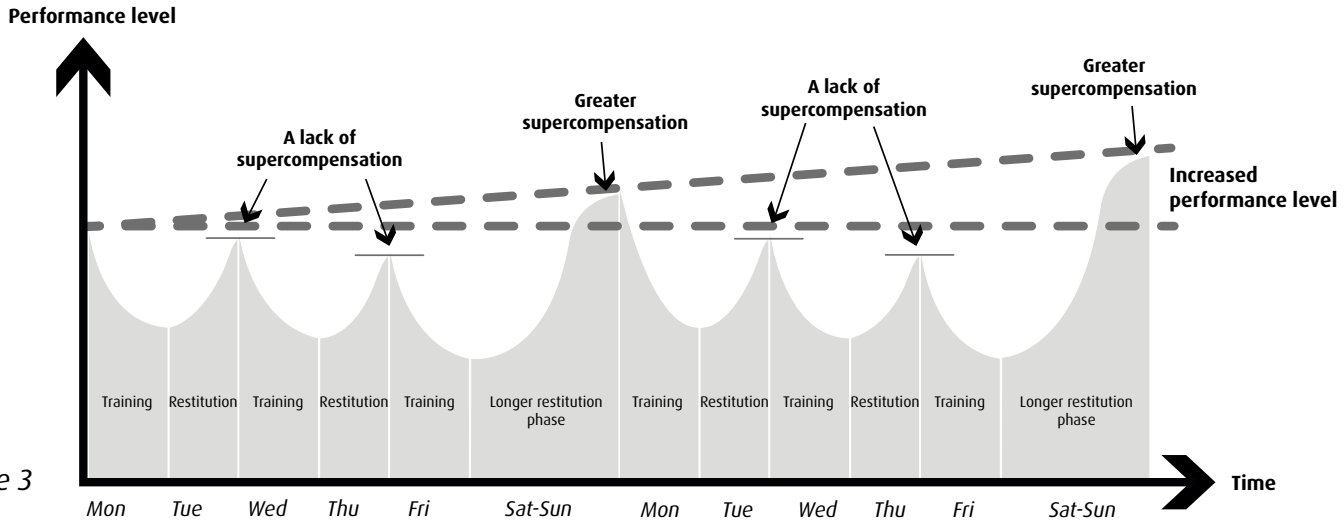


Figure 3

Fig. 4. The scheme shows how long time the body needs for restitution after a training session of certain intensity. In this way the scheme also gives the coach a clue to what is the necessary amount of rest between the various sessions.

Intensity	Normal Duration of Restitution	Normal Duration of Supercompensation
Low	¼ - 1 ½ 24hrs	From a few hours to a couple of days.
Moderate	½ - 2 24hrs	1 – 3 (-4) 24hrs
High	1 – 3 24hrs	1 – 4 (-6) 24hrs
Very high and Maximum	2 – 4 (-5) 24hrs	3 – 6 (-10) 24hrs

Figure 4

Item 10 and 11 When the annual training plan is done it is time to do the periodic plans and weekly plans. Periods can be spring, summer, autumn and winter, or the space of time between two training assemblies for the national team.

The hours of training and the intensity of the training should vary from week to week. This also lessens the risk of injuries.

Figures 5, 6 and 7 below show how the specific weeks during a month can be planned. The same guiding principle applies here: try to create a constant shifting between easy, strenuous and very strenuous days and weeks. This shifting secures variation of the training and causes the body to be strained in different ways. It also creates the right progression in the athletes' physical abilities.

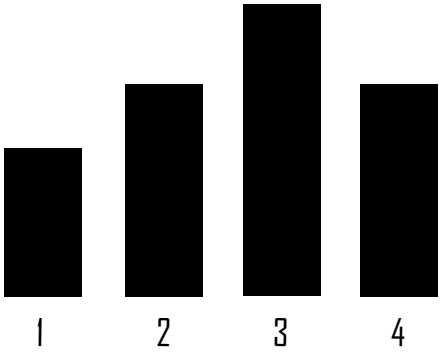


Figure 5

Fig. 5 shows a 4-week training cycle composed of an easy week, a strenuous week, a very strenuous week and a strenuous week. This is the most popular cycle. It is strenuous without being to strenuous for the body.

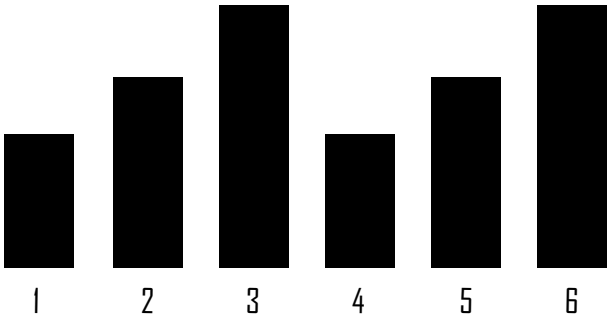


Figure 6

Fig. 6 shows a 3/6-week training cycle. Easy, strenuous and very strenuous weeks are repeated. The athlete needs to have years of training routine and to be in a very good shape for this cycle.

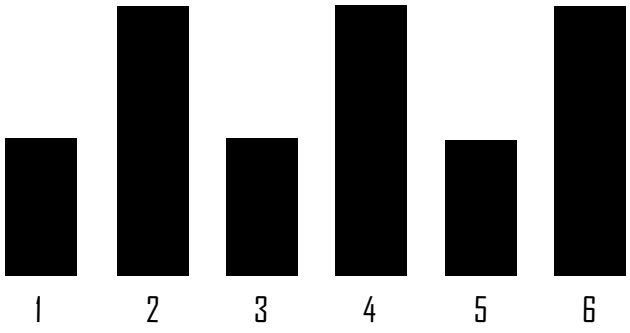


Figure 7

Fig. 7 shows a training cycle that lasts only for two weeks. This cycle is very good for the regular club training. It is composed of a strenuous training day followed by an easy training day.

Item 12 The training session. Below is an example of how a training session can be planned and built up by specific elements:

1.	*10-15 min. running at a slow pace*	**Warming up**
2.	*2-3 x increase run (60m)*	
3.	*Stretching out*	
4.	*Main training*	
5.	*5-10 min. running at a slow pace*	**Warming down**
6.	*1-2 x increase run (60m) .*	
7.	*Stretching out*	

Training Programmes

There are many good reasons to have a training plan. The training plan secures progress and minimizes the risk of injuries. The training plan should not be followed blindly though. It is important to be flexible and follow the athlete closely. A training plan is a basic idea of how to create progress.

Training Diary

It is important to keep a training diary in order to plan the training in the time to come. The diary can also be used to analyse why the performance at a competition was bad or good, or to find out why an athlete got injured.
Many athletes are only keeping track of times and notable deviations. The plan is already there so it is mostly important to keep track of the deviations.
The athlete himself/herself should keep the diary – maybe with assistance from parent/assistant. For the club's training the coach should keep a diary on the progression of the training – what was good and what went wrong etc.

Item 13 Item number 9 was the creation of an annual training plan with the prioritization of the specific competitions. Now it is time to plan for the peak fitness condition. "Peak fitness is a concept that denotes the maximum level of performance that an athlete can reach within a season." Normally an athlete reaches one or two fitness peaks within a year.

Item 14 Up until now everything has been theory only – the planning of the training. Now it is time for the actual training to be carried out – guided by our thoughts, ideals and plans.

Item 15 When the actual training is carried out in real life it is normal that adjustments have to be made along the way. Problems (like injuries) may always arise and then the training needs to be adjusted.

Item 16 Testing. It is important to test if the training that has been planned and conducted actually leads to the objectives and results that are wished for. For a runner the competitions can be such a test.

Item 17 Even if everything apparently works once in a while everybody will experience that something does not function properly. If so the coach needs to check if the plan does not work, if there are any problems with the coach herself/himself or with the collaboration with the athlete. Does the athlete often become injured? Is there a good balance between training and restitution? Is there a good balance between training and meals? Is the athlete often sick or ill?

Item 18 After ending a period or season this period or season should always be evaluated. Did the training lead to the increased performance level? What was achieved? Did anything go wrong? Both the athlete and the coach should be evaluating.

Item 19 Taking into account the evaluation and the experience from the former season it is time to look forward to the next season and the planning process begins all over again.

Physical training

The following sections deal with the physical training. A lot of the elements are to be perceived only as an option for a beginner while they are compulsory for an athlete with elite ambitions.

What are the most important training elements for a RaceRunning athlete?
The most important elements for a RaceRunning beginner athlete are:

- *Condition training (physical fitness)*
- *Strength training*
- *Coordination training*
- *Stretching out*

Condition training is the athlete running various distances at a various pace. The objective is to build up a good physical fitness. A good physical fitness also means that the athlete more easily will be able to carry out a lot of everyday activities and the risk of getting circulatory diseases will diminish.
A beginner typically runs continuously for 15-30 minutes. Or the athlete runs for the same period of time but the interval is divided into e.g. 3 x 5 minutes with short breaks between the intervals. All training for beginners should be based upon the principle of intervals. Intervals is basically a question of shifting between different paces, e.g. from very slow to medium speed, or from fast to very fast. The pace should always correspond with the athlete's abilities.

Strength training is the athlete using himself/herself or an external source (e.g. elastics, weights, machines) to increase the athlete's muscle strength.

Remember

- Analysis of physical demands – for RaceRunning specifically
- Analysis of capacity – describe the athletes' physical and mental condition and capacity.
- Know yourself as a coach
- Have knowledge of the basic training theory
- Avoid overstraining and prevent injuries
- To ensure a certain progression in the training
- Plan the training using you experiences from the former training plans/sessions
- To keep a training diary

The important muscle groups to be trained are the abdominal muscles, the back, the arms, and the legs. The overall purpose of strength training is to increase the general strength of the body. The strength training will also lessen the risk of getting injuries. An improvement in strength will also improve the running technique of a Race-Running athlete.

Coordination training: Coordination is of great importance for the athletes. Coordination is basically the collaboration between nerves and muscles. The better your coordination is, the better your technique will be.

Stretching out: Athletes with CP may experience normalization in the degree of spasticity as a consequence of passive stretching out. This might give the athlete a feeling of calmness. Active stretching out might be practiced just before technique training or strength training to give the athlete a possibility to use most of the range of movement.
There is no scientific proof that stretching out has an impact on the degree of spasticity. [22]
Learn more about stretching out on page 46.

Condition Training

Calculating the intensity

When the athlete is training condition training (aerobic) or anaerobic it is important that the pace is right. There are several methods for determining the right pace for the athlete.

- One way to determine the right pace is the "TALKING METHOD" where the athlete is to speak a certain number of words coherently. How this method is applied will be described below. This method is good for beginners.

- Another and more accurate method is performance timed, measured with a TEST at a given distance.

For a sprinter the time that the training will be aiming at will be calculated from the athletes PB result on either the 100, 200 or 400-meter distances. For a middle distance runner the results used are the results either from the 400, 800 or 1.500 meter.

Examples of this calculating method will follow later.

- The third method is training according to the PULSE. The athlete needs to know his/her resting heart rate and maximum heart rate. This method is not that accurate for RaceRunning athletes since most athletes has a rather high resting heart rate level due to their spasms. In this case the training should follow the maximum heart rate.

There are two ways of determining the maximum heart rate. The theoretical and less accurate:

Women: 226 – minus the athlete's age, e.g. a 19 year old athlete = 226 – 19 = 207 beats per minute.

Men: 220 – minus athlete's age, e.g. a 19 year old athlete = 220 – 19 = 201 beats per minute.
The reason for subtracting ones age is that the maximum heart rate decreases by one beat for every single lived year.

A more accurate method for determining the maximum heart rate is to find a hill to practice on. The hill needs to be about 150 meters long.
The athlete warms up and after this the athlete sprints to a maximum uphill, then stops and counts the pulse for 15 seconds and multiply this figure by 4. The result is the athlete's maximum heart rate for one minute.
Ten minutes later this process is repeated and if the results are varying the numbers are added and divided by two.

Aerobic training

Aerobic training is defined as an activity where oxygen is used in order to release energy in the muscles. In this way carbohydrates (glycogen) and lipids are burned off.
The aerobic training is subdivided into 3 groups: low-, moderate- and high intensity training.

The overall objectives of aerobic training are:

1. *Improving (or maintaining) the circulatory systems´ ability to transport oxygen in order for an increasing part of the overall energy release at high intensity to be due to aerobic processes.*
2. *Improving (or maintaining) the ability of the muscles to use oxygen to burn off lipids and in this way to improve the muscles ability to work for a longer period.*
3. *Improving (or maintaining) the body's ability for restitution after high intensity performances and in this way to get ready faster for a of new high intensity performance.*

Aerobic training is also fitness condition training. By running in one of the three areas of intensity the athletes' condition will be improved.

Low Intensity Training

The purpose of low intensity aerobic training is a faster restitution process and in this way a regaining of the normal physical level after high intensity competition or training.

Low intensity aerobic training is mostly conducted after high intensity competition or training. It is also used before competitions in order to spare some energy.
During a competition or a tough training session small rifts in the muscle tissue and fibres are created. Due to these rifts smaller bleedings will occur and the muscle becomes hard and soar. This soreness appears immediately after a competition or a tough training session and it is felt the most on the second day hereafter.
We know from experience that low intensity training in the days following a competition or a tough training session helps to get rid of the soreness. In this way the restitution will be better and the athlete will get ready for the next training session faster.
This also has a mental function. This part of the training is so easy and calm that the athlete can clear his/her mind and this increases the motivation for the following training sessions.
Low intensity training lasts from 10 minutes up to 3 or 4 hours. The intensity should be rather low – about 65 %.

Sofie Farver and Thea B. Jørgensen during a training session of low intensity
Photograph: Leif Nielsen

For a beginner this will typically mean jogging/ running for about 30 minutes without any breaks. The 30 minutes may be divided into intervals of 3 x 10 min with a short break of one or two minutes between the intervals.

Intensity:
Talking method:
The athlete must be able to speak a sentence with the length of 7 to 10 words with the athlete being understandable and not out of breath. Below is the example of a RR2 athlete.

Time:
Sprints: 200 m. on 55,00 sec.
65-70%: In between 74 and 72 sec.
Middle-distance: 800 m. on 5.00.00 min.
65-70%: In between 6.45.00 and 6.30.00 min.

Pulse:
180 beats per min. 65-70%: 117-126 beats per min.

Moderate Intensity Training

The purpose of moderate intensity aerobic training is:

1. *Improving (or maintaining) the ability of the muscles to endure working for longer periods, i.e. to improve the aerobic capacity.*
2. *Improving (or maintaining) the body's ability for restitution after high intensity performances.*

Doing moderate intensity aerobic training the intensity should be at about 80%, shifting between 70%, 80% and 90%. The moderate intensity aerobic training can be conducted 1/ continuously or 2/ in intervals. Doing intervals the exercise should last for about 3 minutes or longer and the break should last for 1-2 minutes.

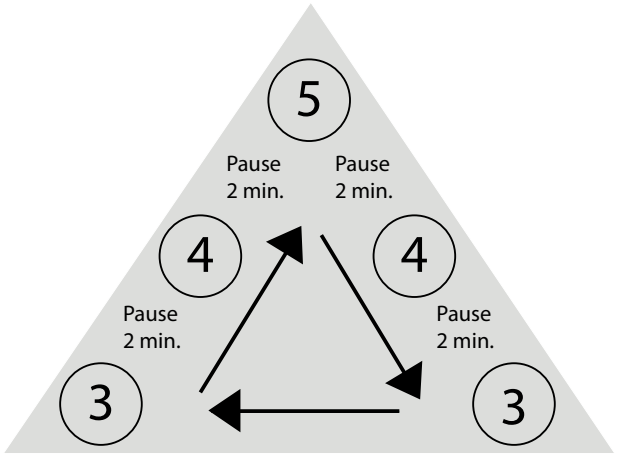
1. Moderate intensity aerobic training may last for up till 2½ hours.

Examples of Moderate intensity aerobic training:

It is important that the movement pattern of the training session is designed specifically for RaceRunning.

The training session can be a certain interval with a certain %-exercise level, i.e. continuously performing.

2. Another method is to do intervals or 'speed games'. The intervals may last from 3-10 minutes with a relatively short break in between (of 1-2 minutes) and with a lot of repetitions (12-20). To create variation the sequence can be built up like a pyramid, e.g. 3 min, 4 min, 5 min, 4 min, 3 min, with the whole pyramid carried out 2-3 times. The breaks should be only two minutes but in between the series (e.g. pyramids) the breaks can be one or two minutes longer. The intensity should be about 80-85%.



Pyramid Scheme

'Speed games' is about playing with and changing the pace. The athlete may e.g. choose to run very fast from the nearest stadium light standard to the third standard. The athlete then runs slowly for a few minutes and then again chooses to run very fast from the nearest stadium light standard to maybe the fifth standard. If the training session is placed during the built-up phase the athlete may choose to sprint uphill on a hill in order to strengthen the take off movement. If the training session is placed during the Preparatory phase or Competition phase the athlete should sprint downhill instead in order to practice speed and a fast footwork.
If the athlete chooses to practice without any breaks the maximum practice time amounts to 15 minutes. These 15 minutes can be subdivided into 5 x 3 min (with short breaks of 2-2½ min.)

Intensity:
Talking method:
The athlete must be able to speak a sentence with the length of 4 to 7 words with the athlete being understandable and not out of breath.
Below is the example of a RR2 athlete.

Time:
Sprints: 200 m. on 55,00 sec.
70-90%: In between 72 and 61 sec.
Middle-distance: 800 m. on 5.00.00 min.
70-90%: In between 6.30.00 and 5.30.00 min.
Pulse:
180 beats per min.
70-90%: 126-162 beats per min.

High Intensity Training

The third aerobic form of training is aerobic high intensity training. The purpose of this form of training is:

1. *Improving (or maintaining) the ability of the body to work at high intensity for a long time, i.e. to improve (or maintain) the maximum aerobic effect (the condition).*
2. *Improving (or maintaining) the body's ability for restitution after high intensity performances.*

With this third aerobic form of training the intensity lies in between 90% and 100%. High intensity training may also be conducted in two different ways, continuously and in intervals.

For the continuously training form the intensity must be at least 90% and the training should last from 10 to 30 minutes.
Training high intensity using intervals gives you two new options: short or long intervals.

1. Short intervals:
   a. Exercise lasts for 10-120 seconds
   b. The break/slow pace phase lasts for 5-60 seconds.

The exercise can be composed in various ways; work/break: 20/10 seconds; 45/20 seconds; 70/30 seconds; or 90/45 seconds

2. Long intervals:
   a. Exercise lasts for: 2-10 minutes
   b. The break/slow pace phase lasts for: 1-6 minute(s)

There are even more ways to conduct the training:

1. Intervals, short or long intervals.
2. Pace race with staggered starts: The slowest runner begins first, the fastest runner last. The athletes then reach the finishing line at approximately the same time.
3. 'There and back again': All athletes start at the time running e.g. 3 minutes and then everybody turns around at the same time. The athletes should then reach the finishing line at the same time.
4. Pyramid race */
5. 'Speed games' **/, playing with and changing the pace
6. Hill running, sprint uphill (strength), sprint downhill (speed and footwork).

*/Pyramid race. The pyramid is wide at the bottom and pointy at the top.
Pyramid training for a sprinter could be: 75 sec. – 60 sec. – 45 sec. – 30 sec. – 15 sec. – 30 sec. – 45 sec. – 60 sec. – 75 sec.

Pyramid training for a middle-distance runner: 2.00 min. – 1.45 min. – 1.30 min. – 1.00 min. – 1.30 min. – 1.45 min. – 2 min.

/ Speed games
Speed games is about playing with and changing the pace. This exercise was invented in the 1960's by the Swede Per Olof Åstrand. Speed games are a kind of jogging or sprint, uphill or downhill, using the terrain in different ways.
Speed games should be fun and playful. In this way the athlete relaxes and clears the mind in order to perform at other times. Speed games can also be done in another way making the training a small journey: different elements of the training can be done or practised during the trip, e.g. sprint between to marks (the shorter the distance, the faster the pace).

Intensity:
Speaking method:
The athlete must be able to speak a sentence with the length of 2 to 4 words with the athlete being understandable.

Time:
Sprints: 200 m. on 55,00 sec.
90-95%: In between 61 and 58 sec.
Middle-distance: 800 m. on 5.00.00 min.
90-95%: In between 5.30.00 and 5.15.00 min.

Pulse:
180 beats per min.
90-95%: 162-171 beats per min.

Remember
- Aerobic training
- Low intensity
- Moderate intensity
- High intensity
- Balancing between training and breaks

Anaerobic Training

Anaerobic training is defined as an activity without enough energy released from oxygen only. Most of the energy then comes from decomposition processes without using any oxygen. Carbohydrates are still the energy source but the decomposition takes place without the use of oxygen.
The overall objectives of anaerobic training are:

1. *Improving (or maintaining) the ability of the body to react fast and to quickly produce energy for the most strenuous exercise level.*
2. *Improving (or maintaining) the ability of the muscles to quickly and continuously obtain the energy for the most strenuous exercise level.*
3. *Improving (or maintaining) the ability of the body's ability for restitution after strenuous exercise.*

The scheme shows the distribution of aerobic and anaerobic levels in percent. The anaerobic work capacity is from 2 to 120 seconds.

The anaerobic work capacity has three main areas:

1. Speed
2. Anaerobic effect: to maintain a very high pace for up to 40 seconds maximum.
3. Anaerobic capacity: to maintain a very high pace for up two minutes.

All three areas are improved when doing intervals. The scheme below shows the distribution between intensity, exercise time, exercise/break distribution, and the number of repetitions.

Examples of Training Exercises:

Sprint

There has to be full physical and mental restitution in between the sets.

10 sets of 20 meter at 4 sec.
Intensity: 100%. The breaks last for 80 sec. 20: 1

6 sets of 50 meter at 10 sec.
Intensity: 100%. The breaks last for 300 sec. 30: 1

Anaerobic effect

There has to be full physical restitution, but the mental restitution gradually becomes worse for every set.

8 sets of 60 m at 13 sec.
Intensity: 90%. The breaks last for 200 sec. 15:1

6 sets of 150 m at 34 sec.
Intensity: 70%. The breaks last for 340 sec. 10:1

Anaerobic capacity

Both the physical and mental restitution gradually become worse for every set.

Example:
Pause/Work-distribution 20 :1 = If the athlete runs for one second the following pause needs to be 20 times longer, i.e. 20 seconds.

Training	Intensity	Exercise time	Pause/Work-distribution	Repetitions
Speed	100%	2 – 10 SEC.	20 - 30 : 1	6 – 15 SETS
Anaerobic effect	70 - 90%	10 – 40 SEC.	10 - 15 : 1	6 – 10 SETS
Anaerobic Capacity	50 - 70%	40 – 120 SEC.	1 - 5 : 1	4 – 8 SETS

Helle Ladefoged, Nicolai O. Christensen and Hayla S. Søndergaard during speed training.
Photograph: Leif Nielsen

4 sets of 125 m at 43 sec.
Intensity: 70%. The breaks last for 215 sec. 5:1

8 sets of 200 m at 96 sec.
Intensity: 50%. The breaks last for 100 sec. 1:1

If we take a look at RaceRunning and the relation between time and distance and if the athlete only trains various distances, e.g. 200m or 400m, the time is normally in between 45 seconds and 1½ min for 200 m and 1.45-3.00 min for 400 m. The energy system used will primarily be the aerobic system.

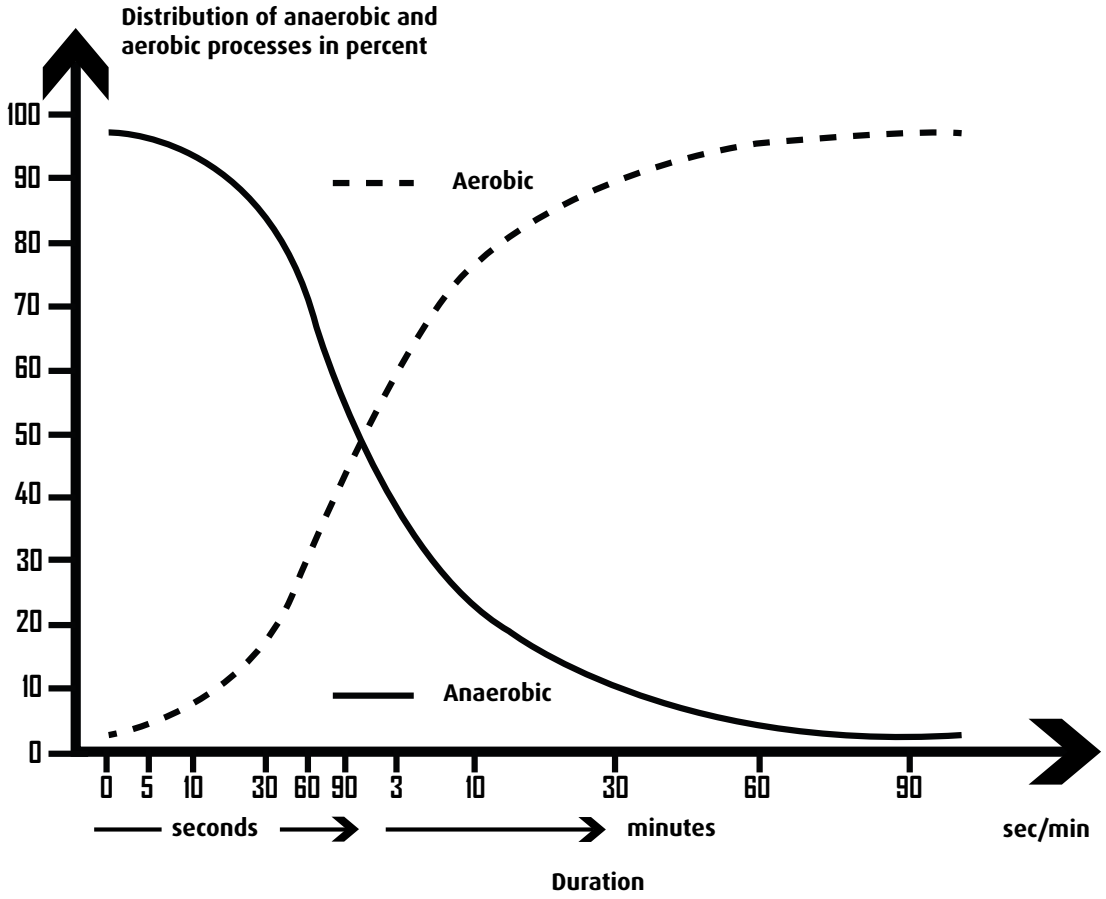
In order to train the anaerobic system the athlete must practice intervals from 6 to 10 seconds in order to increase the speed. If the athlete aims at performing on the 200-meter
distance, the athlete needs to train these short intervals that are developing the anaerobic system.

For a RaceRunning beginner the training of the anaerobic system should be very limited. The training of the anaerobic system is strenuous and the athlete needs a good basic fitness in order to complete this kind of training.

In order to do just a little of anaerobic training a good idea is to practice reaction skills (also a way of practicing sprint) on distances of 10 to 20 meters.

Distribution of Energy during the Race
Most disciplines combine anaerobic and aerobic work.
When planning the training sessions it is important to be able to determine to which degree the two energy systems are used in the specific exercises.
The figure below may help the coach taking into account this aspect of the training.

Source: Aerob og anaerob træning16[16]



Løbedistance	Varighed min / sek	% anaerobe processer	% aerobe processer
100 m	00:10	92 - 94	6 - 8
200 m	00:20	85 - 90	10 - 15
400 m	00:45	75 - 80	20 - 25
800 m	01:45	50 - 60	40 - 50
1500 m	03:30	35 - 40	60 - 65
3000 m	07:30	25 - 30	70 - 75
5000 m	13:00	15 - 20	80 - 85
10000 m	27:00	5 - 10	90 - 95
Marathon	130:00	1 - 2	98 - 99

The figure shows running distances in relation to times and the percentage of anaerobic and aerobic processes. The distances/ times stems from the elite of non-disabled athletes.[16]

The scheme below shows the same relation - adapted to RaceRunning conditions.

Løbedistance RaceRunning	Varighed min / sek	% anaerobe processer	% aerobe processer
50 m	0:10	92 - 94	6 - 8
100 m	0:20	95 - 90	10 - 15
200 m	0:45	75 - 80	20 - 25
400 m	1:45	50 - 60	40 - 50
820 m	3:30	35 - 40	60 - 65
1900 m	07:30	25 - 30	70 - 75
3000 m	13:00	15 - 20	80 - 85
6000 m	27:00	5 - 10	90 - 95
15 km	130:00	1 - 2	98 - 99

This scheme shows a RR3 athlete. The times are the same as in the scheme above. The running distance of a RR3 athlete is about 50% shorter compared to an elite non-disabled athlete.

Remember

- Anaerobic training
- Speed/quickness
- Anaerobic effect
- Anaerobic capacity

Strength Training

Strength training can be a lot of things. The standard definition sounds like this: an organized and planned activity with the primary objective of improving one or more strength abilities:

- Maximum strength
- RFD (Rate of Force Development)
- Endurance

Tools or machines may be used for strength training and many sport clubs have a gym with machines or weights. The athletes' own weight can also be used.

Weight cuffs attached to the athletes' legs, running uphill or tying a tire to the RaceRunner are other possibilities.
The objective of strength training is:

Formålet med styrketræning er:

1. *To improve the peak performance*
2. *To improve the training*
3. *To prevent injuries*

The strength training is divided into three phases:

1. The preparatory phase
2. The built-up phase
3. The maximum phase

When using machinery or weights for the strength training these basic rules must be followed for the specific areas of strength training.

Planning the strength training can be done in two ways: the linear method and the non-linear method.

The linear method is to begin the season with a lot of repetitions with a light load. As the competitions come closer the training will consist of fewer repetitions with heavier load. Some coaches believe though that the effect of the first part of the training is getting lost using this method.

Example:
From November until March: 1-3 series of 20 to 30 repetitions.
In April: more series, 1-3 with 3-7 repetitions.
May until the competition phase: 3-4 series with 1-6 repetitions.

The non-linear method is to mix up different ways of training during the season. Many coaches believe that a progress then will happen gradually.

Example: If an athlete does strength training five times a month a schedule could look like this:

1. week, endurance, 2 series with 30 repetitions.
2. week, endurance, 3 series with 20 repetitions.
3. week, maximum strength, 4 series with 3 repetitions.
4. week, endurance, 2 series with 30 repetitions.
5. week, maximum strength, 2 series with 1-3 repetitions.

For an inexperienced RaceRunning athlete the training of regular endurance is the most important and also the training of the main muscles: thighs, arms, trunk and the muscles in the back.

1 RM = THE WEIGHT LOAD THAT THE ATHLETE C AN DO MAXIMUM ONCE.

Endurance
1-3 set of each 20 RM; i.e. a very easy load, 60-75% of RM.

1 exercise for each group of muscles.

Breaks: long breaks in between different muscle groups, but short breaks in between the sets. Shorter breaks means better endurance.

Quick lowering in order to do many repetitions per time frame.

1-6 different exercises per training session, maybe the athlete wants to train only one muscle group. It is all right to do other exercises during the breaks if the objective is to combine circulatory training with strength training – otherwise do not.

As the athlete becomes more experienced the two following kind of strength training may be tried out – but they are both strenuous and takes a lot of experience.

Maximum Strength
3-4 sets of 1-6 RM, i.e. weight load of 90-98% of 1 RM.

Do 2-3 exercises per muscle group (big and small exercises).

Breaks of middle length (physical restitution).

Maximum 8-10 exercises per training session.

Exercises during the breaks for other muscle groups, e.g. when doing maximum strength training for thighs exercises with less weight load can be done for trunk or back.

Controlled lowering, i.e. the athlete should be in control of the lowering.

Maximum pull upward.

RFD - Training for Speed and Speed-strength
1-3 sets of 3-7 repetitions of each 4-8 RM, i.e. not up till the limit of complete exhaustion. Low weight load of 50-60% 1 RM.
Maximum 2 exercises per muscle group (primarily big exercises).
Take long breaks (physical and mental restitution).

Maximum 6 exercises per training session.

Maximum pull upward.

No other exercises during the breaks.

Remember

- Linear or non-linear training
- Maximum strength
- TFD
- Endurance
- Hypertrophy

See the Strength Training section with specific exercises on page 55. The different exercises in that section are all aiming at muscle endurance training.

A close finish in the RR1 men's 100m at the 3rd. CPISRA Open European Championship
Photograph: Ditte Ravn Aare Petersen

The start of the 200m, CPISRA World Games, Nottingham 2015
Photograph: Leif Nielsen

Technique Training

The objective of technique training is for the athlete to find a style of running as good and correct as possible. During technique training the pace is not at the maximum in order for the athlete to focus on technique and not speed. The pace should be in between 85% and 90% to get the greatest effect from technique training. The distance when training technique should not exceed 120 meters.

Some of the most important aspects to be practiced are:

- The athletes' position on the RaceRunner.
- The position of the athletes' head; is the athlete looking up/down/left/right?
- The athletes' push-off and footwork at the starting line as well as during the race.
- The position of the athletes' toes during the race; are they pointing forward, going inwards or going outwards?
- Adjustment of the athletes' starting block.

Finding the Right RaceRunning Technique

In general there are no wrong movements. Some movements are just more fitting than others for the individual athlete. Together the coach and the athlete should find the running technique that suits the athlete. It is worth noticing that the running technique an athlete has acquired one year may look different the year after due to a normal development and maturation of the body and because the body is strengthened by the training as well.

It is important to pay attention to the potential movements that may be 'hidden' behind spasms and in an untrained body in general. Sometimes it is necessary to experiment, go back to former exercises or to be creative and think of new solutions and possibilities. When the right running technique has been found it is all about repetition. The spasticity affects the movement and the signals sent from the brain to the muscles and back again. By doing the same movement over and over again the athlete can make new and 'fresh' brain cells overtake some of the functions that were destroyed due to the spasticity. The new movements need to be 'burned' into the brains' programming because the disability often affects the program that the brain uses for copying other peoples' movements and to convert verbal descriptions to actions. The golden rule says that it takes 10.000 hours of training in order to acquire the ideal movement pattern.

The experimental process:

- Finding a position on the RaceRunner that secures stability and unrestrained strides.
- In general a running technique becomes
- efficient with long strides.
- Finding a position on the RaceRunner that enables a good respiration.
- The right positioning of body and legs at the starting line.
- Running technique when sprinting and
- increasing speed.

Butterfly technique – jumping with both legs at the same time and with the same rhythm.

Gallop technique – running like a horse.

One-legged gallop technique – one of the legs is used only for counter-movement.

Classical running technique – the hips are pushed forwards, and knees and ankles are bended.

Classical Spastic technique – less coordination in the bending movements.

The role of the coach in the technical training:
Finding the right running technique/movement pattern is a task for the coach, though normally the decision is made together with the athlete.

There are several reasons that it is important to find the running technique/movement pattern that suites the athlete:

1. The right running technique minimizes the risk of injuries.
2. The athlete uses less energy to get from A to B and the joy of running grows.
3. The right running technique/movement pattern uses less energy and gives better results at competitions.

In order to find the right running technique/movement pattern it is a good idea to take pictures or film the athlete running and to analyse this material together with the athlete.

Training of Coordination

Good coordination is fundamental for acquiring a good technique. As the athlete gets better at combining different exercises, he/she also improves his/her running technique. Another important aspect of good coordination is that the risk of injuries is minimized. Idrættens Træningslære[19] describes coordination as an adaption and coordination might be defined as the ability to combine the movements of the body in relation to each other and to the surroundings.
Coordination is all about getting the nerves and muscles to work together in the best possible way. When we begin walking we normally begin on the same foot. If we are asked to begin with the other foot we have to think about it. This is an example of coordination where we have to think before commanding nerves and muscles to perform the movement.

The training of coordination should be placed in the beginning of a training session so that the athletes have lots of energy left. Just after warming up and stretching exercises it is time to do the training of coordination.
This may last 10 – 15 min.
Find 3-4 suitable exercises and repeat them several times.

Examples of coordination exercises:
Do the exercises on a distance of 30m:

- Running: 5 setoff with the left leg, then 5 setoff with the right leg
- Running: 3 setoff with the left leg, then 3 setoff with the right leg
- Running: 2 setoff with the left leg, then 3 setoff with the right leg
- Running: 2 setoff with the right leg, then 3 setoff with the left leg
- Running slalom in between cones, both forward and backwards.

Use your imagination!

Not all athletes will be able to perform all exercises. For athletes without spasms or only few spasms the arms can also be activated, e.g. with knee lifts and swinging arms at the same time.
The booklet Aldersrelateret Træning i RaceRunning[21] contains a list with even more coordination exercises.

Breathing

Breathing correctly is an important element in RaceRunning because many athletes are placing a heavy pressure on the diaphragm. For this reason many athletes are only breathing shallowly. The coach needs to be aware of this – especially for competitions from 100 to 400 meters where the athlete needs to have the body straightened out to regain a deep and steady breathing. On longer distances it is important to find a certain rhythm, e.g. one breath for every second stride, in order for the breathing process not to affect the performance of the athlete.

Remember

- To spend time adjusting the RaceRunner
- To spend time doing coordination exercise

Remember

- Know your strengths and weaknesses
- Know your competitors
- Plan your competitions

Physical Activity is Good for Learning and for the Memory

Maria Willerslev-Olsen & Jens Bo Nielsen

There is evidence that physical activity has a favourable influence on the brain functions. We do not simply get smarter by being physically active but being physically active just before or right after learning something new makes us better at remembering what we have just learned. The specific kind of activity does not seem to be of any importance, the important thing is to get the pulse going. The higher up the pulse is going the better, 15-20 minutes seems to be sufficient though (within 3-4 hours after learning something new You want to remember). This improvement of memory caused by physical activity regards both cognitive knowledge and motoric skills. This insight might be applied when planning the training sessions; a period with focus on technique should finish of with a period of intense physical activity and high pulse exercises.

Tactical Training

Tactical training is actually the planning of an upcoming competition. This planning already begins with the planning of the different competitions in the annual training plan.

When the competition is coming up it is important to decide on the specific tactics for the race. First of all the athlete needs to determine if the focus is on the finishing position or the finishing time. Secondly you need to take a look at the strengths and the weaknesses of the athlete.

If the athlete is aiming at a good finishing position you also have to take a look at the competitors; who they are, how they are running, if the have a strong finish or usually begin at a high pace – and how your own athlete should position himself/herself in the peloton.
If the athlete is looking for a good finishing time he/she maybe needs to talk to the competitors. Maybe they are also looking for a good finishing time and it can be arranged who should take the lead for the first 200m and who will then take over from there.
No matter if the focus is on finishing position or time it is important to plan ones' race and find out where to position oneself in the beginning, the middle and in the end of the race.

Some general tactical advice:

A. Position yourself second to fourth in the peloton. In this position it is easy to join if the front-runners suddenly accelerate but you are still saving some energy because of the slipstream.

B. If possible, position yourself in lane 1 (in the second lane you are running 7,5 meters longer every single round). Be careful not to be in a 'locked up' position if the front-runners suddenly accelerate.

Stretching Exercises

Bent Gaarsted

In General

Exercises for stretching out can be used as intermezzos during the training session – in between warming up, training, warming down, and in between the different training elements.
The more dynamic exercises for stretching out goes along with the functional part of the training, while the more slow and static exercises are a good way to end the training session. The slow exercises are also great as a part of a "good morning"- and a "good night"-routine.

The purpose of stretching out is:

- To increases the athletes' flexibility and range of movement
- To prevent injuries
- To prevent harmful movements
- To increase level of wellbeing
- To prevent soreness

Stretching out exercises primarily involves ligaments, muscle fibres and sinews and increases the blood circulation.
With the stretching out exercises we try to increase our flexibility. But if they are done the wrong way the stretching exercises may have negative consequences such as minor injuries and sometimes even hypermobility and an alteration of the normal muscle reactions.

When using the exercises to end the training session the exercises must be calm and slow. Stop just before the pain threshold. Remember, in general, the following when stretching out:

- Do the stretches calm and slowly.
- The athlete must be able to feel the stretch in the involved muscles.
- Hold the stretch for about 20-30 seconds.
- The stretch should be done slowly and deeply in order to overcome "involuntary" spasms.
- Repeat the stretch 2-4 times and 2 or more times on a daily basis.
- In every single exercise the athlete should slide dynamically into the static position.
- Remember breathing normally during the stretching out.
- Be relaxed in the rest of the body when stretching out.

Specifically

For CP athletes and athletes with other muscular or neurological issues the exercises most be chosen carefully and carried out in a way that takes into account the athletes' specific physical and neurological abilities. Never use force against spasticity or a tight muscle.
Instead, support the muscle in order for the athlete to conduct the exercise correctly and pay attention to the following:

- Athletes suffering from hypermobility should not be stretching out. Instead, use massage for restitution.
- The muscle reflexes of a CP athlete might be unstable, minimal or over-active. In order not to damage muscles, bones or ligaments always pay great attention to how the stretching exercises are carried out and always do it specifically.
- All the time spent in a wheelchair may cause poor sitting positions, a decreased range of movements and a non-optimal movement pattern.

Stretching Exercise A
Stretching the front of the thigh

1. The athlete has a firm grip on the frame of the RaceRunner.
2. The assistant slowly lifts the foot backwards and up.
3. The hips must be in a vertical position - do not lift the foot any higher.
4. Hold the stretch for approximately 30 seconds and then lower the foot slowly.

Repeat 1 through 4 with the other leg.

Stretching Exercise B
Stretching the Inside of the thigh

Standing or lying on the back. Spread the legs as much as possible.

B1

1. If standing, bend one of the legs and stretch the other, if possible.
   a. The athlete bends the bended leg even more;
   b. Or the assistant presses gently against the inner side of the knee.
2. Repeat with the opposite leg.

B2

1. If lying, the athlete himself/herself or the asistant gently pushes the legs apart.

REMEMBER to hold the stretch for 30 seconds.

Stretching Exercise C
Stretching the back of the thigh and the peroneus.

Preferably done when sitting on the saddle or holding on to the frame of the RaceRunner.

1. Keep the back taut.
2. Stretch the left leg and push back the buttocks.
3. Press the toes of the stretched leg upwards (the assistant may lift the stretched leg upwards).
4. Hold the stretch for about 30 seconds.
5. Do 2 through 4 with the right leg.

REMEMBER: Stop stretching before you reach the threshold of pain. Do not overstretch.

The same exercise can be done lying on the back and with the assistant lifting the stretched leg upwards and holding the other leg down.

Stretching Exercise D
Stretching the hip

This exercise can be done standing on the RaceRunner. Tighten the abdominal muscles in order to spare the loin.

1. Stretch and press the left leg backwards while holding on to the RaceRunner.
2. The assistant grabs with the left hand just above the left knee and places the right hand on the athletes' buttock.
3. The assistant pulls with his left hand the streched leg upwards and pushes gently with the right hand on the athletes' buttock.
4. Hold this position for 30 seconds.
5. 1 through 4 is repeated with the other leg.

Stretching Exercise E
Stretching the chest muscles

This exercise can be done sitting or lying and in two different ways:

E1

1. The assistant stands behind the athlete, places his/her underarms below the underarms of the athlete.
2. By stabilizing the athletes' back with his/her own body the assistant raises the athletes' underarms and pulls them backwards slowly.
3. Hold the stretch for 30 seconds.

E2

1. The assistant stands behind the athlete.
2. With his/her left hand the assistant grabs the athletes' left underarm and places his/her right hand on the athletes' shoulder.
3. With his/her left hand the assistant pulls the athletes' left underarm gently upwards and backwards and pushes gently on the shoulder with the right hand.
4. Hold the stretch for 30 seconds.
5. Repeat 2 through 4 for the other side.

Stretching Exercise F
Stretching the neck muscles

This exercise is divided into four sections: the left and right side of the neck; forwards and backwards. The athlete may sit down or stand up – also on the RaceRunner. The assistant may stabilize the athletes' body if needed. The assistant may also put a gentle pressure on the shoulders.

1. Press the left ear towards the right shoulder and hold the stretch.
2. Press the chin towards the chest and hold the stretch.
3. Press the right ear towards the left shoulder and hold the stretch.
4. Press the head gently backwards and hold the stretch.
5. Hold the stretch for 30 seconds.

Note: Item 4 should not be carried out by athletes with spasticity.

Mental Training

Leif Nielsen

The following subjects will be treated in this section:

- Mental readiness
- Motivation and objectives
- Visualization
- The inner discourse
- Concentration

Mental training is procedures and exercises that help the athlete to be efficient and mentally prepared in order to achieve his or her objectives.

Mental readiness

The feeling of mental readiness is based on various factors, e.g. motivation, preparation, general level of stress, and expectations. Disregarding all of these factors it is important that the athlete realizes that it is up to him/her to decide to be ready – both for training and competition.
An athlete entering the stadium looking nervously around and maybe even trying to hide himself/herself is showing a lack of self-confidence. The athlete should instead enter the stadium with a posture of self-confidence and self-reliance: 'Here I come – and I am not afraid of any opponent!'

Motivation and Objectives

Getting a job done is always easier when one is feeling satisfaction completing the task. Otherwise this task will typically be the item at the bottom of the list and the result will probably not be that great.

Motivation is characterized by a great effort, persistence, engagement, willpower, faith and enthusiasm.

The Medals from the CPISRA World Games, Nottingham 2015
Photograph: Leif Nielsen

No matter what aspect of life it is important to have some objectives for the working process. Objectives motivate and directs ones energy in one specific direction.
There are two different kinds of objectives:
1. Outcome objectives (results) and 2. Process objectives.

1. **An outcome objective** is a specific result, a place at a competition or something similar. It is good to have outcome objectives but with these objectives one is always dependant on the competitors and the externals factors are many.
2. **Process objectives**, on the other hand, are only focusing on what you can control yourself. They may concern skills, technique, training processes, competitions or preparation for competitions. They may concern focus on routines, on ones own time results at a competition, or simply on getting the best out of a day of training.

There is clear evidence that focusing on the process objectives and achieving these causes the results to appear by themselves. It is okay to have some outcome objectives but they should not be in focus in the everyday training as they are causing stress in the everyday life of the athlete. In the everyday training the objectives should be focusing on e.g. warming-up, todays' training session or maybe the warming-down process. In this way the focus is not on some abstract future goals but here and now on the training. Focusing only on outcome and results causes stress and eventually poor results.

Objectives can be either long-term or short-term objectives.
A long-term objective is an objective years ahead of the athlete, e.g. participation in the Paralympic Games or winning a medal at the WC or breaking a world record. It can also be optimizing ones running technique or getting better at keeping focus.
Short-term objectives are usually not more than one year ahead and may be considered as stepping-stones on the way to the long-term objective. Short-term objectives specify the objectives for the next month, week and training session.
An example of a short-term objective for a single training session could be focus on the athletes' running rhythm. If the athlete easily looses the right rhythm he/she must learn how to regain it quickly – so-called re-focusing.
In general there are no big differences in planning physical and mental training. The planning process moves backwards, beginning with the overall objectives that lies farthest ahead and then moves backwards and down to the specific planning of a single training session.
The different objectives for the mental training are planned for and written down in the training plan alongside the physical training and in the training diary as well.

Visualization

It is told that a Chinese pianist who was imprisoned for 8 years (without access to a piano) four weeks after his release gave one of the best concerts he had ever played. Later he explained how he had been practising for four hours each day visualising the concert and his fingers moving. All of it was only in his head but he later told that he could even hear the sound and smell the sweat during 'the practise'.

Visualization is defined as a way of consciously controlling and creating all sense impressions without the external stimuli - that normally create these impressions - actually being there.
Visualization is probably the most popular and efficient mental training technique. It has been proved that visualization in itself (without physical training) is improving the performance positively. Visualization in combination with physical training creates even greater improvements.

Visualization can be used for training as well as for competitions with the athlete visualizing how the training or competition will be. The athlete visualizes placing herself/himself in the starting block, the starter yelling "ready!" and "set!". The athlete visualizes how the signal from the starting gun is given and how the athlete runs perfectly with just the right technique, the right rhythm, and how the athletes runs fast and reaches the finishing line in the first place position.

Another example of visualization is seen when a high jumper is preparing for his jump and often stands on his toes, hands in front of him, visualizing the run-up and his jump.
Visualization may also be used for treating injuries with the athlete visualizing how all good forces comes to aid of him/her helping to heal and treat the injury.

The Inner Discourse

Talking to ourselves is something most of us do – but only unconsciously. Some people have

positive conversations: "That will be exiting. This sounds really good. I will be ready for that." Other people mostly have negative conversations with themselves: "That sounds really difficult. I am not going to make it. The other athletes look strong." Both of these discourses will have influence on the athletes' performance. The positive conversation will make the athlete ready to perform and show his/her best. The negative will make the athlete insecure, doubting his/her abilities and the competitors will sense this attitude in the body language of the athlete.
If this negative inner discourse gets out of control the athlete may use the so-called stop-thinking technique. This technique is basically the athlete saying "stop!" to him/her self every time a new negative thought appears.

Koncentration
Concentration is to focus all attention on a specific place or on a specific task.
For a RaceRunning athlete this could be to focus on the beginning of the race or the race down the track.

There are two kinds of concentration, inner and outer concentration. Inner concentration is to focus on oneself and ones own abilities. Outer concentration is to direct all attention at the surroundings.

For a runner it is only possible to affect ones own performance and it is obviously best to use the inner concentration. If the attention and focus is directed towards the surroundings a top performance is simply not possible.

Lasse Kromann visualizing his next race, Herning Games 2016. Photograph: Peter Kromann

Remember
- Show self-confidence
- Use motivation and objectives
- Use visualization
- Inner discourse
- Concentration

Physical Activity

Maria Willerslev-Olsen & Jens Bo Nielsen

No matter on which level the athlete is training and competing the nutrition is an essential factor in order to reach ones goals. The nutrition is also a way of optimizing the bodily response to the individual training session, to shorten the period of restitution and to reduce the risk of injuries etc. It is possible to create a synergetic effect if both the nutrition and the training are right, no matter if the aim is to perform better physically or to alter the bodily composition. Malnutrition and/or to low intake of energy is often seen among children and youngsters with neurological damages. The exact numbers are hard to estimate though. Nevertheless Dahl M. et al. 1996[10] found that 60% of 35 children with CP at the age of 8 years suffered from nutritional problems. Calis E.A.C. et al. 2010[11] and Grammatikopoulou M.G. et al. 2009[12] observed a reduced energy intake among CP children at the age of 10 years and a reduced intake of micronutrients. Hillesund E. et al. 2007[13] similarly finds a low intake of micronutrients; iron, folic, B3, calcium, vitamin E and vitamin D – while Walker J.L 2012[14] no significant differences between children with and children without CP.

In other words: the observations and conclusions vary just as much as the CP population itself. On the other hand it is somewhat evident that people with neurological damages should pay more attention to their nutrition and make sure that their energy intake is sufficient – especially if they are athletes with a high level of physical activity. According to Team Denmark, the intake of carbohydrates should take place as fast as possible after the first training session if there is less than 8 hours of restitution before the next session – in order to speed up the restitution process.

RR2 100m for juniors at the 3rd. CPISRA European Championship, July 2016. Photograph: Ditte Ravn Aare Petersen

With longer periods of restitution available (24 hours) the pattern of the intake of carbohydrates is of less importance. Choose nutritious sources for your carbohydrates (fruit, milk products, bread, lean meat etc.) and add a protein source to the restitution meal.
Sometimes it might be relevant to reduce the energy intake in order to loose weight and fat. In these situations it is very important to take into account that a reduced energy intake may affect the body negatively. Team Denmark states the following: when the daily amount of available energy drops below 135 kJ (30 kcal) pr. kg lipid free weight (FFV) there is a huge risk of experiencing hormonal or metabolic effects on the body that may negatively affect the athletes' performance, health and growth.

Proteins play an important role in connection with the response to training and protein intake is therefore a much-debated subject in relation to training. The right timing and amount of the protein intake are still discussed. There are no evidence though that more than 1,7 grams of protein pr. bodily weight improves the response to the training or increases the muscle mass or strength. The recommended amount is therefore still 1,2 – 1,7 grams of protein per bodily weight a day – a higher intake than the standard recommendation for the normal population.
Too much protein can be harmful but the consequences are still in the unknown and exactly how much too much is still a topic for discussion. It is also more difficult to get the glycogen stores sufficiently refilled on a protein heavy meal and this may reduce the response to the training.
Unless an athlete is having problems getting sufficiently with energy or protein, there are no evidence that energy bars and protein/carbohydrate powder has any advantages compared to normal groceries.

Training cornering technique and the finish straight at the Camp 2014
Photograph: John Clarke Russ

Strength Training Exercises

Peter Kromann & Susanne Braüner Ladefoged

These exercises are designed in order for the athletes to be able to do them at home.
The exercises should in general be repeated 3x10 times. Experienced athletes may repeat the various exercises 3x20 or 3x30. The exercises may be combined as you wish. All the exercises are training the muscular endurance.
All the various exercises contain instructions to be followed closely and a description of the purpose of the specific exercise.

Training with Exercise Balls

Using an exercise ball you are achieving simple and efficient strength training the athlete being able to use all of his/her muscle groups. The small exercise balls are very flexible and may also be used when doing the exercises in the bed. The exercise ball must suit the weight and balance abilities of the individual athlete.
If the exercise results in 'follow movements' of the athlete or increases the spasticity the athlete needs support in the weak side in order for the movement to be performed correctly.

Chest muscles – Exercise 1

Purpose:

- Functional stability training for the upper body (torso).

Instructions:

- The athlete is lying supine with a little exercise ball under the shoulder blades. Feet in the floor, knees are bended. Optional: a small exercise ball between the knees. Optional: weight cuffs on the wrist.
- Move the arms from a horizontal to a vertical position above the chest and clap.
- Repeat 3x10 times.

Pay attention to:

- The assistant focuses on the symmetry of the movement.
- Exercise ball between the knees in order to reduce spasticity and counteract 'follow movements'.
- When arms are lead down the movement will stop when there is no more stability in the upper body.

Chest muscles – Exercise 2

Purpose:
Stability training of the upper body
Training of stomach muscles

Instruktion:

- The athlete is lying supine with a little exercise ball under the shoulder blades. Feet in the floor, knees are bended. Optional: a small exercise ball between the knees. Optional: weight cuffs on the wrist.
- Place arms up above the head to a horizontal position and move them from here to a vertical position above the chest.
- Repeat 3x10 times.

Pay attention to:

- Exercise ball between the knees in order to reduce spasticity and counteract 'follow movements'.
- The assistant focuses on the symmetry of the movement.
- The weight must be suited for the individual athlete. In picture B the athlete has an oblique pull, pulling more to the right side than the left side.

A

B

The Muscles of the back - Exercise 1

Purpose:
Strength training for the back.

Instruktion:

- Prone lying, arms stretched forwards. Head kept straight in line with the back. Hold a little exercise ball between the hands. Optional: weight cuffs on the wrist.
- Raise chest and arms from the surface and then lower yourself slowly once again.
- Repeat 3x10 times.

Pay attention to:

- Keeping the head still is a problem for some athletes in this exercise. The assistant focuses on this and also that the hips stay in the ground.
- The symmetry of the movement.
- Distance between knees using a ball, pillow or similar.

A

B

The Muscles of the back - Exercise 2

Purpose:
Strength training for the big muscles in the back and the gluteal muscles.

Instruktion:
- Prone lying, arms stretched forwards. Head kept straight in line with the back. Hold a little exercise ball between the hands.
- Lift yourself up while the assistant tries to grab the exercise ball out of your hands.
- Hold the position for 10 seconds. Repeat 5 times.

Pay attention to:
- Keeping the head still.
- The symmetry of the movement.

The Muscles of the back - Exercise 3

Purpose:
Strength training for the back and training of coordination.

Instruktion:
- Prone lying.
- The assistant roles the exercise ball to the athlete. The athlete lifts the chest, receives the exercise ball and roles it back to the assistant.
- Repeat 3x10 times.

Pay attention to:
- The symmetry of the movement.
- Distance between the legs.
- Hips stay in the ground.

Exercising the stability of the lower body

Purpose:
Exercising pelvis stability and strength of the backside of the thighs.

Instructions:
- The athlete is lying supine. Feet in the floor, knees are bended. Arms down to the ground following the upper body. Optional: a small exercise ball between the knees. The assistant holding the athlete's feet.
- Lift the buttocks as high as possible. Lower slowly again.
- Repeat 3x10 times.

Pay attention to:
- Assistant pays attention to the position of the pelvis.
- The athlete is perhaps in need of stability support.

Abdominal muscles - Exercise 1

Purpose:
Exercising lower body stability (truncus), oblique abdominal muscles and back stabilizers.

Instructions:
- The athlete is lying supine. A small exercise ball under the loin. Arms down to the ground following the upper body.
- Lift the legs slowly and once at a time. Try to keep in balance.
- Repeat 3x10 times with each leg.
- Optional: weight cuffs on legs.

Pay attention to:
- The exercise ball must be suited for the individual athletes' ability to keep the stability when doing this exercise.

Exercises with Resistance Band

Doing Exercises with a Resistance Band
Below are some examples of how to exercise certain muscle groups when using a resistance band. Depending on the specific resistance band used the level of resistance will vary and the exercise become easier or harder. There are 5 different types of resistance bands available. Be aware that the individual athlete might have relatively more strength in some muscle groups than in others.
If the exercise results in an increased spasticity or 'follow movements' choose an easier resistance band.

Simple Exercises
Using a resistance band is a good solution for athletes who are inexperienced with strength training, after a long break and for rehabilitation purposes. Choose a resistance band that enables you to do about 20 repetitions.

Take a break for 1-3 minutes and then repeat the exercise. Do this three times in total before moving on to the next exercise. The entire programme must be repeated three times per week.

Notes:

Take care of the wrist
When using the resistance band it is important to position the wrist correctly. The backside of the hand must follow a straight line going out from the underarm. Always keep this posture when carrying out the exercises. It is also possible to simply attach the resistance band to the upper arm in order to avoid this problem.
This may also be the solution if the athlete makes an oblique pull. It then needs to be considered if the specific exercise needs to be replaced by another one.



Biceps – Exercise 1

Purpose:
Strength training for the biceps (bending).

Instructions:
- Attach the resistance band by stepping on it.
- Grab the handle of the resistance band.
- Keep the elbow close to the body while bending the arm.
- Slowly lower the arm (pictures B to A).
- Do the exercise using both arms simultaneously or with one arm at a time.

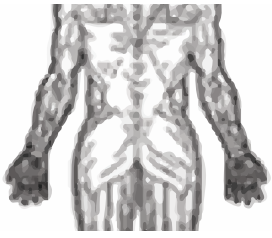
Pay attention to:
- No 'follow movements' in other parts of the body.

Biceps – Exercise 2

Purpose:
Strength training for the biceps (bending).

Instructions:
- Attach the resistance band under the legs of the athlete who is in a sitting position.
- Pull the resistance band upwards. Keep the elbow close to the body and the underarms parallel.
- Pull the resistance band upwards till it reaches the shoulders and then back again. Always keep the underarms parallel.
- The exercise should be carried out slowly.

Pay attention to:
- Support the weaker side of the athlete to compensate for lack of strength.



Triceps (extension) – Exercise 1

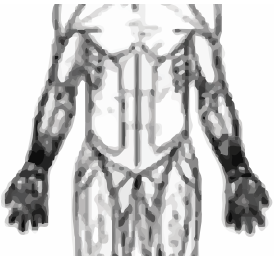
Purpose:
Strength training for the triceps (extension).

Instructions:

- Attach the resistance band to the ceiling,
- a door or a wall bar.
- Keep the elbow close to the body throughout the whole exercise.
- From picture A to B the arm is being stretched. From B to A it is slowly being bended backwards to the initial position A.
- Do the exercise using both arms simultaneously or with one arm at a time.

Pay attention to:

- No 'follow movements' in other parts of the body.



Triceps (extension) – Exercise 2

Purpose:
Exercising elbow flexion and shoulder stability.

Instructions:
- Attach the resistance band under the legs of the athlete who is in a sitting position.
- Pull the resistance band by holding one end closely to the loin and pulling the other arm slantwise upwards behind the back.

Pay attention to:
- That the athlete pulls straight.
- No 'follow movements' in other parts of the body.

Exercising the upper part of the back and the shoulder blades – Exercise 1

Purpose:
Exercising stability for the upper part of the back and for the shoulder blades.

Instructions:
- Sitting in a chair or in a wheelchair.
- Attach the resistance band around the assistant who is facing the sitting athlete.
- Begin the exercise with the arms stretched out and kept closely together. Pull the resistance band backwards in a straight line.
- Repeat 3x10 times

Pay attention to:
- The stability of the athlete's body.
- The shoulders staying on the ground.

Exercising the upper part of the back and the shoulder blades – Exercise 2

Purpose:
Exercising stability for upper part of the back and the shoulder blades.

Instructions:
- Sitting in a chair or in a wheelchair.
- Attach the resistance band around the assistant who is facing the sitting athlete.
- Begin the exercise with the arms stretched out and kept closely together. Pull the resistance band slantwise downwards.
- Repeat 3x10 times

Pay attention to:
- The stability of the athlete's body.
- The shoulders staying on the ground.

Exercising the upper part of the back and the shoulder blades – Exercise 3

Purpose:
Exercising shoulder stability.

Instructions:
- Sitting in a chair or in a wheelchair.
- Attach the resistance band around the assistant who is facing the sitting athlete.
- Begin the exercise with the arms stretched out and kept closely together. Pull the resistance band slantwise upwards.
- Repeat 3x10 times.

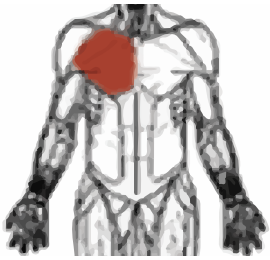
Pay attention to:
- The stability of the athlete's body.
- The shoulders staying on the ground.

Chest muscles

Purpose:
Exercising the major chest muscles and shoulder stability.

Instructions:
- Attach the resistance band around the assistant who stands behind the sitting athlete.
- Pull the resistance band forwards in a straight line or slantwise down/upwards with the arms stretched out.

Pay attention to:
- The shoulders staying on the ground.
- Support the weaker side of the athlete to compensate for lack of strength.
- Optional: a gym ball between the knees to avoid spasticity.



A

B

A

B

Træning af kroppens sidemuskler og nedre ryg

Purpose:
The stability of the body in general.

Instructions:
- Attach the resistance band to the ceiling, a door or a wall bar.
- Keep the elbow slightly bended during the exercise.
- From picture A to B both arms are being moved in front of the body in chest height.
- From picture B to A both arms are being moved back to the initial position A.

Pay attention to:
- The stability of the athlete's pelvis and hips.
- The stability of the athlete's neck muscles.

The Deltoid Muscle – Exercise 1

Purpose

Exercising the deltoid muscle.

Instructions:

- Attach the resistance band by stepping on it.
- Grab the handles of the resistance band.
- Keep the elbow slightly bended during the exercise.
- From picture A to B both arms are lifted up as high as possible.
- From picture B to A both arms are being lowered slowly.

Pay attention to:

- The shoulders staying on the ground.
- The athlete keeping the head still.

The Deltoid Muscle – Exercise 2

Purpose

Exercising the deltoid muscle.

Instructions:

- The athlete is sitting on a big gym ball or in a chair.
- Attach the resistance band by stepping on it.
- Grab the handles of the resistance band.
- From picture A to B both arms are lifted up above the head.
- From picture B to A both arms are being lowered slowly.

Pay attention to:

- Support the weaker side of the athlete to achieve a straight pull movement.
- Avoid 'follow movements' in other parts of the body.

A

B

A

B

The major chest muscle and the broad chest muscle – Exercise 1

Purpose:

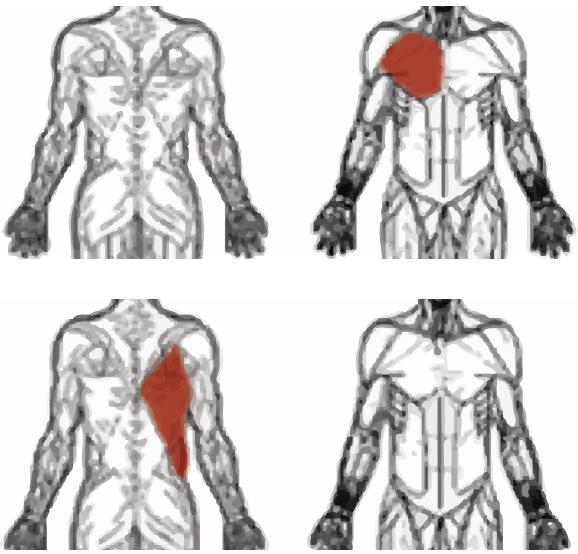
Exercising the major chest muscle, broad chest muscle and oblique abdominal muscles

Instructions:

- Attach the resistance band to the ceiling, a door or a wall bar.
- Slightly bended legs. Standing sideward to the attachment of the resistance band.
- Grab the handles of the resistance band.
- From picture A to B the arm – slightly bended – is moved in in front of the body and to the opposite side while the torso is twisting.
- From picture B to A the arm is moved back slowly to the initial position A.

Pay attention to:

- Stability in body and hips.
- Need for support of the hips to keep the right posture.
- Avoid 'follow movements' in other parts of the body.



Hayla S. Søndergaard is warming up at the Camp 2014
Photograph: John Clarke Russ

Notes:

Exercises Carried out in the RaceRunner

Leg Muscles – Exersice 1-3

Purpose:
Exercising buttocks, back of the thighs and hips

Exercise 1 – back thighs
- The athlete is standing in the RaceRunner.
- Weight cuffs around the ankles.
- Lift up the heels to the buttocks/back of the thighs.
- Repeat 3x10 times

Exercise 2 – back thighs
- The athlete is standing in the RaceRunner.
- Weight cuffs around the ankles.
- Lift up the legs in stretched out posture and in a backwards direction as far as possible.
- Repeat 3x10 times

Exercise 2 – hip bending
- Weight cuffs around the thighs.
- Bend as much as possible in the hips.
- Repeat 3x10 times

Pay attention to:
- Be careful not to trigger spasticity.


Øvelse 1


Øvelse 2


Øvelse 3

Leg Muscles – Exersice 4-5

Purpose:
Exercising leg function

Exercise 4
- Tie the resistance band txo the RaceRunner.
- Begin with a slack resistance band.
- Accelerate and run forwards until the resistance band stops the RaceRunner.

Exercise 5
- Tie the resistance band to the RaceRunner.
- Begin with a stretched out resistance band.
- Keep the resistance band stretched out and walk a few meters.

Pay attention to:
- If the athlete is able to carry the movement through. If not, the resistance band must be tightened to reduce the pace.

Øvelse 4

Øvelse 5

Noter:

About the Authors

Bent Gaarsted

Bent Gaardsted is a consultant at the DHIF (NPC Denmark) and he works with parasport on a daily basis.

Leif Nielsen

Leif Nielsen has been doing athletics for 50 years. He is a former elite runner on the middle distances. Nielsen is an educated coach on academy level and he has been a part of The National Danish RaceRunning team since 2010.

Mansoor Siddiqi

Mansoor Siddiqi has the main responsibility for RaceRunning in Denmark as a coordinator and as the Head Coach of The National Danish RaceRunning Team. Siddiqi is a national and an international CPISRA RaceRunning certified classifier and he is also an ITO under the IPC Athletics. Siddiqi is also a teacher at the national para athletics referee education. Siddiqi has been the CPISRA International coordinator 2002-2012 and he is now a member of the international RaceRunning committee being responsible for all technical issues.

Jens Bo Nielsen

Jens Bo Nielsen is a professor at the Department of Neuroscience and Pharmacology at the Copenhagen University and he is also responsible for the science program at the Elsass Institute. Nielsen's group of scientist are aiming at being the internationally leading research group in the field of CP research and neuro-rehabilitation. Nielsen has published more than 150 scientific articles on CP, spasticity, the brain and movement. He is also the author of a number of popular books about science and he has contributed to many textbooks on neuroscience, physiotherapy and neurology.

Peter Kromann

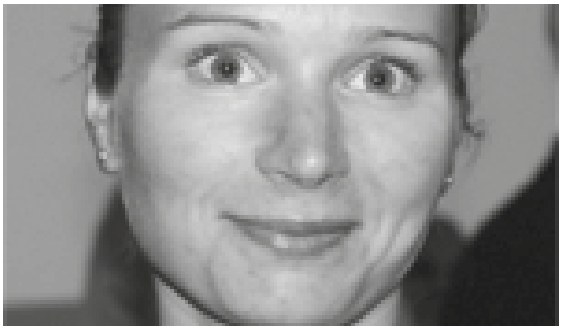
Peter Kromann is an educated physiotherapist and the owner of the BeneFit Clinique in Odense, Denmark. Kromann became engaged in RaceRunning in 2013 when his son, Lasse Kromann, became a part of the national Danish RaceRunning Team. Since 2015 he has been a part of The National Danish RaceRunning Team's staff. Kromann is an educated athletics referee and a certified national classifier under the IPC.

Signe de Place Knudsen

Signe de Place Knudsen is a physiotherapy teacher and she has been a part of the RaceRunning team at Parasport Frederiksberg for three years. Knudsen took her physiotherapist degree in 2011, became a physiotherapy teacher in 2012, and in 2016 she acquired a university degree in Health Sciences.

Susanne Braüner Ladefoged

Susanne Braüner Ladefoged is an educated handball coach and certified athletics referee. Ladefoged is the chairman of and a coach in RaceRunning Club Randers since 2007. She is also the physical coach of the national Danish RaceRunning Team since 2010. Ladefoged is the chairman of the children- and youngsters committee in RaceRunning Denmark and she is also a member of the main committee.



Maria Willerslev-Olsen

Maria Willerslev-Olsen is a researcher at the Elsass Institute and holds a Ph.D. in neuroscience (Copenhagen University 2014). Willerslev-Olsens Ph.D.-thesis is focusing on the training of children with CP and she is the author of many scientific articles on spasticity. At the moment her research focuses on early diagnosis and treatment of newborns with CP. Willerslev-Olsen's main research focal point is the cause of the development of muscle contractions.

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Home page: www.iwasf.com

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International Paralympic Committee, som er handicapidrættens Internationale Olympiske Committee (IOC)
Home page: www.para¬lympic.org

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Parasport Denmark's Home Page
www.parasport.dk

RaceRunning's Home Page
www.RaceRunning.dk

Handicapidrættens Videnscenter
www.handivid.dk

"This is definitely the most natural way to run: When you are going backward you are trying to escape something, but when running forward you are attacking it!"

Dr. Aart Kruimer
Dutch classifier at the Robin Hood Games in England 1991

"It is almost only the imagination that sets limitations to who might use a RaceRunner."

Signe de Place Knudsen
- former RaceRunning coach

"I sat a goal for myself and took the consequences of this - sufficient training of a certain quality - a harmonic and meaningful way of life - relaxing and restitution - giving priority to training and restitution."

Grete Waitz
- former Norwegian runner

A close finish in the RR3 men's 100 m at the Camp 2014.
Photograph: John Clarke Russ

Published by
Parasport Denmark

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Printed by
Asterion Denmark A/S

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www.parasport.dk
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1. Edition, June 2017

PARASPORT DENMARK

Main Sponsors
elsass fonden JYSK PRESSALIT