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SYNOPSIS

TITLE

Nordic Skiing Training Secrets for high performance-sports
DVD-ROM
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PREVIEW

What if you knew the same secrets as the most successful Olympic athletes and their coaches? What could you do with their Gold-medal winning programs in your hands, and had the secrets decoded?

Natural Fitness Labs with xczone studios has created *Nordic Skiing Training Secrets for High-Performance Sports*.

Begin a deep-dive exploration of applied sports physiology, psychology and pedagogy - a journey that exposes the secrets of elite fitness in high-performance sport. The product is a complete synthesis of the most successful medal winning programs and advice by a pedigree of scientists, coaches and elite athletes. Collectively the talent owns 33 Olympic medals, 43 World Cup medals, and 2 firsts in greatest human achievements. Here you will find a comprehensive body-of-knowledge for coaching cross-certification, and the blueprints to train smarter than your competition.

Realize immediate performance gains with a medal-proven prescription, and give yourself the edge.

TALENT

Here at the **Peak Centre**, elite amateur and professional athletes come for sophisticated fitness testing and expert advice.

The **Natural Fitness Labs** integrates a theoretical foundation of fitness, with the pragmatics of field-testing, biomechanical engineering and technical analysis, to build precise high-performance training prescriptions. The lab publishes industry-leading multimedia for coaching certification, and natural sports programs.

Ed McNeely, is a highly sought after exercise physiologist, leader in the strength and conditioning industry, and is a special consultant to 17 National and professional sports teams. Ed is the author of three books, *One Hundred Strength Exercises*, *Training for Rowing*, and *Skillful Rowing.* He is widely prolific author of fitness training and athlete conditioning covering topics such as strength training, plyometrics, weight training, speed and power development. Ed is well qualified to provide a profound

scientific foundation for fitness training.

Dr. Penny Werthner is a former Olympic track athlete, currently a professor at the School of Human Kinetics at the University of Ottawa, and an active Mental Training and Communication consultant. She has been the team sport psychologist at five winter and summer Olympic Games. She is a leader and innovator in international sport and in women and sport issues. Penny helps athletes optimize their mental skills towards tangible podium results.

Thomas Alsgaard, of Norway is arguably one of the greatest cross-country skiers of all time, with 5 Olympic and 10 World Cup Gold medals in his trophy case. As one of the most highly-conditioned athletes on Earth, Thomas has a simple message to convey and the secret to his success.

Sue Holloway was the first Canadian woman ever to compete in both the Winter Olympics and the Summer Olympics in the same year. In 1976, she competed in the cross-country skiing competition in Innsbruck, Austria, and then participated as a kayak competitor at the Montreal Games. She won a silver and a bronze medal in kayaking at the 1984 Olympic Games. Sue reveals what it takes to be extraordinarily and consistently successful in multiple sports

Ole Einar BJOERNDALEN, is, without question, the most successful Biathlete in history, with 5 Gold Olympic medals, 3 silver, a bronze and 16 World Championship medals. He got there by hard work and smart training.

Dr. Sven Pinkert was the German National Slalom Kayak Champion and is currently the National High Performance Director Canoe Kayak. Talent is good, but smart training is better.

Roger Archambault is one of the most qualified coaches in the country. A former National Team Biathlete himself, World Military Ski Team Member, Roger is the head coach and High Performance Director of Biathlon Canada. As Manager of Olympic Preparation for the Olympic Committee, Roger oversaw high performance training programs for all national sports teams. Roger is one of the few Master Course Conductors and Learning Facilitator for Level 5 National Coaching Certification. Roger knows how to get athletes on the podium.

Pierre Lafontaine is currently the chief executive of Swimming Canada. Prior to this role Pierre was the head swim coach at the Australian Institute of Sport, which produced four medal winners at the 2004 Athens Olympics, and he was a coach at the Phoenix Swim Club, whose swimmers won eight medals for the U.S. at the 2000 Sydney Olympics. Pierre shares his wisdom about athlete development.

Lise Meloche, is a Kinesiologist, Educator and co-founder of natural fitness labs. She was a pioneer of women's World Cup biathlon. Her athletic achievements are impressive:

Member of both National Biathlon and Cross-Country Teams;
Junior national Kayak Champion;
200 World Cup races with 21 Top-10 finishes;
9 National Championship titles;
7 World Cups Medals;
3 World Cup Gold Medals;
3rd Overall World Cup rank; and
2 Olympics.

Lise is in an excellent position to provide an aspiring athlete overall direction.

David McMahon was the National Biathlon Champion and Bronze Medalist at the World Summer Biathlon Championships. A biomechanical engineer, Dave was a co-founder of Natural fitness labs and has coached to the Olympic level. Competitor, coach and scientist, David practices what he preaches.

Lynne Bermel dominated Iron distance triathlons ranking 3rd overall in the World. Lynne competed regularly on the National World Military Running Team. Who best to discuss the plethora of training concepts, than an elite triathlete.

Dr. Christain Otto is a world expert in remote medicine in extreme environments, as chief physician of the Antarctic station and special human factors consultant to the NASA space program. Dr. Otto can also draw from mountaineering and skiing expeditions, and as a Junior National Biathlon Team member. Christain knows all about training in extreme environmental conditions.

Phil Marsh is the area manager of the Running Room Store Chain and a highly successful track coach. Phil offers a wealth of actionable and highly prescriptive training advice… stuff that is applicable to all sports.

Jon Westdal turned a lucrative career as a pro-triathlete into tangible successes across multiple sports and disciplines. Even with a full-time law practice, Jon is a force to be reckoned with in any Winter or Summer triathlon. So what is the secret to long lived success?

Ray Zahab is one of World's Greatest ultra-runners having won nearly all the stage and non-stop Desert races on the planet. In 2007, Ray completed the first non-stop 7500 km run across the Sahara. There is something you should know about Ray... he never stops. Never stops running, and never stops talking. We had to go to extraordinary lengths to get an interview Ray. But was well worth it.

Richard Weber was a member of the National Ski Team and winner of twenty national titles. He later was named to the Skiing Hall of Fame for completing the first return ski to the North Pole. Richard is the most seasoned Polar explorer of all time. Do you want to know how to train for to ski 1500 km non-stop over the frozen Arctic ocean, battling high winds, constantly shifting ice flows and temperatures well below minus 58 C?

Gudrun Phleuger competed for Austria on the World Cup Circuit before dominating long distance Cross Country racing across the planet in the Loppet Series. At the same time she was ski racing Gudrun racked up 5 World Mountain Running Championship titles. A quiet and unassuming character, Gudrun reflected on success, lifestyle and training focus.

Bill Hurley the World Masters Mountain Bike Champion cross-trains by cross-country skiing and trail running, and loves it.

Dominique Larocque, is a National Mountain Bike and in-line Skating Champion, Eco-psychologist and founder of nature aerobics. For her, training is a religion.

Chris Blanchard, a former National Cross-Country Ski Team athlete, has been training from childhood, and brings us back to our roots.

Jill Perry is the current National Boxing Champion talks about serious training and confronting your fears.

Rob Marland won Olympic Gold in rowing – a tough mans sport. Rob has refreshing insight into serious training and high-level competition. If you are not willing to do the work, there is always someone else ready to take your place.

INTRODUCTION

Nordic skiing is a good model for natural fitness and clean-oxygen-fed-sport because these athletes practice a highly evolved training regime, necessarily involving competencies in multiple-sports. Elite cross-country athletes are arguably best-conditioned athletes of the planet. So this a good place to start in developing a capability-maturity-model and a common-body-of-knowledge for sports-physiology, psychology, and pedagogy.

The old-school pro-sports philosophy of "steak and eggs for breakfast and then playing yourself into shape," does not transfer in an ultra-marathon, or to any high-performance athletic sport.

The components to high-performance sport are fundamentally bound to the quality of technique and training. Unfortunately, most elite athletes take these secrets to the grave, and the most successful training programs are locked away. You have to train smarter than your competition, not just harder, and it helps if you have a plan.

This program is derived from decades of personal experience at an elite level, supported by mountains of national training programs and reference materials. We have unlocked these most successful gold-medal making programs, and enlisted the help of experts in a variety of athletic-sports to provide their best advice. Leading sports scientists will provide you with the theory that you will need to understand. You will get guidance from the most success coaches on how to build a winning program, and elite athletes will explain the pragmatics of high-performance sport. You will realize that there is remarkable and universal similarity in what constitutes the serious fitness training, and that the secrets are bound in a handful is critical training principles.

GUIDE TO CONTENTS

Let me guide you through Nordic Skiing Training – a high-performance program for all athletes...

We will start by discussing the evolution of fitness, because this forms an early foundation to modern thinking. Many of

the ancient systems have re-emerged in modern high-performance sport. We will answer such questions as: What constitutes natural fitness and conditioning, and how does one develop sports specific fitness?

One of the early chapters dives into a post-graduate-level lesson in the physiology of fitness. This will prepare you for appreciating the real secrets of fitness training, which will be decomposed into a logical ontology. We will invite the scientists, coaches, and athletes to explain these common building-blocks in some depth.

A general discussion of training methodology and philosophy in coaching will establish the mindset for architecting a winning program. Experts will continue to guide you through building a multi-year training program from the ground up. You will learn how to conduct various types of cardio-vascular and muscular workouts, periodize training sessions throughout the week, by month and peak at important times in the year. In this program you will see how to develop endurance, strength, power, speed and skills using a number of training modes. We will show you the sport-specific and dry land training that elite athletes use to achieve phenomenal conditioning.

If you want to win, then you need to start practicing like you will. Hear what Olympic gold medalists prepare for racing. Further, tune your training by understanding the significance of sport psychology. We will teach you how to integrate mental training, with the physical.

If you want to take your sport and fitness to the extreme, then learn from the best ultra-athletes and runners. Chances are that you will get injured, and sports medicine

has some answers to help you training through and recover from injuries.

Getting hungry? Well there is a nutrition chapter too.

At the very end, a conclusion will provide an interactive dialog and engaging monolog that summarizes all the secrets.

WHAT ARE THE SECRETS

What are the secrets for high performance sports and fitness training?

Well, they are self-evident, simple; and this is perhaps why they are most often overlooked in favor of the latest gimmick.

The secrets for fitness training can be presented in essential paired-components consisting of:

- Setting goals, planning and commitment;
- Integrating both body and mind;
- Natural fitness that provides endurance, strength, power, speed, agility, flexibility, balance, coordination and skill development;
- Quantity and quality of training hours;
- Regularity and repetition;
- Intensity and recovery which covers: work load, overcompensation, relaxation recuperation, dynamic range, polarized training;
- Periodization involving progression and frequency and systemization;
- Specificity and diversity;
- Being mindful, thus attending to details, big and small.

You will notice that many of these principles are paired together with an opposite, or dual concepts. The secret is how you tune and balance these fundamentals to optimize performance.

EVOLUTION FITNESS TRAINING

Fitness programs have been around for a long time. As legend has it, ancient Greece's greatest athlete, and 7 time Olympian, Milon of Croton, practiced progressive resistance training; lifting a calf every day until it was a full-grown cow. The Spartans were arguably the fitness nation of warriors in history, and whose survival depended upon fitness. Similarly, thousands of years ago, a system of Yoga was developed India, while, Chinese Kung fu systemized heath, fitness and martial arts. Later, gymnastics was taught throughout European schools at the turn of the century.

Styles of yoga, martial arts and calisthenics flourish to this day, and their secrets are practiced amongst all national teams. We will be integrating ancient, eastern and modern western philosophies in this program – and you will see how it will enrich your training immeasurably.

Warfare dominated the necessity for fitness from ancient times through the twentieth century. During World War

Two, Finnish ski-troops (the precursors to modern Biathletes) fought the significantly larger Russian Army to a stand-still in the dead of winter using superior ski-fitness and rifle-marksmanship. Biathlon serves as an excellent model for mental and physical toughness. Today, the sport of Biathlon is the most popular and widely spectated winter sport on Earth.

However, it was not until the very end of the twentieth century before athletes adopted scientific training methods, and high-performance sports evolved.

In 1925, the winning time for the World 50km cross-country ski record took over 5 hours. Today it takes under two hours. To put this in perspective, the 1925 World Skiing Champion would only place 3400th in American Birkebeiner, and would be seeded in wave 7 out of 10.

Obviously extenuating factors include: better nutrition, equipment technology, and evolved technique. But it is training that plays the most significant factor. People knew how to skate-ski in 1920's, they just never trained it seriously. Coaches thought that the best way to train for skiing was to chop wood.

Similarly, the Olympic Gold Medal winning time for running the marathon in 1924 was 3 hours and 40 minutes, and would not qualify for the Boston Marathon today.

Running is a good example, which highlights the importance of scientific training, because running technique has been around for thousands of years and uses minimal equipment.

If we graph out athletic performance across a number of sports, we can notice well-correlated improvements over time; accelerating around 1960 and beginning to plateau in the 1990s. This phenomena is most likely owing to the emergence and adoption of modern scientific training systems.

Furthermore, extreme achievements only then became possible with modern training. It wasn't until 1995 that Richard Weber (Canada), and Mikhail Malakhov (Russia) became the first humans to complete an unassisted round trip to North Pole. In 2007, Ray Zahab (Canada), Charlie Engle (USA), and Kevin Lin (Taiwan) were the first people to run across the Sahara.

Some messages to take to heart are:

- It is not necessarily the prettiest athletes who win races, but it is most always the fittest.

- There are no gimmicks to getting in shape. It is no-longer enough just to train harder - you must train smarter.

- There exist some fundamentals secrets to training, built upon ancient systems of training and evolved with modern scientific methodology. Once you know these secrets you will be empowered to succeed in the World of High performance sport.

NATURAL FITNESS

Natural Fitness, in its purist form, is rooted in "clean oxygen fed sport." Conditioning both the body and mind through cardio-vascular and muscular training, which optimizes endurance, strength, power, speed, agility, flexibility,

balance, coordination. Natural fitness employes a wide-spectrum of skills and range-of-motion, while integrating core strength through sport. Nordic skiing and free-running are excellent examples of natural fitness.

Natural fitness is not body-building using supplements and machines. It is about holistic fitness that you create for yourself.

SKI FITNESS

Thoughts turn to skiing and snow-shoeing, after the fall colours have long since faded, and the first cold winds have descended over the ground... but that is leaving it a bit late to think of getting in shape.

Do you want to have a stellar ski season? Yes? Then, the single most important thing that you can do for yourself is to participate in specialized dry-land training. Even if you are not a skier, this is a great way to stay in shape - injury free.

The ski fitness prescription applies genuine ski-specific exercises and natural fitness qualities to enhance athletic performance.

Ski Fitness is all about proper conditioning for skiing on snow using specialized dry-land exercises. Once snow arrives, skiing itself offers a superior total body fitness experience. Not only will natural ski fitness training fast-track performance, but it will accelerate the transition on

to real snow and prevent injuries in the long term. This can start with a few simple exercises and progressions.

For the skiing aficionado, we prescribe a regular dry-land training routine. Specific strength conditioning exercises use: calisthenics, plyometrics, and natural resistance to sculpt a skier's body.

SKI TRAINING INTRODUCTION

An athlete that masters the basics of technique and practices the fundamental principles of training will be far more successful than those who follow a more complex path. Take care of the big details first.

There are some key things you need to know about training for high performance sports. They involve technical proficiency, mental, muscular and cardiovascular fitness, and broad experience involving touring, racing or expeditions.

The first training principle is that of specificity. If you want to be a skier, you have to ski. For most of us this is limited to during winter months, so we must simulate skiing with cross-training as best we can. This is why skiing is a good model for multi-sport coaching fundamentals.

There is no off-season for ski training. Plan cross-training in a variety of sports starting in the spring through into summer. This is a time for rebuilding. Much of the

workouts should concentrate on muscular strength using weights, and cardiovascular endurance in such activities as running and biking. As the summer progresses, the activities must become more skiing-specific. Roller skiing, and ski-striding with poles become the major activities by the Fall. The strength training also becomes more specific; migrating from heavy free-weights to plyometrics and drills on roller skis. It is important that the more intense work-outs also be the more ski specific ones.

Periodicity and progressive loading are other important principles of training. That is, alternating between hard and easy days, or hard and easy weeks. The training load needs to be increased progressively to obtain further adaptation and improvement in performance. Thus, gradually building the intensity and hours up to a peak. The body requires rest in order to complete the performance-enhancing hard workouts.

In the spring and summer, the training should concentrate on strength and endurance. As you progress through the fall, more intensity, in the form of intervals should be incorporated into the hard days. The strength training switches to power and then speed. By the peak in February many athletes are alternating racing or practicing light recovery.

Too many people train too many hours at medium-well effort rather than having high dynamic range in their training intensities. Consequently, they cook their performances medium-well.

THE HIGH PERFORMANCE PROGRAM

The following is the multi-sport high-performance sports program designed around developing an elite Nordic ski racer. Any other athletic-sport will follow a nearly identical prescription for fitness.

COOKBOOK PHYSIOLOGY

Although our bodies did not come with an owner's manual, it is essential that every athlete know something about physiology.

THE PRESCRIPTION

Skiing is, foremost, a power-endurance activity. Power can be envisioned as quick, forceful contractions. Endurance is the ability to persist and is influenced by cardiovascular stamina, muscular strength, and mental toughness.

The limiting factors of athletic performance are oxygen, energy use, and neuro-muscular functions related to the economy of motion.

ENERGY

There exist a variety of energy sources. Carbohydrates are easier and quicker to burn than others. However, the

slower burning fuel sources, like fat, tend to be more plentiful. Energy pathways are the means by which stored energy sources are transported to the muscles and consumed. The trick in quenching the energy consumption needs of the body while racing, is to practice wise expenditure of energy through pacing, and to ensure adequate supply. Training at various levels of intensity and duration will strengthen the energy pathways and ensure that the best mixture is delivered on time.

One seasoned coach liked to say that endurance training was necessary to build the cardiovascular plumbing, while intensity work strengthened the pump.

Plentiful slow burning reserves can be trained to be metabolized at high intensity to augment a limited amount of high-octane sources. It is said that fat, burns in the flame of carbohydrates.

A race is performed at sub-maximum level; where the athlete red-lines as closely to the threshold as is sustainable; occasionally going anaerobic for brief periods of time when they can recover immediately afterwards.

An athlete must develop aerobic and anaerobic fitness and corresponding energy systems. There are three systems for energy production: anaerobic-alactic, anaerobic-lactic and aerobic. The three energy systems interact to satisfy the total energy demand. The aerobic system is the predominant energy system for ski racing ... even for sprinting.

AEROBIC AND ANEROBIC

Fuel is burnt (or metabolized) and energy released, causing muscles to move, heat to be generated, and waste bi-products like lactic acid are released. Aerobic exercise burns fuel in the presence of oxygen. Conversely, using fuel without oxygen is an anaerobic process, and is associated with intense exertion. If the athlete starts a workout, too fast, the body initially works anaerobically, and building debt that is perceived as unsustainable. An athlete may feel a second-wind when aerobic glycolysis kicks in.

An anaerobic burn is hotter, dirtier and faster. The analogy can be made with a fighter jet using afterburner and the dramatic boost in speed at the expense of poor fuel consumption. Fuel burns 12x more efficiently aerobically, than it does anaerobically.

An athlete wants to avoid anaerobic flame-out, which will occur within 3 minutes of sustained anaerobic activity. This is when Lactic Acid build-up becomes intolerable. Not only is anaerobic activity untenable, but it results in oxygen debt, where the body must metabolize the waste by-products remaining after the surge. Failure to recover completely results in the debt load being carried by way of a deficit.

The Anaerobic-lactic system is used on moderate up hills. The Anaerobic-alactic system kicks in during short sharp up hills or sprints. The heart-rate increases with the intensity of exercise up to a maximum heart-rate.

Recent Olympic medical studies discovered that those athletes who started a race too fast, carried higher

lactate throughout the race and finished no further ahead as athletes that started with a moderate pace.

THRESHOLD

The anaerobic threshold is characterized by: an increased carbon-dioxide production resulting in break-away ventilation, a the dramatic build-up of lactic acid, muscle burning, inhabitation of motor control, increased heart rate curve, and a perception of unsustainability. The anaerobic threshold signals a significant limit to continued performance, above which the pace is untenable, but for a brief period of a few minutes.

STORAGE

Energy storage is the key to high intensity and endurance performance involving such things as glycogen depletion and the storage of complex carbohydrates. Fat is the body's most abundant energy source but it burns too slowly to be used as the sole source. Rather, it supplements the total energy requirement. In a fashion, it smoothes the transition between glycogen and glucose use.

ZONES

HEART RATE

Heart rate response is a good guide for training zones. The maximum heart rate is a function of genetics and age but is not, in itself, a measure of fitness. How close to the maximum heat-rate an athlete can sustain an intense race pace, is a much better gage for conditioning.

Resting heart rate is a measure of fitness and recovery. Athletes tend to have lower than average resting heart rates [typically 40 beats per minute]. Although lower does not necessarily mean better.

We suggest that you monitor your pulse first thing in the morning. An increase in resting heart rate may indicate that the body has not fully recovered from previous exercise. A continual climb in these readings may indicate overtraining or under resting.

There are five training zones:

Zone 1 and below develops strong central cardio-vascular components and is the foundation of aerobic performance.

Zone 2 and above have more significant effect on the peripheral components of the cardio system and the actual muscular development.

An athlete can identify their training zones through laboratory testing, or roughly by perceived exertion:

Below zone 1 is a very easy over-distance activity like walking.

Zone 1 is perceived as low effort. Exercising with restraint with a long slow distance session.

Zone 2 is a moderate natural effort or pace. Considered Low-sub-threshold

Zone 3 is race pace and typically the fastest sustainable effort. Referred to as high sub-threshold

Separating zone 3 and 4 the athlete will experience the threshold between aerobic and anaerobic zones. This is signaled with a change in breathing rate.

Zone 4 requires hard effort, which is not tenable. The Anaerobic lactic system is at work now.

Zone 5 is a maximum all-out sprint. Here the anaerobic alactic processes are taxed.

Vo2max testing

Laboratory testing will give you the most accurate measurement of your current fitness and establish training zones. Maximum volume of oxygen or vo2max testing establishes a benchmark for cardiovascular fitness.

An athlete runs on a treadmill while their ability to consume oxygen is measured as is: carbon dioxide output, blood lactate levels, and heart-rate.

The speed and incline of the treadmill is increased in stages, and the athlete exercises to maximum heart rate and eventual failure.

Field testing

Field-testing for zones can be accomplished by having the athlete complete an established distance while gradually increasing levels of effort. Zones can be identified at breakaway points on a chart by graphing

time, distance and heart-rate. Cross-reference with an athlete's perceived exertion of zone changes for greater accuracy.

Altitude training

Hypoxia and altitude training is a proven means of boosting aerobic capacity by naturally increasing red blood cells. If you are planning on racing at altitude then this is a must. Acclimation to altitude takes weeks or longer to do correctly. Remember to drink lots of water.

BUILDING BLOCKS FOR FITNESS

Every athlete needs to start with a **Goal, and a Plan** commensurate with **commitment**. Athletes and coaches need to establish mature processes of recording, studying, scheduling and executing training.

An athlete must integrate both the **Body and Mind** throughout their training. Your physiological state will affect your clarity of thought and emotions, whereas your state-of-mind creates the necessary fluidity and preconditions for optimum physical performance.

Every athlete needs sufficient **volume**, but is not sufficient to train more. You need to train smart. Think of this as **Quantity and quality.** The concept of intense overload stresses an athlete's level of conditioning by stimulating it to execute at a higher level. Work duration further builds base.

Repetition causes movements to become automatic and, at the same time, improves strength, speed and

endurance. **Regularity** refers to the level of daily physical activity, which must occur to maintain a level of fitness once it has been attained. This means that you must exercise, at the very least five times a week, for measurable improvement. The body needs **frequent** and physically taxing workouts in order improve fitness. These workouts should gradually increase in difficulty to stimulate adaptation and improvement.

Intensity can be defined as being either absolute or relative in nature. Absolute intensity refers to the quality of training stimulus with reference to a measurable, physical variable such as speed, or wattage; whereas, relative intensity is a matter of perception. Work is measured as a product of intensity and duration. Physical limitations are such that, the higher the intensity, the less time one can persist without **recovery**. Intense exercise can be practiced by alternating between exertion and recovery. We call this interval training. Intensive exertion is absolutely necessary for improved fitness beyond one's present level. Rest and recovery are the most important elements of a well-designed fitness program. Rest allows the body time to recover and to adapt to higher levels of stress. Actual increases in fitness occur during rest. Too many people go medium-well every day, which leads to mediocrity.

Progression is all about gradually increasing exercise loads, to bring about functional changes in the body and corresponding improvement of performance. Conversely, following a bland routine will stagnate performance.

Systemization is the principle where components of skill, muscular, cardiovascular and mental performance are scheduled smartly, such that a foundation is built. For it is upon this foundation that sharpening occurs. **Overcompensation** is the foundation of a functional increase in athletic efficiency and adaptation to training. The trick is to schedule the **periodicity** of exercise to equal that of your over-compensation cycles. Typically, this means that there should be 24-36 hours recovery between hard workouts. **Periodization** is the normal practice needed to incorporate a cyclic loading and unloading of physical demands. You need to alternate between work and rest to maximize performance gains. This procedure can work for you on a daily, weekly, or monthly basis.

One must also learn to balance principles of **specificity** and **diversity**. The two do not have to be at odds. With the right mixture and application, they can work synergistically for you. Specificity means that you have to practice realistically. If you are a skier, then you have to ski. If you are a sprinter, then you have to train skills and conditioning at high velocities. Specificity is especially important during intense phases of the training routine and program. Diversity in exercise intensity and duration serves to develop broad-based fitness and skills. The idea is to expand one's capability to go faster or longer. The appropriate place for using non-specific training modes is during less intense phases in training cycles.

Mindful Practice will provide efficiencies in your training. Be **attentive to details** - big and small. Every workout should be ruthlessly efficient.

PEDAGOGY

Good coaching takes experience, program management, communications skills, and empathy. Being able to mentor the athlete through a development program is a big plus.

TRAINING METHODOLOGY

Now that you have a bit of the underlying physiology, it is time to explain the method that you must use to get to a higher level of fitness.

Training can be defined as a systematic process of repetitive and progressive exercise, which also involves development of special skills such as technique, physical conditioning and mental fitness. It is also the adaptation of the nervous system to training stimulus.

The **acquisition of skill** demands the efficient and rational scheduling of practice and the development of technique and time to reflect. Motor skills and learning are fundamental to eventual performance. All techniques must pull back to basics first.

TRAINING ARCHITECTURE

PLANNING

Start with a plan, one offering a fresh, relaxed and intelligent approach to exercise. Keep it simple and realistic. Concentrate on the basic elements of fitness and recognize that they are the most important. First and foremost, the pursuit of any measure of fitness should be fun, satisfying and sustainable. With this in mind, you are ready to engage in realistic goal setting.

Long-range objectives provide an ultimate purpose to your training regardless of any recent successes, setbacks or fluctuations. A good plan focuses on what significant physiological or technical changes need to occur over the next few years.

An athlete must set seasonal objectives based upon the previous year's performance and in harmony with the long-range plan. Annual goals may include what areas of

technique, fitness, physical or mental training needs attention or emphasis - always keeping in mind your ultimate objects. For example, you may wish to emphasize building upper body power training for a couple of years for the benefit of a grander plan.

An annual program is used to build, guide and track cycles of performance. Each individual workout will have a purpose. Plan for the basics first. The more complicated or contrived the plan is, does not necessary mean that it is superior. The yearly program forms the blueprint for all training.

Keep records, not only of what you have done in a training diary, but of what you have learned.

Review your records in preparing the next season's program, and recognize the necessity for evolution, adaptation, and specificity.

Choose a program that matches your current level of fitness, skills and goals.

Even after a program has been conceived and written, plans must remain dynamic or open to modification, in keeping with the spirit of the overall objectives. Listen to your body.

HOLISTIC APPROACH

The approach to ski training should be undertaken holistically. There must exist a balance of elements from mind and body. Many factors ultimately influence performance.

ARCHITECTING FITNESS AND CONDITIONING

BUILDING A PROGRAM

Let's guide you through building a medal-proven high–performance training program. The following is the composite plan underpinned by over 76 Olympic and World Cup medals.

The trick is that all fundamentals components must be incorporated, while faced with the practicalities of a 7-day work-week, the idiosyncrasies of seasonal weather and personal schedules.

Consider the most important place-holders. Build a year-round program around your race schedule and core 12 week intensity-peak phase.

Now, let's start with the workout itself

DAY

The training day represents a good place to begin to build your training plan. Each day offers a new training opportunity and challenge with the workout.

THE WORKOUT

A workout should follow the following steps:

A general 20 to 40 minute warm-up should prepare the muscles, loosen the joints and get the heart beating mildly.

Stretch lightly all-round and test your full-range of motion. Identify sore or tightness that needs to be worked out before engaging in the primary workout.

Then ease into the workout.

Within the workout there is often a core intensity component (typically 30 minutes). It is the reason why you are here, so make it count.

A warm-down will allow time for the metabolism to purge the body of waste products and to restore depleted energy resources directly to the exercised muscles. This revitalization occurs best with light activity rather than complete rest.

The purpose of the warm-up and cool down is to optimize a core session that consists of either work or recovery. The work is done as intensity, duration or strength.

The typical length of the workout is 1-2 hours with a 30 min target component. This is dependent upon schedules. You can vary the overall length of each workout, or

prolong a warm-up/cool-down to keep a more consistent and manageable daily schedule.

Workouts will often be twice a day.

Stretching after exercise and when the muscles are warm maintains flexibility and promotes recovery.

Regression is the recovery time you need between workouts. Remember that active-rest is the time where you get stronger.

Now let's look at how you can arrange daily training sessions into multi-week cycles.

You recall that, overcompensation is the foundation to a functional increase in athletic efficiency and adaptation to training. The trick is to schedule the periodicity of exercise equal to that of the over-compensation cycles. Typically, there should be 24-36 hours of recovery between hard workouts.

Adaptation occurs in exercise only in those parts or systems of the body, which are stressed by the exercise. To get the training effect, you need to find the optimum frequency, duration and intensity phases in your training that neither injures the body nor fails to challenge it.

Latent learning and motor skill development of the neuro-pathways continues to occur subconsciously between training sessions. Since skills need time to set in, an athlete

should optimize skill training and recovery in order to absorb the effect. A few instructional sessions each week should be enough to accelerate the learning of new skills. Ample time is required between concentrated instructive sessions for the student to absorb, practice and improve.

Fully loaded (hard) days are followed by a recovery day or more to allow the physiology to recuperate, readapt and overcompensate to a state of enhanced fitness. Then we stress the body with another hard workout. The body rebuilds during the recovery not the workout. Timing is crucial to using over compensation to promote continued gains in fitness.

There are a number of categories of training that should be reapplied every week following a hard/easy microcycle of work and recovery:

- Hard intensity using short and long intervals;
- Hard Endurance;
- Race or Tempo;
- Speed;
- Unstructured sessions;
- Strength and Power work;
- Active Recovery; and
- Rest.

The intensity of cardiovascular work is identified by zones.

We will fill out the week in a pragmatic fashion. Take for example a typical week in the middle of the year:

- Races normally occur on the weekend so that is where we plan our race or tempo workouts;
- The weekend also offers more time to train so that we can put in some long-slow-distance and over distance training;

- Consequently Monday is an active-recovery day;
- Tuesdays are far enough away from race day to do hard short intervals;
- Wednesdays provide an opening for fartlek or unstructured work;
- Thursdays is where long intervals simulate race distances but broken into segments, and accurately stresses the body so that it reconstitutes itself towards what a race demands. This is also a good time to carbo-load; and
- Friday has to be easy prior to the demands of the weekend but prepare the athlete in a manner that they feel fast and energetic. We recommend speed work.

The contents and emphasis of training sessions within the week will depend upon where you are in the annual program.

- The Recovery phase will structure the number of total training hours in the week will be low, as will the duration and intensity of the workouts. Every day will be an easy day.
- The Base Phase will emphasize building an aerobic and strength base. Nearly all the work will be low intensity and long duration.
- The Intensity Phase will schedule key intervals to raising thresholds, while continuing to load duration
- The Peak Phase will continue intervals sustain the high-end and drop the duration hours.
- In the Race Phase the athlete should be racing or participating in active recovery. Any speed and intensity work is in place to stimulate the physiology for the races.

Let's sum the week-days up into a single bar, while illustrating relative intensities and durations.

We cannot keep increasing the load every week without reprieve. The physiology adapts best to a pattern of loading we call a mesocycle. There are four weeks to a mesocycle.

The body adapts to regular stresses and the added demands of training. One must increase the work in order to improve, but a direct increase in training intensity is not ideal. Rather, a gradual increase in intensity and duration in training from week to week is best accomplished by stepping the load level 1-2-4-3 where the numbers represent relative levels of work intensity and duration over a four week mesocycle.

If we group four mesocycles and align them to the same pattern, we have a macrocycle.

The body cannot sustain a perpetual and unabated increase in training and various attributes must be emphasized within phases of training throughout the year. Everything in life happens with pace and rhythm - as it is with training. The yearly training programme is broken into phases called macrocycles.

This periodization of the performance cycle is designed to reach peak performance at a certain time of the year, by systematically building and recovering. The order in which this building occurs, and the type of activities that the macrocycles include, is important. The building foundation must be built before the roof.

The year has 52 weeks arranged in microcycles, mesocycles and macrocycles.

This topology of work duration, intensity and modes are further shaped into the five phases:

- Recovery,
- Base,
- Intensity,
- Peak, and
- Race.

The concept is illustrated with a pyramid. We need to start with health, then build a strong cardio-muscular base upon which intensity is required to reach a peak-performance.

To reiterate, the athlete needs first to be in good health before training. Similarly you need a strong base in order to do the hard intensity work. Without intensity you cannot peak.

Total hours for a high-performance annual training program vary from 500 to 1000 hours for developing and elite athletes respectively. Get into the routine doing 2 workout sessions per day for 52 weeks a year.

Ok, now you are going to ask... when do I get a day off? The answer that you are hoping for is to take a guilt-free day off whenever you feel you the need.

A general training prescription is appropriate for Recovery, Base, and Race phases. Whereas, the intensity and peak phases need a 12-week highly-prescriptive program.

You will notice that, just as an individual workout is planned around the core work session, the whole year is scheduled to optimize the intensity phase, looking forward to the races. That being said, what you do, or don't do,

during the race phase will significantly influence performance.

To this point with have structured an annual program using variables of cardiovascular intensity, duration and recovery. We have shaped into five phases. We now need to consider the influence of training modes, muscular, psychological and skills development. Thus, further tuning the annual program.

Let's examine **modes**. Most, if not all, intensity work should be done in the specific training mode of your sport; within a workout, the training week and particularly in the intensity phase, peak and race phases of the year. The intensity phase will also include specific dry-land training that most accurately simulates the sport. Cross-training is most prevalent in the recovery and base phases or during low-intensity work. The early season is a good time to build general all-round fitness. More about modes later.

Muscular fitness starts the season by building general strength, then transition to more specific strength, power and finally speed. You need to train all components of muscular conditioning throughout the year. The emphasis is what changes. We will have more to say about how to flex your muscles.

Mental training follows a similar annual plan. Begin with relaxation, then concentration, visualization, focus, and finish with activation. We will show you how to psych yourself up, later in the program.

Skill development or technique work has a number of progressive stages throughout the year, where an athlete would emphasize:

The beginning of the year is the best time to take corrective action and to re-enforce of fundamental motions such as arms-only and legs-only drills. Start with improving general skills like: agility, balance, structure, form, fluidity. Major corrections or modification of technique happen early in the season.

Next, work to expand capabilities by introducing entirely new skills and by performing technique on exceedingly more difficult terrain and conditions, in order to increase the envelope of efficiency. An example would be a work-out where the athlete only does one-skate technique, irregardless of the terrain.

At the intensity phase of physical training, there needs to be an integration phase with all-technique over all-terrain. Emphasize sports-specific technique in the base phase and high-speed technique into the intensity phases.

During racing, the athlete and coach should be tuning technique. Once you start racing there should be no need for corrective training. Focus of using your strongest skills and do not dwell on weaknesses.

There you have it! A complete annual high-performance training program on one page. This particular program was used to win 4 World Cup Gold Medals.

Take this program and, with the help of a good coach, modify it to suit yourself.

Of course coaches can generate precise quantitative metrics from a spread-sheet or computer training program software, with inputs from vo2max testing. I would caution against getting seduced by quasi-quantitative metrics and minutiae. Regardless of how complex you make your program must adhere to the fundamental training principles:

- Take a holistic approach to fitness involving both the body and mind;
- Develop Natural fitness that provides endurance, strength, power, speed, agility, flexibility, balance, coordination and skill development;
- Have quantity and quality of training hours;
- Practice Regularity and repetition;
- Alternate Intensity and recovery
- Structure periodization
- Think sport-Specific and diverse cross-training; and
- Always be mindful, in your training.

Don't loose sight of the forest of the trees. Or as Thomas Alsgard said so succinctly "Concentrate on the big details."

The following is a benchmark of general fitness for and elite skier:

TYPES OF CARDIO WORKOUTS

Establishing a strong cardiovascular base requires prolonged low-intensity exercise. There are a variety highly effective cardio prescriptions:

At the low end of the scale, try ACTIVE REST by engaging in light activity just for the sake of promoting circulation and range of movement.

OVER-DISTANCE activities like day-long hikes develop the sub-aerobic base and facilitate the burning of fat.

Often an athlete will go into a MAINTENANCE phase during the early off-season, or during a taper to lightly activates the physiology in preparation for a more specific mode.

LOW SUB-THRESHOLD DISTANCE training is often referred to as Long Slow or Steady Distance (LSD). It will form the basis for providing your aerobic base when undertaken at zone 1, and should comprise the majority of your exercise hours.

Just as stamina is developed with base workouts; significant improvement in the ability to sustain a fast pace can only be realized by CORE training workouts undertaken at race pace or within zone 3:

HIGH SUB-THRESHOLD DISTANCE INTERVALS emphasize higher tempo paced intervals at an intensity that is neither sluggish nor too difficult. This type of interval normally lasts between 10 and 30 minutes at 80% to 90% effort. This intensity typically translates to a sustained high zone 3 race pace.

THRESHOLD NATURAL INTERVALS or FARTLEK workouts are the single, most important type of workout that an athlete can do. Let the terrain dictate the intensity with unstructured speed play. The average intensity level is intended to be mid zone 3 with peaks into zone 4.

INTENSITY workouts are what are required to reach maximum speed. They are all performed above race pace:

ANAEROBIC LACTIC INTERVALS build your anaerobic attributes on top of an aerobic foundation. Typical intervals last between 1-3 minutes with time to recover in between. The sum of all the interval times rarely will exceed 30 minutes. These intervals are great for lactic acid tolerance and are meant to be very hard.

SPEED & POWER ANAEROBIC ALACTIC INTERVALS develop quick power and turnover using the energy locally within the muscles and the ability to replenish quickly. Intervals are kept under 30 seconds and are followed by a complete recovery. A typical workout would include 20-40 of these intervals pushed at zone 4 and zone 5 intensity levels. One very clever way of combining aerobic training

and speed work is to include short 30sec pickups within a long slow distance workout.

The reality is that most ski training is carried out at much slower velocities than race pace, and the economy of motion or technique is optimized for low velocities. However, racing requires an evolution of technique. Therefore an athlete should incorporate short bursts of speed into distance training.

Similarly, OVER SPEED training pushes the bounds of mechanical velocities and coordination with high-tempo bursts usually performed on slight down-hills.

Frequent TIME TRIALS or natural interval training with a group both simulate an actual race.

RACES of course, have their own intense training effect that needs to be taken into account.

A SPECIFIC strength workout such as double poling up steep hills should be classed as a hard workout, especially if it involves intervals.

MUSCULAR TRAINING

A yearly muscular training program starts with developing strength as a base, upon which a athlete then builds power, power-endurance, finally speed and impulse power.

Ironically, there is a point at which an increase in strength no longer contributes to performance in skiing; where the extra muscle strength cannot overcome the weight of the muscle. Athletes must cultivate a high thrust-to-weight ratio.

STRONG ENOUGH

The desirable maximum strength for skiers is approximately two-and-half times the magnitude of the average force required in a sustained activity.

STRENGTH AND POWER

Strength represents the maximum sustained forces that a athlete can exert, whereas, power is a product of acceleration of forces. Power-endurance is developed in skiing; one stroke at a time, every second, for hours on end.

Speed training often suggests the maximum speed obtained in a short sprint. Pace refers to a sustainable speed for a given distance and time. Tempo is the cycle time of a technique or turnover. A few 4 to 6 repetitions of high-resistance, builds strength. Fifty, explosive plyometric contractions with medium resistance, trains power. Speed refers to how fast one can move against little resistance.

Base strength has to be adapted to skiing through specific power-endurance training. The level of force, movement velocity, and joint angles of the exercises should correspond to those of skiing.

SPECIFIC STENGTH AND POWER

An athlete should ensure that strength is maintained throughout the season. This can involve using weights to exercise primary and antagonistic muscle groups and build well-balanced muscle composition.

Ski skating requires a greater contribution of upper body and overall muscle energy requirements than does diagonal stride.

General strength training includes:

- **Isometric** exercises using static contractions;
- **Isotonic** exercises produce contractions throughout a range of motion, in various angles;
- **Isokinetic** exercises combine static and dynamic contractions;
- **Calisthenics** are great muscular exercises that use the natural surroundings and your own body mass to create resistance. There is a fortuitous aerobic component as resultant of sustained and repetitive muscular action. Strength is transformed into sport-specific power through natural power training methods.
- **Plyometrics** develop explosive reactive power by rapidly switching between loading and release. Similarly, a muscle will contract more forcefully and rapidly if stretched the instant before the

contraction. In practice, incorporate ski-bounding and agility exercises into your training regime.

An athlete should recover the affected muscle groups for 24 hours after a heavy muscular workout.

WEIGHT TRAINING DISCUSSION AND DEMO

It's time to visit the weight room, for a general strength program for skiing.

TRAINING MODES IN DETAIL

You are what you do. As a rule, an athlete needs to exercise within their sport, or simulate the activity using the most specific training modes available.

For a cross-country skier the primary in-season mode of exercise is skiing in all its incarnations: classic, ski skating, backcountry, telemark, and alpine skiing.

The secondary in-season training modes for a Nordic skier consist of snowshoeing, some free-skiing or nordix.

Necessary support activities in-season are: running, core-strength workouts, and range of motion exercises.

Primary off-season dry-land training modes for a cross-country skier consist of: roller-skiing and ski striding.

Secondary dry-land training activity for a Nordic skier will include:

Trail running, mountain running, free running that are supplemented with road running and track workouts. Paddling flat-water and white water kayaks, rowing, or canoeing for upper body power-endurance. Other modes may include inline racing, mountain biking and cycling hill workouts.

We prescribe a general year-round fitness program that includes lifting weights, core strength exercises, flexibility, calisthenics, and plyometrics - all of which enhance: strength, power, speed, fluidity, coordination, balance and agility.

For active recovery a skier may cross-train using: triathlon, swimming, road cycling on the flats or hiking.

ON-SNOW SKIING DRILLS

Outside of the long-distance endurance and intense interval workouts that you will already have scheduled into your program, there are some advantageous on-snow skiing drills that you should do:

- Legs-only drills to promote a strong base and optimization of core power;
- Arms-only work for upper body strength;
- Arms-Legs Progressions;
- Classic skiing without grip wax that promotes weight shift;
- Extremely slow skiing concentrating on balance, form and fluidity;
- Over-speed training on slight downhill to emphasize neuromuscular velocity;
- Expand the envelop of technique using difficult terrain;

- Explore beyond boundaries of fatigue with some outrageous workouts;
- Conduct a field fitness test to place milestones in fitness;
- Create chaotic situations such as poor conditions and equipment in which to train;
- Play games;
- Try some power training with biathlon rifle or pack to smooth out your skiing and apply realistic resistance;
- Add very short sprints into long slow distance endurance workout to train speed-endurance. Skiers will spend a lot of time at low speeds in training. The concern is that we optimize our physiology and technique to slow skiing, whereas races are done at high speeds. Insert short bursts in speed into all workouts, to counter this effect;
- Try to ski in groups at least once a week. Use the other skiers to establish points of reference; and
- Introduce natural speed play and adventure into your weekly training regime.

DRY LAND TRAINING SPECIFIC SKIING

Now let's discuss more about DRY LAND training requirements.

For half the year, nordic skiers will have to train for skiing without snow. It is possible to prepare yourself technically, mentally and physically for skiing by training wisely in the off-season.

Most classic and skate skiing techniques can be practiced using roller-skis and varied terrain. Attention should be given to adhering to proper form, timing and adaptation to the terrain. Athletes should be aware of, and avoid, the idiosyncrasies of roller-skis, and especially roller blades.

Ski-Walking simulates either the diagonal stride or offset techniques. The trick is to respect proper skiing form and avoid just walking with poles.

Ski-Striding emphasizes a more flowing and dynamic motion than ski walking but still smooth and best performed on flat or moderate terrain.

Ski-Bounding and Plyometrics can be used with all techniques. The athlete initiates one cycle of given technique as explosively as possible. The emphasis is both traveling forward (not up in the air) and maintaining school technique. You can simulate quick telemark hop turns on the way back down the hill for added plyometric exercise and skills development.

RUNNER TO SKIER

Although running is essential for dry-land training, running itself does not necessarily translate directly to good technique in skiing. The high tempo piston action of the legs in running, tend to punch holes in the snow. Conversely, in skiing, one must glide over snow with long powerful full-body motions, using weight-shift rather than rebounding. Running invokes an internal visceral stress that is proportional to the speed, effort, and pace. Whereas, in skiing, the muscle and cardiovascular fatigue occur across all systems towards complete failure. This exertion may give runners a false perception of effort when skiing.

Are you interested in ROLLERSKIING ?

Roller-skiing is the closest thing to skiing, and the best technical training, in conjunction with ski striding on hills,

but has its own idiosyncrasies. To begin with, the pavement has high friction and is hard; therefore, roller athletes can get away with more twisting and stomping then they could on snow. The wheels on roller skis roll away instead of digging in and can cause a wider stance. Even wider wheels smear the pavement, which prevents climbing steep uphills as nicely as skis in snow. The resistance may increase with push, owing to rotation of the wheels' angular acceleration. Rollerskis have a shorter base, and are easier to control than skis. On pavement, you will have to plant poles more gently or smoothly than on snow.

Roller Skiing is the primary means of dry-land training for cross-country skiers and biathletes. It should be used by Alpine skier but is too often overlooked in lieu of the weight room. Roller Skiing, in and of itself, is enjoyable. Historically it pre-dates roller-blades by almost a century. The roller skis are specifically designed to simulate on snow resistance and handling.

Roller Skiing is an absolute total-body workout for the summer. You will be exceptionally well-conditioned come winter. The resistance in the wheels provides a great work out. All classic, skating and downhill techniques can both be performed on roller skis. Start out very slowly and under the guidance of a trained instructor. This is not something you want to figure out on your own.

A helmet is mandatory safety equipment and you'll want to wear gloves too.

Begin every roller-skiing workout by checking your equipment. Start by double poling to acclimate to the

new balance and resistance of the skis. Make sure that you can stop safety before picking up too much speed. Since most roller skis do not have breaks, it is essential to think ahead. Understand your route, have a plan for the unexpected and an exit or avoidance strategy.

You will want to use roller-skis not roller blades. If you use roller-blades and skate like hockey player, you will get nowhere on the snow.

Use skis with a similar rolling resistance to a skis on snow, and poles about the same weight as your normal poles. The poles for roller skiing will need to be a few cm longer than normal, and you will need to use a special roller-ski pole tip.

Elite skiers will have multiple pairs of skis and poles. Slow skis for resistance training, moderate speed skis for simulating snow skiing and racing high-speed roller skis for fast tempo work or easy workouts. Likewise, skiers may use heavy poles early in the off-season to build more arm strength and switch to light poles in the fall to regain arm speed.

Skiers should also practice classic, skating and downhill techniques on roller skis.

With roller-skis, you can replicate all snow drills. Skiers often emphasize free-skating and double poling during the summer, and hill training leading into fall.

Nordic Ski Walking and striding with poles, when combined with roller-skiing, completes an off-snow simulation of real skiing. All skiing techniques can be trained in this fashion.

What is Ski Walking?

Ski Walking involves striding and bounding with ski poles to acquire ski-specific fitness and coordination in classic, skating and downhill techniques. Ski Walking, at the early stages, is simply walking using short ski poles. The movement can be further refined by lengthening the stride and using the arms to assist a more dynamic motion. Eventually, ski walking can imitate alpine and skiing to a remarkable degree. There are also key drills performed on a steep downhill that are guaranteed to improve slalom turns, strength, balance and agility.

What is the real difference between "Nordic 'Ski' Walking" and just "Nordic-Walking?"

The goal of Nordic Ski Walking is to enhance ski-specific fitness and re-enforce proper biomechanics. It is a key mode of dry-land training for cross-country (all-terrain) skiing and alpine. It is a great form of exercise for pretty much anyone. Nordic Ski Walking & striding are considered a core competency of ski racers. These techniques have been refined over centuries.

Conversely, plain Nordic Walking, on the other hand, is no more than light to moderate fitness walking with poles but with little to no application to real skiing or appreciation for serious training. The biomechanics are not designed for proficiency, and are inappropriate for skiers. The commercial “Nordic Walking” brand technique and philosophy has been radically modified and promoted primarily through fitness retailers, pole manufactures, and a proliferation of new-fangled associations – many of whom claim to have invented the concept of Nordic walking as well as what they call Nordic-Blading. Skiers, of course, have known and practiced these training modes respectively as ski striding and roller-skiing, fro many years.

So what is the history of Nordic Ski Walking?

Nordic Ski Walking was developed and refined by competitive cross-country skiers over a hundred of years. Every elite skier would have reached a high-level of proficiency in Nordic Skiing through years of training in the off-season. The teaching methods and technique is very well established, and has evolved in the last 25 years to include skating techniques. Nordic Ski walking has been, and continues to be, taught by every cross-country ski coach and instructor as an essential part of dry-land training. Nordic Ski walking technique standards have long been established under National Skiing Sports Governing bodies. You can find photographic evidence of roller ski races and roller blading using ski poles dating back to the early 1900s.

Very recently, the new Nordic Walking Associations have modified the technique for fitness walking, removing all applicability to skiing and reduced the training value. Beware from whom you learn. We suggest going to a registered ski club and find a coach recognized by the US

ski association, Cross-Country Canada or equivalent national sports governing body.

What would compel someone to do ski striding?

Ski Walking & Striding are safe physical activities. This is an exceptionally easy, low-effort entry into the exercise, and lots of room for growth. This is why a seventy-year-old arthritic grand-mother and Olympic Skier can both participate in Nordic Ski walking together and get something from the exercise. To see it, you wouldn't think that something so simple, can be so effective. But it is!

Are there other benefits that make it so attractive to the average person and athlete alike?

Nordic Ski Walking is a full-body cardio-muscular exercise that engages the arms, back, stomach, and legs. This combination promotes circulation, correct breathing, burns more calories than walking alone, and develops total-body coordination. The activity itself is very low impact, more than aerobics, dance or even walking. Nordic Ski Striding teaches lower-upper body coordination, posture, form, structure and good biomechanics; in a dynamic way that is applicable to a healthy lifestyle.

Why is it becoming so popular?

Over the years, Jogging, Aerobics, Spinning, Yoga, Pilates, and Ball classes have motivated segments of the population to participate in healthy activities, by offering something new and invigorating. Similarly, Nordic Ski Walking is a re-branding of cross-country and alpine ski training; known for high level of cardio-muscular

conditioning, with all the benefits of skiing on snow, but without the learning curve. It is simple, easy, inexpensive, healthy and safe. In this one activity, you can combine many of the benefits of aerobics.

What are the benefits of Nordic Ski Walking over plain old walking or running?

Although, many of us run, bike, or hike during the summer months, skiing can benefit from specific dry-land training exercises such as Nordic Ski Walking & Striding. It is possible to get a significantly better workout than from walking alone, and the movement is far less injurious than running because it is smooth and low-impact. Nordic Ski walking is also a bridge between walking and running. Approaching running directly can be tough. Nordic Ski walking allows you to loose weight, develop stamina, tone the upper body, exercise your joints to the point where it is safe to take up running.

Is it just for competitive Skiers or can everyone do it?

The interesting thing about Nordic Ski walking is that, a more advanced application of technique can be actually slower, than more rudimentary movements. Therefore, beginners can easily keep the same pace as experts.

Do you need specialized equipment for Nordic Ski Walking? Specialized poles are ideally suited for entry-level Nordic Ski walking. However, the truth is that any set of poles will do. In fact, normal cheap ski poles are better for advanced techniques. Poles should reach just above your waist for walking and to your underarms for ski striding or bounding.

What are basic techniques for Nordic Ski Walking?

Nordic Ski walking starts, surprisingly, by walking with poles. Let them sway by your side but don't use them initially. Get the feel for the swing weight and coordination. The step in the progression will involve lightly planting the poles with the tips at you feet, refraining from applying power initially. The idea is for the legs to do all the work until you can achieve some degree of coordination.

The secret to coordinating the technique is to keep moving as you perform the progression.

When you are ready, start to exaggerate, or lengthen, your stride while applying more force onto the poles. Use more of your body weight, back, shoulders, stomach and arms to drive propulsion through the poles. You can moderate the ideal blend of leg and arm effort.

The next stage is ski-striding. The leg-stride lengthens, and the effort is shared more equally by the arms. The movement approaches the biomechanics used in

diagonal stride in snow-skiing. The key distinction between Nordic ski walking and ski-striding is that in striding; only one foot is touching the ground at a time. The arms achieve a full reach and extension. Striding is also more vigorous. Ski Bounding resembles up-hill diagonal stride and over-emphasizes the push phases.

Ski-Skating can be simulated with Nordic Ski walking, striding and bounding. You can closely replicate the offset technique on steep up-hills as well as diagonal-skate. Do ski-walking and striding correctly, and you will be able to ski-skate any hill, come winter! Exercises help coordinate effective pole-planting for slalom on down-hills, and can perfect the Telemark transition for steep descents. Downhill work with poles, will help with tight turns (like hop Christies) and will create an excellent plyometric exercise.

"If you can Nordic Ski walk, you can Nordic ski."

Nordic ski walking, ski striding and bounding deliver a high-dynamic-range of exercise. It is absolutely possible to move from resting heart rates to maximum oxygen-efficiency using Nordic Ski Striding and Bounding. Cross-country skiers are some of the most conditioned athletes on Earth, and they use these dry-land exercises religiously. If you can ski walk up a steep hill correctly, then you can ski up or down the same hill.

Should I warm up first before Nordic Ski Walking?

Although Nordic ski walking is very gentle on the body, it is a new exercise for many people, and it is wise to stretch through a full range of motion before starting out. The poles also create a number of very effective stretches.

Nordic ski walking, and striding transitions beautifully into roller-skiing.

NORDIC SKI WALKING DRILLS AND DEMOS

Watch the following Nordic ski walking and striding drills. Try to integrate them into your dry-land training program:

- Start with a progression by walking first without and then with poles.
- Get the arms swinging naturally.
- Introduce the poles by allowing them to tap the ground.
- Begin to ski walk
- Lower your centre of gravity and increase your stride length. Now you are emulating diagonal stride
- Ski striding reproduces the training effect of a more dynamic uphill diagonal stride
- Ski bounding over-emphasizes this effect to create a plyometric exercise.

We can also imitate ski skating techniques with accuracy – particularly on steep up hills, where there is little glide anyway.

Offset technique is probably the easiest to begin with. Start by ski walking, then striding, and finally bounding hop skate to inject some plyometrics again.

You can also simulate 1-skate and 2-skate techniques in the same manner, with and without poles.

Now let's isolate the movements with free skating walking, striding, and bounding.

Double polling on dry land is guaranteed to provide some exercise.

Other dry-land conditioning drills include:

- Standing up-hill-broad jump
- Side jump up an incline
- Cross-over side jump for those skating muscles
- Making full use of the down-hills between sets by practicing the correct attitude to executing parallel, slalom, and telemark turns.
- Downhill techniques can be done very dynamically and reintroduce realistic plyometrics, with ballistics and ricochets.

Now take all these skills onto the trails for some freestyle ski-striding, blending endurance, speed, agility, balance, range of motion, fluidity and coordination.

The **Roller Board** is a very specific training device for Nordic skiers to build arm and core strength. There are two basic positions on the board.

Much of Western sports philosophy emphasizes hard training. **Soft training** can promote the fluidity achieved by high-performers only after many years of repetitive training. There are some organic principles and drills found in Chi Chung and yoga which many of the national teams use but talk little about.

Yoga is great for general positional work and flexibility.

Tai Chi, many soft martial arts and dance promote fluidity and perpetual motion that can help you polish any rough edges in your technique.

Pilates and the use of an exercise **Ball** are very good for building core strength necessary for skiing and general natural fitness.

Start to practice **ski-specific positional exercises**. There are only a limited number of positions in skiing that show up over and over again. You have to be able to place and hold a correct position on dry-land before you can ever hope to have perfect form on-snow whilst moving.

DRYLAND TRAINING DEMOS

Core Strength, Form, Flexibility and fluidity are essential for a skier. It is not necessary that you become an expert in Yoga, Pilates, Tai Chi Chung, or spend an extraordinary time in the weight room. We have thoroughly researched and practiced all these disciplines and there are only a few exercises that you absolutely need to know as a skier. Then there are drills that will give you the best return on your investment.

STRETCHING

Stretching is a very important component of training and racing. Lengthening of the muscles will provide more effective strength and flexibility. Also, proper stretching will prevent muscle and tendon tear. Release of muscle tightness and restriction of movement aids in fluidity of motion and ultimately speed. Even a little stretching makes a difference. One of the wonderful aspects of nordic skiing is that it involves the whole body. Therefore, just about every muscle group has to be stretched. Stretch in all planes including lateral stretching and exercise a full rotation through out the joints.

Here are some basic stretching exercises we recommend for skiers:

- Stretch you arms over your head
- Cross the arms in-front
- Cross the arms in-back
- Touch the ground in a splits position
- Alternate touching each leg in a splits position
- Touch your toes or place your palms on the ground
- Touch your toes while crossing your legs
- Balance on one leg and stretch quadriceps
- Balance with one leg out to the side
- Bend and stretch your ankles
- Lie down on your back, cross one leg over the other and grasp leg underneath
- Sit-up, cross one leg over the other, twist and stretch

Try some basic **positional** drills:

- Learn how to adopt and hold a good standing posture. This is the most basic technique found in all styles of martial arts, yoga and dance. It is also the most important and easiest to neglect.

- Extend your arms as if you are hugging a tree
- Now for a selection of poses to affirm good structure:
- Warrior variants
- Downward facing dog
- A Plank
- The Sun salutation
- Combine into a pushup

Once we have some done some stretching and form, let's practice **fluidity**:

- Promote full range of motion by circling joints. Start from small to large joints. Move them individually and then coordinate many movement joints together. Involve your whole body.
- We do this because it is the fastest way to promote fluidity. The biomechanics and motion path of elite athletes tend to follow circles and figure 8s rather than linear motion that starts, stops and reverses.
- These next drills will help you engage your core to lead primary motion:
- Start by relaxing and swinging your arms side to side using the power-torque of your core only.
- To be more ski–specific, transfer this idea to double poling. Use the core and hips to swing arms into position. Create a wave and oscillation that will enhance the power of you double-poling and skating technique.
- Shake out your legs
- Use a low telemark position to coil and uncoil the trunk

It is time for the important **calisthenics**, now that we are warmed up:

- Pushups are something pretty basic that a skier should do
- Modify your sit-ups to copy double polling
- Strengthen lower abdominals with lots of leg raises
- Skiers tend to do a lot of running so it is important to practice the A, B, Cs.

Skiing **plyometrics** are most often performed as explosive tuck jumps, or ballistics and ricochets by rebounding off of a landing. You can do these uphill or down hill, or over an obstacle.

SKILLS

Athletic training is the frequent, and repetitive series of actions directed towards achieving certain movements. The motor-skills are a coordinated system of conditioned reflex connections between the sensory organs, central nervous system, muscular apparatus and internal organs. These connections are not formed immediately, but must be developed deliberately.

Although it is helpful for athletes and coaches to understand the underlying concepts, much of the motor learning is best acquired through other means such as imitation.

Ironically, automated motor skills exercised under uniform ideal conditions can easily become manual if these conditions suddenly change. To prevent this an athlete must vary the manner of training by expanding technique to cover extremes in speeds, conditions and terrain.

Technique should be emphasized early in an athlete's development. Relearning is more difficult than learning. The more consciously a skill is formed involving all the senses, the more strongly it will be consolidated. Major technique work and modifications should be done in the first half of the season.

"Train your weaknesses but race your strengths."

To master a technique, an athlete must have knowledge and a clear concept of how it is to be performed. Actions must be done correctly and repeated. One must focus a high degree of attention and quality to the action rather than sloppy quantity. Imprinting the feeling of proper motion through mentoring is the most effective means of learning a skill. Too often coaches try to talk their athletes into becoming good instead of leading them.

Motor skills are a result of conditioned reflex and connections in the central nervous system, creating an equilibrium of basic nerve processes. Training restructures physiology as a consequence of the body's adaptation to work. Functional restructuring of the central nervous system perfects muscle activities and instills muscle memory, and is possible only when training is regular and sufficiently intensive.

Plasticity of cortex describes the capacity to form new connections faster through training. An athlete should vary the exercises to increase the ability to subsequently master new motions more quickly and to improve the

accomplishment of those skills already known. Short pickups in a long slow distance workout are a good idea.

SKILL FORMATION

The first phase of skills development involves conditioning reflex connections. It is a stage of generalization of movement and response with a wide and inefficient use of muscle groups.

The second phase can be achieved after movements have been repeated many times. The recruitment of unnecessary muscles is now inhibited by processes in the brain. Stimuli is concentrated and motor actions perform more optimally.

The third stage in skill formation is characterized by automation of movements and intuition. Consciously directed attention is not generally required and motor skills allow one to accomplish several tasks simultaneously, whilst concentrating on one primary task.

PHYSICAL TRAINING AND SKILL

A certain level of fitness and strength is necessary to begin practice and develop skills especially as a beginner expends more energy. Skiing is also bounded by the principle of permanence of skill and rapid variability of fitness. Emphasis should be placed on developing perfect skills at the earliest stages where the greatest gains can be made in the shortest period of time. An athlete should lay down a base with skills on which fitness can be built. Precision should be emphasized before speed.

DRILLS

Now let's look at the utility of DRILLS.

Drills are practiced on dry-land and on-snow to isolate movements of a particular technique for development, map a progression to a complex movement and to super-load specific muscle groups in training.

A series of drills can form a technical progression to a complete and proper movement. A complete technique cycle embodies a number of orchestrated and interdependent movements. Within the cycle, it is difficult to correct one particular area in exclusion. Usually, a proportional change has to be applied to the whole system - a bit at a time.

If one component can be isolated from the rest, as in a drill, then the athlete can concentrate on modifying, correcting, strengthening a particular element. It is best to make major changes early in the season.

Drills work on the components of an action and improve them individually before integrating them into the overall technique and giving the required emphasis to accelerated motor learning.

The most important drills for skiing are: double poling, free-skating or legs only.

Free-skating isolates the base of stability and power for skiing.

Arms only or double poling over all-terrain forms the basis for upper body motion for most skating techniques.

Drills are a means to an end, not the end in themselves. Too many athletes and coaches practice contrived drills that detract from correct biomechanics.

RACE PREPARATION

The athlete should always be training to race. Mature and experienced athletes have some of the best advice on how to prepare to race.

MENTAL TRAINING SPORT PSYCHOLOGY

Mental training is assembled with and influenced by:

- Mindful practice;
- Commitment, consistency, persistence, patience;
- Goals and commitment;
- Mental visualization, adaptation to extreme situations, relaxation, concentration, motivation, focus, and suppression of anxiety

Every athlete needs to respect the principles of mental preparation as they would the physical training. It takes practice, repetition, and application.

The quadrant of mental training starts with: practicing relaxation through to facilitating a relaxed performance. The ability to form clear associative and dissociative focus is achieved with improved concentration. This concentration is vital to establish visualization skills that will provide the winning imagery. The quadrant is completed with activation drills that motivate the athlete for their best performance.

The complex coordination and timing of the whole body is not easily adjusted in bits. Rather, the athlete needs to absorb the entirety of the movement and timing. This is best accomplished through visualization, imitation and imprinting off of highly-skilled athletes through mentoring. Third party observations are the least helpful for absorbing correct timing, position, or form.

PREPARATION

Psychological fitness plays an enormous role in determining a favorable outcome, whether you practice an Eastern or Western view.

A neurological pattern is imprinted and established through **imagery and visualization**. The effect can be enhanced with kinaesthetic cues; including the feeling of speed, tempo, coordination, proprioceptive sensations of touch and pressure.

Concentrate intently as you imagine the correctly movement with the sights, sounds, and environment to produce correct electrical responses to muscles. This self-image refined with access to video and by imprinting the form of a good athlete.

Promoting positive thoughts and imagery is a self-fulfilling prophecy. However, desire must be balanced with commitment.

When you are ready, let's introduce a simple and effective mental exercise.

MENTAL EXERCISE:

- Find a comfortable environment.
- Start by relaxing your face and hands.
- Turn on some soothing music.
- Progressively relax; flowing from muscle to mind and from mind to muscle.
- Imagine still skiing position.
- Bring the picture into focus.
- Add colour to your image.
- Work on the ability to hold an image.
- Then try controlling and changing image.
- Experience tactile, taste, and smell.

- Experience environmental detail by adding sounds, feeling the wind across your face and gravity.

- Put the image into motion and visualize the ease of flow.

- Now just, concentrate on what you desire.

TEAM

So many athletes praised the virtues of having talented team-mates to training with on a regular basis. Immense performance gains can be made by belonging to a team.

EXTREME

High-performance sport can be taken to the extreme, where body and mind are truly tested. We have some ultra-athletes with words of wisdom from the edge that you can apply to your event.

INJURIES

Avoiding accidents and exercising through injuries is part of the business of serious training. The body tends to heal itself once you have put in place the necessary preconditions.

NUTRITION

You are what you eat, and an athlete needs to pay particular attention to nutrition.

EQUIPMENT

Take care of your equipment and it will take care of you.

CONCLUSIONS

We finish as we began; with a biathlete and triathlete summarizing the secrets of high-performance training.

"START WITH A PLAN."

What if you had the wisdom of the most successful Olympic athletes and their coaches? What could you do with their Gold-medal winning programs in your hands, and had the secrets decoded?

This is the philosophy of success:

Start with a plan; one offering a fresh, relaxed and intelligent approach to exercise. Keep it simple and realistic. Don't loose sight of the forest for the trees.

Remember that improvement requires belief, and desire must be backed by commitment.

Plan and act. Understand the fundamentals of the game

and apply them. Don't sleep-walk through your training. Analysis plus intuition equals good decisions.

Set goals and appreciate what it takes to get there. This establishes mission-objectivity and keeps your sights on the target. Engage in realistic goal setting.

Do your homework. Become a good student of your sport, because knowing only comes with understanding and experience. Written records add value to your efforts a provide clear recollection of what has really transpired.

Concentrate on the basic elements of training, because they are the most important. First and foremost, the pursuit of any measure of fitness should be fun.

The secrets are locked in the performance of these basics. Master the fundamentals. Emphasize simplicity and balance in life. Take care of the big details first.

Appreciate the value of quality, and understand that quantity has a quality all of its own. Make every workout ruthlessly efficient and put in the effort. Training volume, repetition and consistency are your foundation.

Specificity and diversity are two complementary principles. If you are a skier, then you foremost have to ski, if you are a runner, you have to run, but each sport can learn from another.

Mix high-intensity workouts with light active recovery. Because always exercising at a medium-well pace will keep you slow.

Build the substance of your training, progressively loading day after week after month after year. Doing the same thing, will cause your body to stagnate.

Be mindful in your training. This means giving proper attention to detail. Play-out your technical game, and cultivate innate fluidity. People do a sport for 30 years and never get beyond a novice level because they either don't think or don't care. Evolve or become extinct.

Create attitude. This is what will drive you to succeed.

Keep in mind the clichés "form follows function", and "you are what you eat." Exercise and Nutrition go hand-in-hand.

Equipment management is the easiest thing to overlook, until you experience a malfunction.

Breath consciously.

The legs act as second heart, pumping the return blood against gravity. Strong legs promote a healthy circulatory system.

Every once and awhile, take a refreshing view to your training, and listen to your body.

Stretch. Something so simple can be so important.

Getting out there is 90 per cent of the battle. Your competitors are training in the snow, sleet and rain.

Take a holistic approach to training the mind, body and spirit.

Strengthen and correct from your core. Be true to the basic kinetic principles of simplicity, directness and economy of motion. Development of skills benefit greatly from kinesthetic perception, visualization, and empathy of

good form. Thus, practice good form always – especially when you are going slowly.

A suitable frame of mind establishes emotion content and affects physical performance. You choose what to think.

Successful outcome is fuelled by desire, effort and repetition,

Sort out what is most important and give it the lion's share of attention.

Take the time to warm-up and cool-down. You will have a far better workout than if you hadn't.

The common keys to success are maintenance of good focus, quality of effort and being well rested.

Do not expect something for nothing. Do not let yourself get distracted with short cuts or get fast quickly schemes. There is no silver bullet. You won't be able to dodge hard work.

Don't make excuses for poor performance. Fix the problem not the blame.

Say to your self, "if it is going to be, it is up to me."

You train to race, not train to train. Similarly, don't drill just to drill.

Always seek out different and more difficult challenges. Only by daring to lose can you hope to win.

Similarly, find ways to expand the envelope of present capabilities. Push your limits. It is the only way you will

move them.

You body is mostly water. Drink.

Practice eating during exercise.

Maintain the best fat percentage for your health.

Understand the difference between health and fitness. Fitness exists only on a foundation of health. Do not let one compromise the other.

Don't do drugs. A candle that burns twice as bright, burns half as long.

The important stuff for a skier is all between the toque and the boots. The rest anyone can buy.

Don't try anything during a race that you have not practiced in training.

Train like you race and you'll race like you have train. Perfect practice, and practice perfect.

Get comfortable with uncertainty. Occasionally indulge in excessive-compulsiveness but in moderation – including moderation itself.

Training is a continuous building process. Plans are made to be evolved. Start with a strong foundation. Stay current and observant.

Actively communicate with your coach, but value your own council. An experienced coach is just more likely to be right. Learn from your competitors.

Be open-minded to suggestions. Brilliant ideas can come from unlikely sources. The truth is the truth regardless of

where you hear it, or from whom. The same is for falsehoods. Complex explanations are largely unworkable.

If there is ever a question; quality overrides quantity.

Most of basic training methods are grounded in logical, fundamental and tried & true principles.

The road to success is always under construction. To go further, be innovative and stay ahead of the game. Evolution and discovery happen usually by chance.

Even after a program has been pondered and written, plans must remain dynamic or open to modification, in keeping with the spirit of the overall objectives.

Perseverance will guarantee a large degree of success. Most high performance athletes are self-made not born. Talent is something that you get for free, and it is ultimately worth what you paid for it.

Your technique can never be too good.

Listen to the silence and recovery in every motion

Enjoy your workout. Consider it play with a purpose. Afterwards relax with a sports massage and hot bath.

One's measure of self-worth ought to be gauged by one's best performance - it takes no effort to have a bad day. If you are not enough without medals, you never will be with them.

Your pedigree is measured by your best performances not your worst. Forget bad days; everyone else has.

You will be able to perform a skill before you can fully explain how and why. So conscious understanding is not the way.

A good warm-up and cool-down, stretching and rest are some of the easiest paths to good performance.

The secret is in the basics. The way is in tuning the fundamentals.

Surround yourself with people who are a positive influence on your training. Train with someone better than yourself.

Hard training is only one half of preparation. Good recovery and regeneration habits are essential. Rest allows the body time to recover and to adapt to higher levels of stress. Overtraining is more often a case of under-recovery.

Capitalize on success, seize opportunity, correct your mistakes and reinforce strengths.

An elite athlete needs to develop Jedi mind skills for relaxed performance, concentration, focus, imagery, visualization and activation. Create stressful environment in training to train the mind. You need to be able to control yourself before you can hope to influence competitors or your race environment.

Know your outcome - belief gives birth to reality.

The only way to win is to start behaving as if you are going to.

Knowledge is power but wisdom gives perspective.

Evolve from an outcome focus to process focus.

Think with your muscles. Feel with your mind.

There is more to workouts than increasing its speed. Sometimes to go faster you need to slow down and reflect on the technique. Cut out wasted motion rather than trying to move faster.

Universal Conditions for success are: a clear conception goals imagination, Belief, Confidence, Focused concentration, Creative industriousness, Commitment and tenacity, Character, and Capacity to enjoy what you are doing.

To move from a goal to reality needs firmness of commitment and flexibility to adapt and learn.

Create the capacity to enjoy. Say, “nothing is worth more than this day.”

Success depends more on inward disposition than external circumstances.

Much of what we think is self-fulfilling prophecy. Similarly, doubts limit performance.

Goals must be challenging but obtainable, measurable, manageable, and prioritized

Natural learning has a progression that involves climbs, acclamation, a plateaus, regressions between times of growth. Do not become discouraged or panic. Stay on the correct path.

Follow one program. Vacillating between multiple programs will just stall and tail-spin your performance.

The whole athlete has to be prepared to go over the edge, not just the body. If you are not living life on the

edge then you are taking up too much room.

Visualization programs the wetware in the brain, and stimulates the sensation of success.

Stop bad thoughts and promote good ones.

Silence the part of you that casts doubt.

Repetitive ritual motion opens the channel to creativity and real motor learning. Identify the major motions patterns in your sport and explore ways to train them without doing your sport itself. Involve as many senses into visualization as possible to reinforce muscle-memory.

The better you train, the luckier you will be in races.

But what ever you do, remember the secrets and start with a plan.