Translator's Note

This is a translation of a document created by numerous contributors and sponsored by The Norwegian Ski Federation. In Norwegian the title is "Utvikslings Trappa i Langrenn" and it translates as The Development Stairway in Cross Country Skiing. I have chosen to use Development Staircase in the English version. This is as much as possible a direct translation. Clearly there are bits where idioms and colloquialisms don't cross over well and the translation is looser there. As a long time coach I have of course had thoughts and reactions to things but have always indicated those under the heading "Translator's" or "Coach's Note" and highlighted it in blue. My lack of skill with the computer has made some tables impossible to duplicate in a simple fashion, but the explanations are there.

There is a lot of valuable food for thought here and I hope it will provide just that to coaches and club members. I have been personally impressed by the emphasis on the need for patience and the creation of independence and knowledge in the athletes. The individual Athletes are the most important parts of the process.

This is solely for educational purposes.

Pete Phillips
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Ketchum, Idaho

The Development Staircase

In Norway we have many young Cross Country skiers who dream of one day standing on top of the podium. Even though only a very few reach this goal, it is important that as many as possible reach their potential. The road from childhood's play based sport to becoming a world or an Olympic champion is long; and the first thing we can learn is that no two stories are alike. Every single champion has a unique tale, something which every future champ must also have. A very few are "best" from the moment they put on skis, but by far most must work patiently forward through success and challenge. For all of them the Development Staircase can be a guide for young promising skiers who hope and are willing to work carefully to develop their best potential in the sport.

The Development Staircase describes a purposeful, long-sighted development journey from 13 years of age to the elite level. It should ensure that young skiers face the challenges and gain the ability that step by step lead to the development of elite performance. The Staircase describes how the development of the skills we find among the very best ought to be carried out. Training must be laid out so the athletes can reach or meet the demands that are presented. It is important that the right skills are developed at the right time so that training isn't simply "senior training Light" but as well as possible designed to suit the step on the staircase the athlete is on. Individual condition and biological age are frequently more important than the age in years.

Specific xc ski training should increase yearly. General and varied activity in the younger years is a determining factor in being able to manage the long and hard training required of an elite athlete.

Even if the DS has competition in age based classes as a starting point, each individual must be developed in light of biological age, and training base. This can vary tremendously and before puberty it is difficult to distinguish between good results based on 'talent' and those that come from early maturation. We should therefore be careful about picking out talent too soon. The advice given in the DS must therefore be adapted to each individual's development, and an optimal staircase or step, must be created for each. No two plans will be like.

One of the success factors in Norwegian xc is that we have depth in the sport and take care of those who perhaps do not have the prerequisites to be among the elite. Those who possibly are short on the physical or technical talents can still play an important role in the overall ski environment. They can be inspiring, and good sparring partners to those who go on to be the best. In addition they can be contributors to the training milieu with their positive attitudes. The sport needs future coaches, leaders, and parents with a background and their own experiences as skiers.

Genetics: Those who succeed in xc are first and foremost those who respond well to training over time. This is highly dependent on training that is adapted with the right content, load and progression for each individual.
Training Environment:
Those who succeed have not only strong inherited prerequisites. They also first and foremost have strong motivation, and love to train long and hard. In addition they have gradually developed the ability to train toward goals, consciously, and intelligently. This is what we call “training talent” and is the most important of all inherent prerequisites..

We have below categorized some preconditions that we believe are the most important for success as a senior in xc skiing.

Patience

Athletes want immediate returns from training. Often that doesn’t happen; progress comes slowly, step by step. Results as a young skier are dependent on much more than personal performance alone; growth, maturation, and skill level among local competitors all have an effect. This doesn’t mean that results in the younger years are without meaning. Many experience progress and success as the most important inspiration. The coaches must point out that development happens gradually, and that progress is being made even when the times are tough and results aren’t coming. If the coach has a focus on mastery, on becoming a better skier, and on the right steps of the individual’s staircase, it is frequently easier for the athlete to pull through periods when the results aren’t happening.

The training milieu and spirit should be characterized by the fact that it is goal directed towards the demands and requirements of the sport. The bar should not be lowered so the individual can succeed. Quite the opposite. The training should be laid out so the athlete is well able to take the next step on the staircase and thereby steadily get closer to the desired level. Concurrently it is important to ensure that the training environment is also characterized by fun, social support and fellowship, a sense of ‘team’ that helps carry more athletes through the times when the natural rapid progress they experienced in the early years slows down and the next steps take more effort.

Training oriented toward mastery and development

A mastery and development directed training, *and* competition program is characterized by tough training and hard effort, but also by fun and positive experiences. Athletes and coaches both are setting goals and targets for each workout. It is important after periods of directed training to test the progress to determine whether or not the goals have been reached, or specific targets hit. To build the optimal development programs we are dependent on coaches with

strong senses of sport science and human development. It is critical that coaches involve the individual athletes and other human resources in the development process, and create a team that works together toward a common goal. To the greatest degree possible coaches should be in a close relationship with the athletes and through coaching and other manners of leadership contribute to the athlete being able to develop him or her self.

The 24 Hour Athlete

It is important to preserve and develop the "whole" athlete. The term "24 Hour Athlete" sketches out the overall demands that are laid out, and that must be mastered. In this overall picture it is also necessary to facilitate development in other arenas than Cross Country skiing – studies, career, possible job training, other hobbies, family and friends. Even though training for the sport has to come first with those senior athletes who want to reach the elite level it is important that they develop as a "whole" person.

Parallel with the step by step increase in training content and volume, there needs to be a plan where other activities are scaled back to the point where there is a reasonable overall load. To succeed in XC skiing one must make time for recovery after workouts and tough periods. To have some thing else, something other than the sport, to work with, and in which to have an interest has a good effect and helps an athlete refresh, work harder, and be better able to manage injury, and difficulties.

"Good Attitude" is a much-used phrase in all team milieus. The athletes with this quality have strong inner motivation, satisfaction in the development process, take responsibility for their own development and make the priorities that are necessary to succeed. Their attitudes and the team's culture are based on the sport's base values and what these basic values mean for each athlete and each team:

- Joy and satisfaction through mastery; improvement as a skier.
- Camaraderie through developing together
- Health from an whole and wholesome life style
- Honesty with oneself and others

Skiers with these characteristics are good examples for others, and are often a powerful motivator for the whole team.

Demands and Requirements for tomorrow's Elite

XC is a typical endurance sport. Solid endurance and an effective technique are the most important base requirements. With the arrival of mass starts and sprinting the need for strength and quickness increased. The importance of each element; endurance, technique, strength and speed varies a bit in the different disciplines of the sport, different course profiles, and between classic and free techniques.
Aerobic endurance is the body's ability to use available oxygen to give it energy; a capacity to carry out work at a steady pace over a long period of time. This capacity is primarily influenced by the individual's maximum oxygen uptake (VO2max) and the ability to draw on the max over the course of a race (%VO2max). These two factors determine how much oxygen, and consequently energy, an athlete can draw on in a competition.

Because aerobic endurance and technique are the most important factors in determining performance, it is not unusual that an athlete can excel in competitions of lengths varying from three to four minutes, e.g. xc sprints, to as long as two to three hours in both free and classic techniques. At the same time, quickness and powerful burst speed is needed to win the final dash in all mass start races. This is the reason that we don't recommend that young athletes specialize too soon in either distance or sprint racing.

"it isn't recommended to specialize for sprint until late in the junior years or even until one is a senior. This is based on the fact that the demands of sprint at the elite level still show that having a strong aerobic capacity is a major factor for success, and that specializing in the discipline as a junior has a negative effect on the thorough development of that same capacity. Of course one should take care of and cultivate his talents as a sprinter but as a junior it is even more important to think long-sightedly and to prioritize development of the aerobic capacity. At the same time it is critical to
maintain a strong focus on developing the skills for speed and spurts at a young age. These abilities are important in both sprint and distance events. The anaerobic *endurance that is needed for sprinting will develop through traditional intensity training, short intervals, isolated longer endurance directed speed workouts e.g. over speeds, specific sprint workouts and occasional sprint competitions.*

Cross country places large demands on technical skill. It is an advantage to be "born with skis on your feet" in the quest to win races, as long as it has helped development of effective and efficient technique. In other words there is an enormous demand for aerobic capacity but you won't reach your potential. if technique is not effective at the highest level. Beginning with crawling there are thousands of hours in play and training behind effective technique. A diversity of technique variations in both skating and classic need to be mastered in order to be a complete skier. Some are good at one discipline but the very best, Bjorgen, Northug, Skari, Dahlie, Alsgaard, are masters in both skating and classic.

For each technique variation physical and motor skills need to be developed so the athlete has:

- Control over balance and body position
- Good feel for power development and relaxation in the muscle groups
- Ability to adjust power input , frequency (rpm) and rhythm in all techniques
- Strength and endurance to maintain good technique throughout the whole race

In Classic skiing the two most important techniques are diagonal stride on uphills, and double poling on flat terrain. Herring bone is used on steep ups, or when the grip is poor. Doublepole kick is a good technique during transitions between poling and diagonal stride. In skating V1 on steeper hills, and V2 for flats and slight uphills are the most essential techniques. V2 Alt is an important technique for slight downhills and rolling flats, and no-pole skating is good on long downhills.

(Translator's note: the intent here is to emphasize the importance of being able to smoothly use ALL the gears.)

Good technical solutions are characterized by a balanced play or cooperation between the upper and lower body. This provides the prerequisites for the power applications that are repeated throughout a competition. Central to accomplishing this in varied terrain and conditions are the two following factors:

- The ability to choose the right gear in each technique (there are many variations of each main gear!) Athletes must master V1 and V2alt on both sides.

- The ability to regulate power input to the kick, the poles, and at the same time the frequency rate in response to terrain, snow condition, and speed in the different gears

Technique must become automatic so that it becomes the body's immediate response, a reflex even when one is tired, and you must have the strength and aerobic base to maintain that reflex over the whole course.

Tactical skills including the ability to choose the right moves at the right time have become more important in xc. The different formats of competition present the need for different tactical responses:
In interval starts the athlete individually can choose speeds and techniques based on personal knowledge of skills and estimated tolerances of loads. Since courses and conditions constantly vary a well-developed sense for what are the right tempos and techniques or gears in different parts of the course is critical to success.

In mass starts one is dependent on being able to stay with the others. This means that it is important to manage changes in speed, to be able to be efficient in the competition field, to choose the right solutions technically and tactically based on personal knowledge of strengths and weaknesses on the course, and to be able to position oneself for the final spurt.
The biggest variations in speed between the best and the not-quite-there-yet skiers show up in the last half of a races and especially in the last uphills and the following terrain. The importance of maintaining speed over the top is a well-recognized and important goal for the athletes.

The introduction of mass starts and sprinting led to a much greater demand for quickness (as distinct from speed). An increased demand for being quick and able to maintain speed is also due to better course preparation, hence less friction, and to the facts that both skiers and equipment have improved. This has led to higher average speeds and greater demands on being able to change gears up and go with higher speeds in short spaces of time. The goal of greater strength and quickness is to improve the ability to demand bursts of speed, and sustained spurt efforts at the finish. In addition, increased strength and quickness lead to a greater efficiency on the course. Strength and quickness are skills that complement each other. The forces developed in the muscles are used for movement and stabilization. The muscle groups that control the hip, knee, ankle, and elbow joints, the large outer core muscles have as a main function producing movement and forward progress. They pass forces to the terrain via the legs and the arms. This is only a specific part of the muscle activity that is creating force in the direction of travel. Large parts of the body's musculature provide stabilization of the body parts in relation to each other. The forces used in the stabilizing function provide little power in and of themselves but have an essential function in effective power transfer and efficiency.
Many who have been among the best have become accustomed to hard physical work at a young age. Both Northug and Bjorgen were raised doing a lot of comparatively hard farm work, which could be described as the most relevant strength training for the stabilizing muscles.

There are few sports in which the top athletes vary so much in size, weight, and body type as in xc. Among the best there are athletes with huge differences in size and weight. Some are heavily muscled and relatively powerful, and others have less weight to carry around a course. The different body types provide benefits in different parts of the courses. On easy terrain there is demand for enough strength and raw power to maintain or increase speed.
It is important to have a focus on good and healthy nutrition, with equal weight on energy intake and energy use, and the intake of the proper food. The right nutrition improves the effect of training and goes a long way to insure a balanced body compostion. Weight reduction should only be done under the supervision of an expert athletic nutritionist, because it can have large negative consequences for long-sighted performance development. If one approaches

this in the wrong manner it can lead to hormone imbalances, inefficient digestion, reduction in muscle mass, and development of severe eating disorders. In other words, self guided weight loss must be avoided.

The feeling of mastering tasks and skills is an essential factor for the motivation to continue learning. If an athlete experiences stagnation or lessening of fitness the confidence and interest necessary for success can begin to slide away. It is therefore important to encourage athletes to have the confidence to master concrete tasks, and to give them the motivation to work on these specific things. A conscious development of self-confidence will also lead to more independent athletes, who know what is next and are ready to take the responsibility for carrying out their own training, and to make the small individual adjustments to optimize their training program. This is what characterizes “training intelligence”. At the same time several central mental conditions must be developed in line with the physical and technical factors. For example, the motivation to prioritize so training effect is optimal, the will to hang in and push oneself despite physical pain, to control one's thoughts and feeling during training and racing; i.e. proper focus and being in the present moment.

Athletes who have different qualities that allow them to strengthen and inspire each other, and not least those supporters and teammates around them have been shown to have a strong significance for motivation and performance. For good training communication to be successful a high demand is placed on the individual athlete to be honest with themselves and the support personnel, and the ability to give feedback to the coaches in matters affecting training and performance. This insures that people recognize what is going on and can work together toward a common goal.

The best possible equipment is important to an xc skier, however it is not important to have the best as a younger junior, but it is important to learn to take responsibility for ones own equipment and to get the best out of what you have. Senior skiers who have the top of the line also often are capable with waxing, maintenance, ski selection and optimal preparation

To succeed, athletes in the junior years need to seek out increasingly effective training opportunities so they can work on the important task in good surroundings. Among other things this means:

- Good tracks, good conditions, and other good skiers
- Rollerski opportunities with varied terrain, and good asphalt
- Varied terrain and paths for running and biking
- Strength training possibilities.

The table following sketches which skills are necessary at different stages of the staircase from childhood to the elite senior.

Table One
Development Requirements At different stages on the Development Staircase

Children to 12	13-14	15-16	Junior	Senior
Physical Requirements				
Be able to stay focused in varied training activities: Minimum 60 min for 10 yo and 120 min for 12 yo shift between high and low intensities, slow and high speeds in varied forms of exercise Participate in hikes and ski tours of up to 3 hours Basic activities carried out with necessary balance, strength and coordination	Stay focused and attentive in low to moderate intensities on runs and ski sessions while maintaining good technical quality for 1.5 -2 hours Be able to do competition like activities at high intensities for a continuous 20 minutes Execute Basic exercises correctly with consecutive repetitions Able to turn on bursts and finish spurts in all techniques running and on skis	Stay focused and attentive in low to moderate intensities on runs and ski sessions while maintaining good technical quality for 2-2.5 hours Be able to do competition like activities at high intensities for a continuous 30 minutes Perform the "Basic Drills" from the NSF correctly and repeatedly Able to turn on bursts and finish spurts in all techniques running, on skis and on roller skis	Stay focused and attentive in low to moderate intensities on runs roller ski and ski sessions while maintaining good technical quality for 3 + hours Be able to do competition like activities at high intensities for a continuous 45 minutes Continue to develop and perfect the basic requirements Able to turn on bursts and finish spurts in all techniques running, on skis and on roller skis in an exhausted condition	Have high aerobic endurance capacity: VO2 max 6.5L for men, and 4.4L for women Anaerobic Threshold over 80% of VO2 Max High O2 utilization rate and efficiency in competition speeds on skis Perfection in burst and spurt techniques, and physical requirements The ability to push one self above and beyond in competition The ability to bring the best performance to the most important competitions
Technical and Tactical Requirements				
Good base preparation on skis and dry land training Balance, rhythm, weight shift Able to maneuver the skis; turn, jump, stop, and reverse direction Master all the main techniques in skating and classic Achieve good forward momentum in all of these techniques	Further development the foundations Able to choose the best technique in varied terrain and speeds and to refine the feeling for rhythm and glide Work on the feeling for loading and unloading power in all techniques Good form in moose hooves, bounding and ski walking	Perfect the basics, (Translators note: part of this is identifying and tackling deficiencies) Has the basic tasks for developing good technique: athletic position, weight shift, low shoulders in arm swing etc. Able to ski with high and low gears in each technique Maintain good tech on both sides Ski technically well at both high and low speeds Perfected technique in the execution of moose hooves, ski bounding, and ski walking with and without poles	Have clear tasks and projects in the different techs and the ability to carry out independent technique training Comes well prepared for training sessions: Technically, mentally and physically Can ski technically well in both techs, at all speeds in both a rested and an exhausted (from competition) condition Able to engage in a race with appropriate tactical choices both in mass and individual start formats	Optimized individual technique in all techniques and gears Every session is also a technique session. Seeking solutions and improvement has become reflex the ability to choose the right tech for the moment and to adjust it according to the terrain Have the physical and motor capacities to be able to maintain good tech throughout the whole course Good tactical ability in the field
Knowledge, Values, Attitudes				

Learn the sport's basic values Good effort every session Do as well as one can Tolerate physical sensations that can be uncomfortable Punctuality Understand the "rules of the game"	Understand the sport's basic values Good effort every practice Develop the will and desire to work hard and push for your best Learns the basics on nutrition and recovery punctuality and the capacity to accept instruction and correction learns to win and lose in a good manner Contributes to the whole positive team environment	Lives and promotes the sport's core values Develops an understanding for foundational training principles Increased knowledge and understanding of nutrition and recovery Develops the ability to communicate about training with coaches and other athletes Follows the "rules of the game", the plan and purpose of a workout in group settings	Lives and promotes the sport's core values Learns to live like an elite athlete Sets up an individual training facility - home gym, favorite hill climb etc, Optimized nutrition for good health and performance, and successful routines for recovery Has developed the ability to have realistic appraisals of a situation, and the ability to evaluate oneself in context Contributes to development of the base values of the sport and way it is played in a group. Contributes as a role model for the team and especially for the younger athletes in the local environment	Lives and promotes the sport's core values 24 Hour Athlete Takes responsibility for one own development; planning, execution of evaluation of training. Good communication and relationships with other athletes and coaches the ability to make independent decisions Contributes to the game by good example
Equipment				
One pair of skis, boots and pole up to 10 yo One pair for each technique to 12 yo Only the use of regular waxes	Two pairs of skis, combi boots, two pair poles Only basic waxes	Four pair skis. Racing and training for each technique Classic and skate roller skis with normal resistance	Develop a fleet of skis over the junior years but keep it reasonable! Trans/Coach's note: Take good care of all the skis in the fleet. Don't write 'em off as "Rock skis" too soon. If you keep them clean and oiled the old musket just might take down the deer on a day of surprises! Develop the ability to recognize good skis. Learn about ski testing!	The best is needed at this level. Athletes need to use a lot of time testing their own gear and developing good dialogues with the wax gang and ski suppliers.

Training Principles and Training Content for Young Athletes

Training planning and execution for young athletes must pay attention to the same basic foundational principles as training for seniors, but the content needs to be designed for the biological age, the training experience and the level of mastery achieved in the basic skills. Regardless of age and skill level the effect of training will largely depend on the type of training, the training load and the recovery measures implemented after a training workout. The training load depends primarily on the length, intensity, and frequency of training sessions. A purposeful combination of training load and recovery produces an “over compensation”. One has, in other words improved in condition.

Training has, during and after a session, a depleting effect on the body. This is the catabolic phase. After a certain period of time the body undertakes adaptations to rebuild the structures that are stimulated by the workout. If the training load is big enough, and the recovery is appropriate, the athlete can enter a phase of overcompensation. This rebuild to a higher level during recovery and overcompensation is the anabolic phase. The athlete has adapted to the initial training load and is at a higher level of performance and ability to tolerate more training. Individual athletes respond differently to the same load. The challenge is to plan individually adapted training that maintains or improves the performance / fitness level.

If an athlete undertakes a training session during the overcompensation phase the effect can be increasingly positive and the base level of performance will improve. However, *if the load is applied before the athlete is fully recovered the effect will be negative.* Over time this can lead to serious overtraining. Performance declines if the training load is too big, or if the time between training loads is too short.

Translator’s note: Recovery and the design of recovery activities and the length of time needed is as important, and perhaps more so, as all other aspects of training.
Pay attention to it!

Performance can be improved and developed when new training loads vary from workout to workout and when the time between each session is varied with respect to whether the athlete is fully recovered or not.

Translators Note: This all points at individual athletes taking increasing control of their own training. One can see between the lines here that the athletes need to truly learn about why training goes in certain directions, and to manage what they will do, and that they will need to seriously evaluate goals on a more frequent basis. For juniors with hopes of continuing to improve, and to race well

as seniors performance goals and process goals truly must become tools.

From the junior years on it is important to plan training. Long-sighted planning insures that the development process from a young talent to an elite athlete will allow the athlete to reach the highest level of performance when it counts in the big picture. The long sighted plan for several years culminates in single year plans, period plans, weekly plans and plans for single workouts. The planning has to be based on the abilities and preparedness of the individual athlete, the specific sport, and foundational training principles. Long term development requires some continuity in the coaching group, or an open and substantive dialogue when coaches change.

Intensity and Intensity Zones

For young athletes up to 16 years of age the intensity scale should be divided into four parts; easy, moderate, hard and quickness. “Easy” compares to Zones 1 and 2 on the intensity scale described by Norway’s Olympiatoppen, and the NSF. “Moderate” is zone 3 and “hard” is in line with zones 4 and 5. “Quickness” corresponds to zone 8; anaerobic training implemented as shorter max power bursts in hard workouts, and in specific “quickness” drills. The Goal with these simpler scales is for the athlete to begin to feel the difference and to develop the recognition of the difference as they train in the different zones. This is important in taking control of the training load from workout to workout. A good workout plan is the most important piece in helping the athlete maintain the speed and the technique in regard to the individual workout’s goal.

From the beginning of the junior years of 17-20 the 8 zoned intensity scale of Olympiatoppen is introduced and used based on foundational values of % of max pulse, and blood lactate measurements. It is necessary to know one’s max pulse to make the scale useful. Max declines as age increases so it is good to check it at least yearly.

Max pulse Test
After a good warm up run a 3-4 minute gentle uphill with moderate intensity. Next run the same hill with high intensity. Finally, run the same hill at a high intensity for two minutes before winding the speed up to flat out max for the last two minutes (or exhaustion if that comes first). The highest registered pulse is your max.

Training Intensity Scale
Zone 1 60-72% of Max – Recovery work, warm up, and easy long distance

Zone 2 72-82% of Max – Long distance with moderate effort

Zone 3 82-87% of Max – Natural intervals, quick long distance and long intervals with rest periods at ca. 20-30% of on-time

Zone 4 87-92% of Max – Distance training (Trans. Note:20 minutes and longer at a Higher than Comfortable speed. Very tough. Use it Carefully!), high input intervals with rest of ca. 50% of On.

Zone 5 92-97% of Max – competition, and max intervals with rest of 70-90% of ON

Zone 6 HR not used - La tolerance training with short intervals with equal or Longer rest than On time.

Zone 7 HR not used - Anaerobic training with short intervals and long pauses. Not unlike track and field; 10-15 sec Max, 5 min pause.

Zone 8 HR not used - Quickness training as a specific workout or as bursts in Distance workouts.

Work in zones 1-5 primarily affect (and use) the aerobic energy process. Training in zones 6-8 use and affect the anaerobic processes. In 6-8 the Max pulse and lactate measures are not useful in measuring the inner intensity. With anaerobic training it more common to use speed as the measure of intensity. Note the values in the scale are meant to be guides and as an athlete gains experience are used in addition to the athlete's individual sense of the level of intensity.

Training Volume

Both research and 'best practice' indicate that close to ten thousand hours of or ten to fifteen years of training are needed to reach an internationally competitive level. Data from Norwegian gold medalists in xc emphasize the importance of long hours over several years. From the time the athletes began organized training in the sport of choice, it took on the average fifteen years before the career best results were reached. During the intervening years seven to ten thousand hours went in.

Training data from Norwegian world cup winners show a gradual increase in training hours from younger junior to senior levels. From the age of 16 to the middle of the 20's hours increased by 30 to 80 hours per year (10-25%). After that the hours stabilized between 750-900 hours per year. The gradual increase is extremely important in avoiding injury, sickness and over-training.
Trans Note: My own experience with juniors would add emphasis to the latter. Sometimes, instead of slavishly increasing hours, staying on the same step of the staircase, and improving the quality of the hours is a better investment.

Analysis of the training programs of Norwegian World Cup skiers shows that the

increase in volume and intensity from youth to senior levels in the main means an increase in relatively easy training. The eventual increase in training hours for younger ages means more and longer easy workouts; Young kids and adolescents can experience this as monotonous and boring. Many training hours in the younger ages can also mean that kids have less time for varied and general physical activity.
The training logs and histories of successful seniors show that is very important to have a lot of varied and fun "training" as part of daily activity; cycling, ball games, orienteering etc. All of the best xc skiers have had a lot of play and sport as kids, and this seems to be a demand, a requirement in order to succeed as an endurance athlete as a senior.

We must remember that when we refer to total training hours it is total hours registered in the training log for xc; almost all are systematic and specific goal oriented xc training hours. This hour total is difficult to compare to the training and physical activity in the younger (11-16) years when keeping a log and registering exact hours is rarely done, and is not so important. Younger juniors (and junior coaches) who are eagerly active outside specific xc training have to remember this so that the total training load is optimal, and the maximum dividend is gained.

Translator's Note
Total hours and total load are a little different. Particularly with Juniors and Seniors the total load includes not only the training periods, but also school, family, economy, social, health, and other factors. We shouldn't forget this when dealing with the 11-16 year olds either. An hour of activity per day shouldn't be too hard to do. That equals 365 hours per year. In my opinion, and I believe in the opinion of this document, 11-16 is too soon to start logging those hours or to make them too ski specific. There is so much base building that can and should happen in this window of development that the focus needs to be long-sighted and rather broad. The more vague 'loads' of growing up need to be taken into account, and training should always have a large element of fun and play.

We know that a training volume of 750 to 900 hours is needed to succeed at the international senior level. This requires that skiers use the junior years to gradually come up to a large enough volume, while at the same time keeping performance progression on track and remaining healthy, injury free, and training with good effect and good motivation.

Every step on the development staircase is important but in thinking toward development of future skiers to a high national and international level the junior years, 17,18,19 & 20, are probably most important. This is the last phase prior to entering the arena of senior competition, and in order to facilitate optimal progress in the senior years there are many things that must be in place. For juniors it is important to consider how much training to do, how many different training activities and intensity zones to use, and what all should be

emphasized during the different training periods on the year. In addition juniors in the last phases of that time need to learn how to implement their training so the quality of the work is good enough. As the amount of training increases in the junior years the training needs to be more systematic, the intensities in the workouts more controlled and the requirements for recovery and rest safeguarded.

There isn't a definitive number for how much a young athlete should train, nor an absolute for which progression is best. The main point is to have a sensible progression from year to year so that one is in position and has the foundation to do what is needed when one fills out 25 years and is approaching the top years of a career. Successful athletes have used the junior years, 17-20, to reach 500 quality hours by the time they are seniors, while others have trained as much as 800 while still juniors. These differences seem to stem from variation in training from childhood, and different progress due to biological training age. The key is for the training progression in the junior years to have a long-sighted perspective, and that performances come as steps in overall development.

We see athletes who have taken nine years to gradually increase training volume from 400 hours as a 16 year old to 800 at age 25. Others ramp it up earlier and have started with a volume of close to 600 in the junior years and reach 800 at age 20-21. There is no fast answer to which is right or wrong. By far the most athletes have followed the more conservative path with relatively low numbers in the junior years. One also needs to be clear that an extremely solid and broad foundation from adolescence is needed to be able to take the step with the large volumes as a junior, and so is maintaining a varied "base training" program to build and solidify the capacities we know are necessary to reach the highest international levels.

We have 5 official ski academies in Norway, and these schools perhaps know the most about junior training. Below is an over view of the general recommendations of the school in regard to the progression of training volume in the junior years. There is no difference in hours between girls and boys at any of the schools.

School	17 yr	18	19	20
Hovden	450	500	550	600
Nordreisa	420-470	480-530	500-620	600-700
Meråker	400-450	450-500	500-550	550-600
NTG/L-hammer	400-500	500-600	600-700	650 -750

NTG/Geilo 400-500 500-600 600-650 600-700

Research and training literature recommend that training ought to be general and broad based in childhood and adolescent years and gradually more specific in junior and senior progressions. Training data and log info of world cup athletes support this recommendation. In the ages of 17-18 there is approximately 200-300 hours of ski and rollerski training (in addition to running, biking, strength training etc) for most, while the training total was 450-500 hours in their most successful junior seasons as xc skiers. It is important that one start early enough with both organized and free xc training in order to be well prepared in technique and with the tolerance for the hard training that is required as senior.

It is desirable for juniors to have an emphasis on general base training and preferably the addition of activities other than xc, and xc training. Training content in the later junior years is characterized by an increase in ski specific training; rollerskiing, ski walking, bounding and moosehoofing with poles. The main reason for having a sensible progression over to more specific work is to ensure that an athlete takes enough time building a solid foundation of varied training before entering the senior ranks. The more varied and solid a foundation one has going into the senior years, the better the chances of success as a senior. For a 17 or 18 year old 30-40% of training hours is enough. A reasonable goal for a final junior year (19-20) would be close to 50% specific ski training. The top seniors put in 4-500 hours of specific work. If one is training 800 hours per year this would correspond to a 60% specific load. Running in varied, preferably soft terrain is the single best training one can do to supplement specific ski training.

The training of all the best xc skiers is, without exception, characterized by large amounts of easy training and small amounts (15%) of high intensity. The whole is spiced up with strength, plyometrics, and quickness. The table below shows how training has been sorted out during the junior years of Norway's most successful cross country skiers.

Content I-zone	% of total	Comments
Easy Training Zone 1and 2	70-80 %	How large a load and the athlete's base determines the amount of time in each zone here. Elite seniors who train high hours find it possible to maintain capacity and technique at lower speeds and they use a lot of I 1. Younger and less trained skiers ought to use a bit more I 2 to continue working on capacity. Compensation for lower training hours can be done with higher amounts of I 2 work. However it is nevertheless important that the longest sessions (2-3 hours) are done easily and with the average pulse in I zone 1.

Intensive Training	8-12%	As a recommendation for juniors: one should have about the same percentages of the three intensity zones spread over the whole year, with a larger percentage of I 3 early (summer and early fall) and more I 4-5 out over the rest of the fall and during the competition season.
Strength	5-7%	For juniors it is important to have an equal focus on both specific upper body, and general strength. Throughout the training year there should be more focus on general strength in the beginning to gain and refresh a good base, while in the fall the focus should slide over to more specific strength needs. Specific strength is most often carried out on Rollerskis, moose-hoof with poles, and on skis. It can be supplemented with certain good inside workouts as well. Strength training shifts between strength endurance (over twenty reps, with 30 – 60 seconds of on time), "maximal" (heavy loads, 3-5 reps) explosive strength (moderate load, 8-10 reps vigorously explosive execution) depending on what capability one is trying to improve.
Quickness	2-4%	"Quickness" has become more important in the last few years with the development of different forms of competition in xc skiing. If one wants to advance in the xc game as a senior quickness training needs to be prioritized as a junior; even in the pre-adolescent and younger junior years. Uneven terrain, different techniques, when athletes are fully rested, and when they are tired. An endurance component can be added by using shorter pauses and longer on times than usual. This work should be carried out without lactate accumulation so one can implement it more often – up to several times per week as it requires a short recovery period. *25 minutes of quickness each week for 11 months is 20 hours per year. If one trains 500 hours it is about 4% of the total time.*

Spenst	1%	Use proper bounding with poles, stair bounding, hurdles and obstacle courses. It is important for both being 'snappy and also to be 'on' in technique (a quick sharp kick, timing of parts) and to counter a lot of slow easy training by keeping "life" in the muscles.
Flexibility		Stretching several times per week is Extremely important. XC is not a sport that demands more than normal flexibility other than in the ankles and hip flexors. If you are normally flexible, the stretching is critical in maintaining that and in speeding muscle recovery. If you are not flexible you need to focus more time there.
Other Training		Now and then all athletes should train at Something completely different than traditional xc, or should take part in another sport or other activities. Much of this varied training can count as endurance, strength, plyometric, or quickness work. We in effect, steal hours from other activities though they will not constitute a large portion of the xc year. It is spice, not the main course.

The Different Periods of the Training Year

It is important to allocate the training hours in the best possible manner over the year. Even though as juniors we want to work at base development out over the whole year, it is nonetheless appropriate to divide the year into different periods where the training goals, focus and content are a bit different in each period.

- Relaxation and Recovery Period

April – May

This is an important period both physically and mentally. Spring skiing should be used as much as possible. Easy long tours with a technique focus, Spring fun races, and just skiing as a source of pleasure are important and worthwhile activities as long as the conditions allow. Also important in this period is toning down the goal oriented and systematic training sessions that typify the rest of the year. As long as the activities are varied and pleasurable it is possible to put in quite a few hours of training, and at the same time have an effective period of

rest and relaxation.

- Base/Foundation period

June – August

Here we begin the more systematic workouts, the plans will begin to implement the planned increase in volume. Long intervals in I zone 3 make up a larger part of the intensity work during this period than in the following Base 2 period. This is an important time in identifying and prioritizing work to improve and eliminate weaknesses. (Translator's note: The Swedish coach, Bengt Stattin notes, " Some of the biggest gains you can make happen from systematically working on a weakness – tackle it head on and decide to beat it!).

- Base Period 2

August – November

Volume remains at a stable level, but there is a progression in the intensity sessions with a larger proportion of I zones 4 and 5 than in Base 1. By far the largest portion of this training in carried out on rollerskis, with Moose hooves, and ski walking with poles.

- Special Training – on snow if possible

November -December

This is an important period for juniors where there are limited competitive activities, and competitions are used as extended training opportunities. Technique training on snow should be the central focus, but dryland and base training should continue.

- Competition Period

January-March/April

The Race and Competition schedule in large part directs the training. However it is important to distinguish between important, less important, and unimportant competitions and how they affect training. Even in this period one needs to put in some good volumes, and solid base work to keep moving up the staircase. A tight racing schedule can often leave time for only one intensity session per week in training but it is critical in the big picture to maintain development of quickness, speed and strength throughout the season. (Translator's Note: with juniors it is also extremely important in this period to ensure adequate recovery, and good nutrition. As a coach this can be a challenging, maddening, and highly educational task!)

In addition to the progression in total training hours from adolescence to adulthood, it is also important that there be a progression in both easy and more intense workouts. There ought to be more long tours training when one is older and when the long workouts can be carried out with good technique. At the same time it becomes critical to truly design the intensity workouts with a specific purpose.

In the tables below under each age group you will find an idea of the values for

A Progression of Workout Sessions from a younger junior (17-18) to a senior

Suggested values for interval times, rep times, pauses and total effective ON time for development workouts in Intensity Zones 3,4,& 5 during different periods of the year are described below.
Total times for zones 1 & 2 are included.

Younger Junior

Zone	Rep time	pause/ active rest % of rep time	Hard session Total Interval ON time Summer	Hard session Fall	Light session
5	.5-3 min	50-100%	10-15 min	10-20 min	5-10 min
4	2-6 min	25-75%	15-25 min	15-30 min	10-20 min
3	5 min	0-25%	25-40 min	25-50 min	20-30 min
2	-		40-70 min	50-80 min	30-45 min
1	-		100-150 min	100-180 min	45-120 min

Older Junior

Zone	Rep Time	Pause/ active rest % of rep time	Hard Session Total Interval ON time Summer	Hard Session Fall	Light Session
5	1-4	50-100%	15-20	15-25	10-15
4	3-8	25-75%	20-30	20-35	15-25
3	6	0-25%	30-50	40-60	25-40
2	-		50-80	60-100	40-60
1	-		120-180	150-210	60-120

Senior

Zone	Rep time	Pause/ active rest % of rep time	Hard Session Total Interval ON time Summer	Hard Session Fall	Light Session
5	1-5 min	50-100%	15-25	20-30	10-15
4	4-10 min	25-75%	30-45	30-50	15-20
3	8 min	0-25%	45-60	50-75	30-45
2	-		50-75	60-120	40-80
1	-		120-180	150-240	60-120

interval times, interval pauses, and total effective times for different training periods in the junior years. This can give you a target for workout planning but only creativity limits the workout model.

Designing workouts that can be carried out with high quality within these frameworks is essential, but again imagination is the only limit to what one decides to use. Short intervals (e.g. 15/15, 70/20, 30/30) with short or equal rests can be valuable beyond the above guidelines, especially with younger athletes. This helps take advantage of the growth window, and to insure a high quality in each repetition.

It is important that athletes enjoy competition. In childhood and adolescent years most of the top athletes of today participated in a lot of competitions, and not only in their primary chosen sport. Many played soccer and team handball. Others ran and competed in orienteering right into the senior years as a cross-country skier. It could be this variation and individual progression in different sports helped put down the foundation that let the athletes experience competition as something positive and developmental. There should be a natural progression in competition; in the younger years it should stay close to home and be seen as a fun part of daily life. It is important to build a social framework and feeling of security and acceptance connected to competitive situations. After the athletes are older, and the level of competence has risen then the theatre of competition can widen to national and international levels.

Most of today's top athletes were more concerned with 'mastery' than with results in the younger years. At the same time they gradually developed more concrete and higher result goals. After a time Olympic, and World Cup participation slid into focus as real targets the athletes worked toward. The steadily improving capacities from small steps gained was a positive motivation.

For younger athletes who continue with several different sports it is important that both training and competitions in the different disciplines are coordinated so the athlete gets an optimal development opportunity and is able to carry out the different competitions. Parents have an important role in coordinating the loads of the different demands.

Translator's Note: This means more than scrambling to get the kids to all the competitions; it means tracking rest, and nutrition. It means communication with coaches and sometimes means saying "no" to too much. In our team/school driven theatre here in the US coaches in different disciplines are often at odds over what the kids should do. Frequently the concern is not truly motivated by the kid's best long term interest, but by a coach's or a school's or parents' selfish interest for the pennant on the wall. This fire for recognition often drives us to poorly manage and misuse talent.

Training Activities

It is critical to use on snow work as much as possible in technique training. Winter training ought to have a focus on development of physical and technical capacities not on 'peaking' or short term gains. Some training sessions ought to be used for ski training activities aside from long tours or competitions. Remember to take advantage of spring snow when it is still available. Summer on-snow training isn't necessary for younger juniors largely due to the costs associated with it. In addition a lot of time can be lost in travel and it is more important to focus on general, and varied training at this age.

Translator's Note: For North Americans, who are often trying cross-country skiing for the first time or who might have a later attraction to the sport, summer ski and travel camps can be an enormous incentive to continue. Kids come because it is fun, and the serious business of not being too serious is easily built into the adventures of a good camp.

Since skiers only have snow for at most half of the year, much important training has to be carried out as dry-land work such as running and roller skiing. Ski walking variations with and without poles are effective techniques for developing the aerobic capacities. This kind of training also provides a good opportunity for improving technique and developing muscle memory. Workouts should be carried out in as close an imitation to ski movements as possible.
Translator/Coach's Note: We tell our athletes that when they are "moose-hoofing" if we were only able to see them above the knees we would think they were on skis.
Running is an effective training form for developing aerobic capacity. A relatively large portion of summer and fall training is done in some form of running. This ought to use varied terrain, and as much as possible should be done on soft ground, in hilly terrain.

Roller skiing becomes a useful part of training once one is able to carry it out with good technique. It is important to choose the right terrain and wheels with the proper resistance and stability; as close to what we encounter on snow as possible. The same technical emphases should be put on roller ski technique as on snow ski technique. Skiing without poles should be done on r-skis for the same reasons we do it on skis. The training should have an emphasis on leg work, lateral stability, balance and rhythm.

Speed and Quickness Training

The introduction and evolution of new competition formats that require more burst speed has led to athletes training more for explosive power and speed than previously. In short we can say that for xc skiers it is important to:

- Be able to shift into high gear bursts, or break away faster than the competition.
- Be able to execute the necessary speed changes during a race
- Able to start quickly and cleanly in mass and relay starts
- Improve technique and thereby improve efficiency at competition speed

Quickness is developed specifically in the movements where it is required. It is largely determined by technique and the ability to rapidly produce high power in the competition specific musculature. Training for xc specific quickness should be carried out on skis, rollerskis, or as a variant of ski imitation with poles. If XC performance is to be improved by speed training, the training needs to be implemented with proper technique in appropriate terrain:

- Over the crowns of hills shifting into break away speeds
- Bursts in flat terrain to win the final sprint
- Downhill terrain to improve high speed technique

This training is performed at or close to maximum power input (over 95% of max speed). This high intensity is necessary in order for the cross-country specific musculature to improve at producing high power quickly. In order for the training to be accomplished at a high enough intensity, the “ON” time should generally be less than 15 seconds and initially the pauses between reps should be at least 90 seconds.

Different workouts that are appropriate for different age groups are presented in the "workout bank" later in this document.

Strength Training

Strength is important for good performance in xc and strength training ought to be a component in training for young athletes. Strength training for xc skiers has four functions;

1. It should increase the power development potential in the xc specific musculature.

2, It should improve the athletes ability to control and direct the central xc musculature.

3. It shall develop the musculature around the core such that stability and balance in the core is better.

4. It should contribute to injury prevention.

Strength training should have more emphasis in the spring, summer and fall when stabilization and balance training is combined with a bit heavier/harder strength training. From the time one hits the snow until the season is over strength work should continue but with a bit shorter sessions. This is important for maintenance of the gains made in the preparation period and to avoid actually losing some of that progress.

One needs to be careful with tough/heavy strength training for young athletes before puberty. It is enough to use body weight and to emphasize challenges that also improve stability and explosiveness such as pull-ups, push-ups, high and long hops etc. When weight training begins it is most important that weight does not increase until proper technique has been mastered and that the exercises can be carried out with good control and technique regardless of the load. For heavy strength training one should choose exercises that stimulate the xc specific muscles. Upper body, core, and back are the areas that should be prioritized. Strength training for the legs should largely be carried out through spenst work and explosive strength training.

Flexibility Training

The primary purpose of flexibility training is to develop full flexibility and range of motion in the joints and connective tissues. The important bases for this training are the following:

Flexibility training provides the prerequisite foundation for purposeful technique development.
It reduces the risks of muscle and connective tissue strains and injuries.
It can improve body position, and consequently the ability to gather and deliver maximum efficient power.

Good routines for flexibility training should start at a young age. All of Norway's top xc world champions have 5-10 minute sequences of flexibility and stretching from 3-7 times per week. It is especially important to the central joints (shoulders, hips, and ankles).

Training Quality

If one wants to be the Best, one needs to train Best (Translator's note: "Best" not, most or hardest!) In this, training quality is as important as training content and training volume. In the course of the junior years the athletes ought to gain an understanding of the demands and requirements of quality training, and of course to teach themselves how to carry them out.

There are very small percentage differences between seasoned xc athletes in the amount of training executed over a year. Therefore there must be other

conditions that determine whether or not one is training Best, and that explain why one has trackable and positive development, and goes faster on skis than others who for all practical purposes train the same.

HOW training and training hours are spent are of determining significance.
(Translator's note and opinion: the following is hugely important!!)
Experience shows that in the junior years there is often too much focus on training hours and training content, and too little focus on good execution and good quality. An important goal in the junior years must be to develop athletes with an understanding of what distinguishes between good and poor quality and to learn how to carry out all of the training with the best quality they can. Further the athletes ought to be encouraged to develop enough of a sense of personal security in themselves and in their competence that they maximize the development possibilities as skiers independent of the training milieu and coach changes that often occur in the shift from junior to senior theaters.

Different categories of training have different demands to insure top quality. It depends on the purpose of the training exercise.

- Long distance training must be carried out at the right intensity with good technique. Top athletes give themselves entirely to the workout, They play on skis, and use the long hours to improve downhill and turning technique, to visualize tactical choices they'd make in a competition, and work with technique details like shifting gears, skiing (or roller skiing, bounding, moose hoofing, running) in rhythm with the athlete in front

- Intensity training must first and foremost be carried out with high speed, and proper intensity such that each repetition can be executed with the same speed and good technique.

- Strength and quickness training need good technique, explosive execution, and specific quickness training should include tactics, and technique choices, starts, bursts, and spurts, and the ability to surprise the competition.

Important Factors for training quality, and typical athlete mistakes:

A marked difference between those that profit from a workout and those that don't is the ability to stay focused in all the daily training. Those who train with good focus and understanding are skilled at using easy training workouts to additionally work at one or more other tasks that will improve their skiing.
Common mistakes: more concerned to chat about everything and nothing with companions, thinking that technique training only occurs when the coach is there and telling them what to do. Must often ask others how long the workouts were, and what they did when it is time to do the log. Often more occupied with

total reps than effort input and technical quality in strength training.

There ought to be a high level of precision in both easy and intense training. At the junior level it is important to teach the athlete to use perceived or felt level, and to design workouts to help develop the sense of felt intensity. HR monitors are useful as supplements but to use them to direct a workouts is, from broad experience, more often wrong than right, especially in easy and moderate training. *Common mistakes: a large part of the low intensity training becomes too low (and technique suffers) because one is using the pulse slavishly as a director, or the opposite occurs and long tours are carried out at too high a level. If 80% of training is carried out in large part with poor quality it isn't helping much to have a few really good intervals.*

One must take care to insure that the training week's hard sessions can be carried out with the highest possible quality! *Common mistakes: one is not well prepared for the tough workouts; tired still from work or play the day before, have eaten breakfast too close to the time of the workout, eaten the wrong kind of breakfast, or skipped it, mentally not focused. Consequently the workout does not do what it is meant to do, and one makes little progress.*

A well designed and executed intensity workout can be recognized by the fact that the first part is a bit controlled and load and intensity are just a little lighter than in the last part. It is the execution of the last half of and intensity work that determines whether it has a negative or positive training effect.
Common mistakes: The first part or first reps of the session are performed with too high a load such that one builds lactic acid and lactate in the muscles and blood that cannot be metabolized quickly enough and therefore one ends up with a tough workout that in the best case has no training effect and very likely has a negative one!

There ought to be variety in general training. *Common mistakes: monotony and little change in training over time leads to "heavy legs" , muscle over use issues, and little profit. Another issue is that many athletes get comfortable and 'good' at one special workout, but the requirements in a ski race are different or tougher; the workouts have produced little progress.*

There needs to be progression in training. *Common mistakes: Poorly planned progression in the intensity workouts over the year, mis-use of the HR monitor leading to poor precision (sticking to an HR routine that doesn't contain a progression plan), or that that long easy workouts are not long enough to have the desired effect.*

Training has the most positive effects when one stays on the "plus side" where it concerns progress or improvement from a workout, and the opposite is true when one over time trains without enough progression and recovery time for it to lead to positive compensation. *Common mistakes: All the signs point to an*

athlete being tired, but they stick to the schedule anyway. They are not going into the important intensity workouts well prepared to "crush it" and the workouts are poorly performed.

The athlete needs to be knowledgeable of and thoroughly committed to recovery practices if he/she expects to profit from long hours and tough sessions. *Common mistakes: Skipping or ignoring one or more elements of good recovery; eating and drinking properly before, during and after training and competition, shifting to dry clothes, cool down, proper recovery workouts, rest days and rest periods, sleep quality every night, flexibility training etc. Training can go along OK while cheating recovery but it is usually not as productive as it should be. Frequently it ends up with an illness or a period in which there is no progress.*

One must teach oneself that rest and recovery and taking a rest day are an equally important of the training work as the training itself. *Common mistakes: Following a training plan instead of listening to signals from ones body, starting training too soon after an illness, using too little time to build oneself up gradually after illness or injury, testing one's form too soon with a hard workout,, believing that the best medicine is more/harder training.*

(Inserts: Age progression chart, Examples of Age workouts)

4. Training Planning

By planning training thoroughly, one achieves effective workouts. Training planning has the additional purpose of increasing the awareness levels of both athlete and coach, and gives a foundation for beneficial discussion along the way. Planning must not be followed slavishly, but must constantly be adjusted to the athlete's individual abilities and conditions.

Adolescent and Junior years are an important learning and development period, during which impatience for short term results must not get the upper hand! The necessary abilities and skills must be conveyed in the proper fashion, training planning must take as a starting point a long term perspective the goal of which is to bring out the potential of an individual as a fully grown senior athlete, and to cool off the impatience and the desire to be the best in the shortest possible time. The athletes need to be involved intimately in the planning so they develop a strong sense of ownership in their own development and their own training workout. It is important that the sports demands and requirements are clear to the athletes, and that they are encouraged to take responsibility for both planning, execution and evaluation of training. In the course of the junior years the athletes must gradually take more and more responsibility for their choices, and to teach themselves to stand up for the choices they make. It is crucial that the athletes understand that this awareness is totally necessary, and that they are eager to learn about the

The Tables below illustrate the progression in training content requirements at different age and competence levels.

U12	U 14	15-16	17-20	senior
Physical Training	**Physical Training**	**Physical Training**	**Physical Training**	**Physical Training**T
daily activity Ski regularly all winter. General activity the rest of the year. Participate in a variety of sports. Organized training 2-3 times per week for most of the year, Activities other than xc directed April - October All organized training contains activities with high intensity and/or high speed. Progression in frequency and content as the year goes by. Only "Ski Play" up to 10 years of age with very gradual introduction of instruction Foundation building for balance and dry land and snow through Play directed activities.	daily activity with ski focus Ski training August - March or April. General activity the rest of the year. Participate in several sports Organized training 3-4 times a week most of the year. Endurance Training • 1 long tour / week of 1- 1.5 hours • systematic use of interval training each week Daily inclusion of quickness training Strength: general with body weight as resistance 1-2 sessions per week Stimulate and develop the desire and ability to train on one's own several times per week. A rest day should be planned every week.	"ski training" the whole year XC should be combined with other activities. 5-7 workouts with specific goals and directions e.g. endurance, spenst, One long session on foot per week of 1.5 - 2 hours. 2-3 of the workouts should include moderate to high intensity Quickness: every session should have a round of bursts, intense agility or the like. High intensity, short duration (less than 15 seconds per rep) minimum of 90 sec rest. Strength: 2 x 30 minutes per week of general and specific strength using body weight as resistance.	XC as the main sport Progression from 450 to 650 training hours per year through the junior years 100 -120 hours per year in I zones 3-5 (8-12% of total training time) with shorter rep times and total on times 50% of the training time is specific i.e. roller skiing, moose hoofing with poles etc. Spenst/ Quickness at least 2-3 times / week Strength: 2 x 45 min / week A purposeful blend of heavy strength and general base, stability, and balance training should be introduced and mastered in these years. General summer training with a progression of more ski specific work with the approach of the season Learn the skills of goal oriented intensity management and progression Testing 2-5 times / year- Blood Tests, standardized tests and workouts	XC as an occupation 700 -900 training hours /year About 85% of training is done as endurance training. 100-120 sessions in the year i l zones 3-5 (10% of the total training time) +/- 500 training hours are specific in form (skiing, moosehoof, ski walking, running with poles etc) Altitude training Systematic development of power, speed, and finish burst preparation 2-3 sessions with spenst and quickness / week 1-3 strength sessions / week Training quality evaluation through testing
Competition Local , fun All competition should contain elements of "ski Play" that encourage development of technique and balance preparedness through varied forms of competition. Average a max of one comp per weekend, and every other weekend should be free of competition Participation in competition in other sports, steered by the weekend end off/ weekend with one comp	**Competition** Intra club, and local regional comps get the focus. Develop a primary goal for the season. Mastery or improvement of an element of technique 8-12 competitions per year including some relays. Even teams, though working for the best combination in regional relays. Ought to have free weekends in the course of the season	**Competition** Keep the focus local! Participate in regional competitions Total of 15-30 competitions per year, including summer and tests. Should compete in all age group distances and all techniques. Learn to be skilled at preparing for individual races; warm ups, routines for food, clothing, ski testing etc. Ought to have several free weekends in the season	**Competition** Shoot for JN's Prepare a good overall race plan that distinguishes between the more and less important competitions 25-40 comps per year including summer and tests Good comp prep skill and routines Learn to be IN the course and make a race specific plan. Good warm up and cool down routine skills Try to develop a "peaking" capability two or three times a year. This is an individual art and can be a good coach/ athlete collaboration opportunity	**Competition** National team, Nationals, world cup, Olympics are drivers National races become an important part of the picture Training is optimized around the most important races. 35-50 Comps per year including summer and tests

individual training processes.

Being aggressive and positive are other capabilities that distinguish those who have become good skiers. The top skiers have a fantastic ability to look for possibilities, and to look forward, not dwelling on what is done. One rarely meets an elite athlete who blames anyone or thing other than him or herself for a poor performance.

The best athletes didn't get to the top without an aggressive attitude. Chances have to be taken, boundaries pushed. The best are skilled at encouraging their bodies to give everything they can tolerate in training. At the same time they have the ability to say "Enough is enough", and are completely unafraid to change "The Plan" and to take a rest day when it is necessary. They balance being thorough, serious and ready for the important aspects of training with a playful and reckless attitude toward much that is not so important or demanding of concentration.

For adolescent athletes it can be enough to have an overview of a year, and to encourage them and their parents to lay out week plans that take into account other sports, the school load, and other activities such that the overall load during a given week *fits.* In the junior years (16-21) more detailed plans are needed and the coach takes on a more marked role as an advisor.

Junior Several Year Plan

Juniors should make a long sighted plan that describes a training progression that guarantees the proper development of the foundations demanded by xc skiing. This is a broad strokes plan that reaches out over four to five years. It ought to contain the following:

Identification of the athlete's goals for each training year

Plan for development of capacities in accordance with other demands (school, family, etc)

A rough plan of training content, with total hours, dividing up the plan in between low and higher intensity, strength, explosive and quickness. Specific development areas need to be identified.

Multi Year Plan

Juniors and their trainers ought to lay out a plan over four to five years to provide a longsighted training progression that ensures the proper development of the capabilities XC demands. Such a plan should contain the following elements:

Identification of the athlete's goals for each different training year

A plan specifically targeted at increasing the athlete's *capacity* according to the demands of the sport. (Translator's / Old Coach's note: this goal setting should concentrate on biologically appropriate work, and follow a process of identification of Result, Performance, and Process goals at each stage.)
An overview of training content with total hours, distribution of low intensity, high intensity, strength, plyometric, and quickness work. Areas of training concentration, and targeted elimination of weaknesses should be laid out.

Single Year Plan

From the starting point of the multi year plan we lay out more detailed plans for each training year. The Year Plans should contain:

1. An overview of activities for the year; competitions, tests, training camps

2. Goal setting for the whole year and for each training period during the year

3. Periodization- the division of the year into training periods

4. "Load" structure of the period- whether weeks are heavy, moderate, or light in training load

5. An overview of whether tests, competitions and camps are carried out as planned

6. A plan for the progression of training times and content from month to month

Week and Session Plans

Working from the Single Year Plan we build the plans for weeks and days. These should contain:
An overview of each workout for the week
Coach's Note: As athletes get older and their sense of ownership increases it is beneficial to include them in the understanding of the purpose of each workout, and to let them identify an individual focus for each session.

Detailed descriptions of length, intensities, and techniques in the concentration blocks of each workout.

12 tables of workout sessions go in here
Pages 45-56

Example of a training week in spring or summer for an older junior

Dag	Workout 1	Workout 2
Monday	Rest day	
Tuesday	15 min warm up l 1 run + 5 min l 2 moose hoof. Intervals: 5 x 5 min l 4 moose hoof w/ poles cool down: 15 mi l1	90 min l 1 cycle
Wednesday	Steady stat RS 45 min l2 quickness: 10 x 10 sec, 90-120 sec AR between	90 min l 1 run
Thursday	2 hour + RS duathlon (both techs)	Off
Friday	35 min l 1 Max and general strength 45 min	Off
Saturday	Warm up 20 min skate l 1-2 Interval: 8 x 6 min skate l 3 CD 15 min l 1 skate, then light short run	90 min, row, kayak,
Sunday	3 hour + run, hike in bog terrain (soft ground)	Off

	l zone 1	l zone 2	l zone 3	l zone 4	1 zone 5	Strength	Quickness	Totals
Hours	11:15	1:10	0:50	0:25		0:45	0:20	14:45
workouts in zones	7	2	1	1		1	1	9 workouts

Example of an Autumn training week for an older junior

Day	Workout 1	Workout 2
M	Rest	
T	WU 15 run, 5 Moose hoof w/ poles Intervals: 6 x 5 min Moose L 4 CD 15 min L 1 run	90 min RS skt L 1-2
W	2 hours RS duathlon L 1	Off
Th	RS cls speed progression 1 hour last 30 min L 3 Poling bursts 10 x 10-15 sec, 90 sec AR	Off
F	35 min L 1 run Max and general strength 45 min	90 min RS skt L 1-2
S	WU 20 min RS skt L 1-2 Interval: Distance 10 km RS Skate L 4/5 CD 15 L 1 RS, run	90 min L 1 bike
Su	3 hours run/hike soft terrain	

	L 1	L2	L 3	L 4	L 5	Strength	Spenst	
Hours	10:45	1:25	:30	:30	:25	:45	:25	14:45

Example of a training week in winter for an older junior

Day	Workout 1	Workout 2
M		
T	80 min Skt L 1	
W	WU 20 min cls L1-2 Speeds: cls 8 x 10-15 sec CD 15 cls L 1	60 min L 1 skt
TH	20 min L1-2 skt Interval: 5 x 4 min AR 2 min L4 CD run L1 20 min	30 min run L
F	Travel day	30 min run, drills and 5 x accelerations to race pace
S	WU 30 min cls L1-2 Interval: 3 x 3min cls L5 Speeds: 5 x 15 sec CD 15 min cls	
Su	WU/CD 90 min cls L1-2 Bursts 5 x 10 sec Competition: 10/15 km cls	30 min run L1-2

Intensity zone	**1**	**2**	**3**	**4**	**5**	**strength**	**speeds**	**total**
hours	**7:10**	**1:10**		**0:20**	**1:00**		**:30**	**10:10**
workouts in zone	**5**			**1**	**2**		**2**	**9**

Example of a training week in spring / summer for a younger junior

Day	Workout 1	Workout 2
M	Rest day	
T	WU 15 min run L 1 + 4 min Moose L 1-2 Interval 5 x 4 min Moose w/ poles L-4 CD 15 min run l-1	
W	75 min RS cls L 2 inc 10x 10 sec bursts	90 min run L 1
Th	120 min RS duathlon L 1	
F	35 min easy run L 1 Max and general strength 45 min	
S	WU 20 min RS skt L 1-2 Interval 8 x 5 min RSskt L 3 CD 15 min L1 RS	60 min Bike L 1-2
Su	150 min L 1 run in bog	

I Zone	**1**	**2**	**3**	**4**	**5**	**Strength**	**Speeds**	**Total**
Hours	**9:00**	**1:10**	**0:40**	**0:20**		**0:45**	**0:20**	**12:30**
Workouts								**8**

Example of a training week in Fall for a younger junior

Day	Workout 1	Workout 2
M	Rest day	
T	WU 15 min run L 1 + 5 min Moose L 1-2 Interval 6 x 4 min Moose w/ poles L-4 CD 15 min run l-1	90 min RS skt L 2
W	90 min RS duathlon	
Th	60 min progressive speed inc 10 x 10 sec sprint poling	
F	35 min easy run L 1 Max and general strength 45 min	
S	WU 20 min RS skt L 1-2 Interval 10 km RS skt L 4-5 CD 15 min L1 RS	60 min Bike L 1-2
Su	180 min L 1 run in bog	

I Zone	**1**	**2**	**3**	**4**	**5**	**Strength**	**Speeds**	**Total**
Hours	**8:15**	**1:25**	**0:30**	**0:25**	**0:25**	**0:45**	**0:20**	**12:15**
Workouts								**8**

Example of a training week in Winter for a younger junior

Day	Workout 1	Workout 2
M	Run 30 min L1 Max and general Str 30 min	
T	80 min easy L1 skt	
W	WU 20 min cls L 1-2 **Classic Speeds 8 x 10-15 sec** CD 15 min Cls L 1	
Th	WU 20 min Skt L 1-2 **Intervals: 4 x 4min P 2 min skt L 4** CD 20 run L 1	Easy 30 min run L 1
F	Travel day OFF	
S	WU 20 min RS skt L 1-2 Interval CLS 3 x 3 min L 5 Speeds 5 x 15 sec P 90 sec	
Su	WU , CD 90 min skt L 1-2 Speeds 5 x 10 sec **Race** 5/10 Km skt	

I Zone	**1**	**2**	**3**	**4**	**5**	**Strength**	**Speeds**	**Total**
Hours	**5:30**	**1:10**	**0**	**0:20**	**0:40**	**0:30**	**0:30**	**8:40xs**
Workouts								**7**

Example of a Spring / Summer Training Week for 15/16 yo

Day	Workout 1	Workout 2
M	Easy RS sit 75 min, Strength 20 min	
T	Uphill run Intervals, Hard 2-3-4-3-2 45 sec hard, 30 sec easy	
W	RS Cls 60 min include 5 x 30 sec hard poling	
Th	Other activity e.g. orienteering run 75 min 20 min strength	
F	Rest day	
S	Skt roll 75 min, 15 min speed drills, 20 str	
Su	Long easy tour 120 + min	

	General	Easy	Mod	Hard	Str	Speeds	Total
time		6:15	1:15	:30	1:00	:30	9:30

Example of a training week in fall for a 15-16 yo

Day	**Workout 1**	**workout 2**
M	RS Skt 1:30 easy, Gen strength 20 min	
T	Intervals 3-4 x 4 min 45 sec easy + 30 sec hard	
W	**RS** 60 min + quickness drills	
Th	Natural Intervals : @ 45 min 45 sec easy 15 hard	
F	Rest	
S	RS sit + quickness drill 15 min + strength 20 min	
Su	Long easy tour 2-2:30	

	General	**Easy**	**Mod**	**Hard**	**Strength**	**speed**	**total**
time		**7:30**	**1:00**	**0:45**	**1:00**	**0:30**	**10:45**
total wo's							**6**

Example of a training week in winter for a 15-16 yo

Day	Workout 1	Other Activity
M		general activity, other sport
T	**Classic Relay** Hard/quickness	
W	**Cls** Short easy tour with and without poles	
Th	Skt fartlek in hills Moderate/quickness	
F	Rest	
S	Skate distance Hard (or Race)	
Su	Easy tour Technique of choice.	

	General	Easy	Mod	Hard	Strength	speeds	total
time	**1:30**	**3:00**	**0:30**	**0:30**		**0:30**	**5:30**
workouts							**5**

Example of a Spring / Summer training week for 13/14 yo

Day	Workout 1	Workout 2
M	General activity, game, + Strength	
T	Hard Session- Run or other sport. Hard intensity	
W	Easy to moderate general, bike, roller ski sit, terrain run	
Th	Short hard relays for Spenst and speed	
F	General Activity + strength	
S	Hilly terrain with poles - run- moose- Hard	
Su	Easy terrain run or bike	

	gen	easy	Mod	hard	str	speed	total
Time	2:00	4:00	:30	:40	:40	:45	8:35
Tot WO's	2	2	(1)	2	2	1	9

Example of Fall training week for 13/14 yo

Day	Workout 1	Workout 2
M	General activity, game, relays	
T	Moderate to hard - relays, obstacle course use the imagination	
W	R ski Skt with and w/out poles - easy with tech focus. Strength	
Th	Short hard relays for Spenst and speed	
F	General Activity	
S	Hilly terrain with poles - run- moose- Hard	
Su	Easy terrain run or bike	

	general	easy	Mod	hard	str	speed	total
Time	2:00	4:00	:30	:40	:40	:45	8:35
Tot sessions	2	2	(1)	2	2	1	10

Example of a Winter training week for 13 / 14 yo

Day	workout 1	Workout 2
M		General Activity, other spt
T	Hard Classic Relays, speeds	
W	Easy: short w/, w/o poles Cls	
TH	**Skate Fartlek in hills. Mod hard**	
F	Rest day	
S	**Skate Distance or race Hard**	
Su	**Easy long tour. Tech of choice**	

	Gen	easy	moc	hard	str	speeds	total
time	1:30	3:00	0:30	0:30		0:30	5:20
	1	2	1	2		1	5

Workout BanK -NSF Development Staircase

Examples of various intensity zone works for an older junior (17-20 yo)

	Hard Load	Lighter load
I Zone 5	Note: AR and P stand for Active Rest or Pause. They are used interchangeably. 6x3 min Active Rest/Pause 2 min 5 x 4 min P 3 Pyramid Ints 2-2-3-3-2-2-1-1 P 1-2 3-4-5-4-3 P 2-3 Short Ints 10 x 1 AR 1 6 series of 45 / 15 for 5 min On/off with P 2 min between series Competitions and relays on skis and rullski.running	5 x 2 min P 2 min 4 x 3 P 3 1-2-3-2-1 P 1-2 5 x 1 P 1
I zone 4	6 x 5 min AR 2 min Pyramid Int 30 min with 2 - 6 min rep and 1 -4 AR Natural Ints 30 min Distance 20-30 min Long competitions	4 x 4 min AR 2 min 4 x 4 AR 2 6 x 3 AR 1 Pyramid 20 min reps 2 - 4 min AR 1-4 Natural Ins 20 min
I zone 3	5x8 min AR 2.5 min 4x10 AR 2-5 45-50 min steady state Orienteering or mountain run	6x5 AR 2 6x5 AR 2 3x8 AR 1-3 30 steady state
I zone 2	Medium distance tours, These workouts should be at running, not jogging pace and with good speed and technique	Short tours of .5 - one hour
I Zone 1	Long workouts of 2.5 - 3 hours. Hikes, long runs in soft and varied terrain . Bike tours and kayaking, canoeing, rowing are good variation in the summer season.	easy tours 1-2 hours short tours and or recovery workout
Quickness	• Ski/R ski 4 skate accelerations. 3x5 sec starts,3=4 x 10 hop V1 3-4 x 10 sec V2 sprint, 3-4 x 10 V2Alt on slight downhill. Pause (AR) 2-3 min between reps, 6-10 between each series. • Ski/Rski classic 4 x 30 sec accelerations, 4x19-15 sec D poling, 4 x 10 diagonal on easy uphill, 4 x15sec of high race speed shifting to finish spurt, Rep AR 2-3, series AR 6 -10 min. • AR in I zone 1 • Both techniques: 4 x warm up accelerations, 6-8 x 12 sec bursts from a start position or from Izone 1 or 2 speed. R 2-3 m • Running, moose hoofing 10 x short bursts, bounds 10 sec. AR 2 min	Do 4-8 of the quickness drills in the course of a longer easy work out is varied terrain

Examples of Workouts for younger juniors (15-16)

I Zone 5	Hard load	Light load

I Zone 5	Medium length Ints 5x3 min AR 2 min 4x4 min, AR 3 min Pyramid: 1-2-3-2-2-1-1 AR 1-2 min 3-4-4-3 AR 2-3 min Short Ints: 8x1 AR 1 5 series of 5 min 45/15 AR 2 min between series Competitions, reay	4x2min AR 2 min 3x3 R 1 1-2-3-2-1 AR 1-2 5X1 AR 1min
I Zone 4	6x4 AR 2 20 min in Pyramid rep 1-4 min AR 1-2 Natural ints 20 min Distance training 20-25 min Longer competitions	4x3 AR 2 6x3 AR 1 Pyramid 15 min, reps 1-2 AR 1 Natural Int 10 min
I Zone 3	5x6min AR 2 4x8 AR 3 30-40 min steady state Orienteering or bc run	5x5 min AR 2 2x8 AR 3 min 20 min Steady state
I Zone 2	Medium long passes of 45-90 min *running not jogging*, or done on Rskis with good speed and good technique	Short tour of 30-60 minutes
I Zone 1	Long workouts of 2 - 3 hours. Hikes, long runs in soft and varied terrain . Bike tours and kayaking, canoeing, rowing are good variation in the summer season.	1-1.5 tour short tour, recovery ints
Quickness	10-12 x bursts of 8-10 seconds with longer Active Rest. Take advantage of different techniques and terrain. Most of the quickness drills can be effectively used to "spice up" longer workouts. Train starts, start procedure, and acceleration. Train finish spurts and lunges in 2x2 or 3x3 format. Work downhill technique! 2 ski easily with in line. underway the leader accelerates to a burst of max power and speed of 10 seconds. Nr.2 tries to hang. Or Nr. 2 tries to surprise Nr. i and spurt past , 10-15 bursts in all. Endurance challenged quickness: a lap of 3-5 minutes is marked out with cones with "Start" and "Finish" in distances at max power/speed of about 5 - 10 seconds. 4-6 sections in the lap with decent rest in between. Do the lap 3-6 times with a short pause between the laps. Athletes should be tired (increasingly) but not building lactate. Easy good technique between the burst sections.	Put 4-6 quickness drills into a longer workout.

Examples of workouts for younger athletes

Hard Workouts	13-14 years Traditional intervals 4-5 x 2-3 min. The same rep each time and the last rep should be as fast as the first. Vary between using time as the goal and using distance as the goal. Rest should be shorter than the 'on' time. Different types of pyramid ints; e.g. 1-2-3-2-1 with Active rest of half on time. Series of short intervals; 4 series of 5 x 30/30 on an up hill or 5 x 40/20 in flat terrain. 3 series of 6 x 10/10 sec 2 x 5 min. Set distance and target the last lap to be as fast and the first. 3 min active rest between. Natural intervals of 10-15 minutes where intensity is higher on the uphill and drops off a bit on the downs. "First back to the stadium" from a point out on the course (2-3 km) Distance training; 10 -12 minutes a bit harder than is comfortable on a set lap. (*Translator/ old coach's note: this type of distance training is hard, but effective. Don't use it too often, and make sure the athletes are focused on* how *to use it i.e. that they understand individually what it offers and how to execute it.*) "Play" directed activities: Relays etc. Be creative; use different techniques, poles/no poles, backwards, zig-zags, pushing and pulling each other. Vary between shorter (10-20 sec) and longer (1-2 minutes) legs. Work on this for 10-15 minutes total perhaps divided between two different relays.	15-16 years Traditional Intervals 4- 5 x 3-4 minutes. The same rep each time and the last rep should be as fast as the first. Vary between using time as the goal and using distance as the goal. Rest should be shorter than the 'on' time. Different pyramids; e.g. 1-2-3-4-3-2-1 with half time active rest. Series of shorter ints; 6 series of 5x30/30 on uphill or 5 x 40/20 (On/Off) sec on flatter terrain. 4 series of 8 x 10/10 3-4 x 5 min or 2 x 8 min with the last as fast as the first on a set loop. 3 min AR. Natural Ints for 15-20 min. "First back" from a set point on the training loops. 3-5 km. Distance training; high speed for 10-15 min on a set loop. Team competitions; skiing, running, hill clamps, orienteering 2 man relays: Be creative; use different techniques, poles/no poles, backwards, zig-zags, pushing and pulling each other. Vary between shorter (10-30 sec) and longer (1-2 minutes) legs. Work on this for 15-20 minutes total perhaps divided between two different relays.
Comments;	It is important at this age that hard workouts are a blend of traditional interval training, distance and competition, and play/fun focused activities. For 13-14 year olds the emphasis should be on skill building fun and for 15-16 it should slide over to about 50-50. In practice it is appropriate to do many of the activities together, but to give "homework" in which the young athletes are encouraged to carry out some of the intervals on their own. Take the opportunity of common sessions to illustrate a examples of well executed intervals. Relays: imagination is the only limit here, but remember that the the goals are the most possible activity, high speed and effort so there is an endurance effect. Keep 'em moving! Use as little time as possible in organization and rest and move quickly from one relay to the next. These are only a small part (15-20 min) of a workout. Translator's note: this means that organization by the coaches has to happen well beforehand! Winging it while the athletes are standing around is not good. These relays are a great way to start a workout (post warm up) or to finish one, and it is important to maintain the momentum.	

Medium intensity workouts	Traditional Intervals/distance Lay out a loop that takes 4-6 min in varied terrain with good technique and speed, but at the same time not full bore. One should be breathing hard and keeping a speed that "you think you can hang on to for 15 minutes" as the task. Time the round. The task is to do each lap at about the same speed or to go as far each time. 3-5 laps with 1 min AR while the athlete gets feed back on the execution. A little longer lap of 8-12 minutes. 2 rounds with 2 min AR as above. Task is to go as fast/far on the second as on the first. A longer loop (15-20 min) done at "half-ahead" or steady state. Use the same tasks as above. Put a short obstacle course or a series of bursts in the loop. Participate in orienteering runs, backcountry runs Play/Fun directed activities; Relays are not so good here; by their competitive nature they are not the best for moderate intensity training. A game element can be introduced by a "Follow the Leader varied terrain run with shifting leaders and tasks. Use the imagination. Team games can be good.	Lay out a loop that takes 6-10 min in varied terrain with good technique and speed, but at the same time not full bore. One should be breathing hard and keeping a speed that "you think you can hang on to for 15 minutes" as the task. Time the round. The task is to do each lap at about the same speed or to go as far each time. 3-5 laps with 1 min AR while the athlete gets feed back on the execution A little longer lap of 12-20 minutes. 2 rounds with 2 min AR as above. Task is to go as fast/far on the second as on the first. A longer loop (25-40 min) done at "half-ahead" or steady state. Use the same tasks as above. Put a short obstacle course or a series of bursts in the loop. Participate in orienteering runs, backcountry runs Add in a roller ski tour of 45-60 min in varied terrain. Hold good speed and technique but not "Max" Moderate intensity fun activities with occasional bursts.
Easy / Long	Family hikes, long tours with the club. This should become a weekend routine. At least once / week young athletes should take an easy run in which they add fast ski walking or moose hoofing on long uphills. Varied terrain for 1-1.5 hours- on their own or with friends, Bike tours can be good. Short tours (30 Min) that are run, not jogged. Orienteering at a walk Now and again participating in similar but unrelated activities is a great way to get a new and fun endurance workout; Biking to soccer and then to ski training! Multi sport days can be really good if the athlete learns how to plan and use them.	Long, easy tours outdoors. At least once /week young athletes should take an easy run in which they add fast ski walking or moose hoofing on long uphills. Varied terrain for 1.5-2 hours- on their own or with friends, Bike tours can be good. Short 30 min runs (not jogs) or roller ski tours at high speed and god technique (long R-ski sessions are not recommended until the athletes can ski with high speed, good technique AND low intensity). Low intensity orienteering Multi-sport days

Quickness	Quickness can be added into other workouts. Short on-times (10-20 seconds) and longer active rest (3-5 minutes). 8-10 x short bursts (10 sec) with long AR as skiing, bounding, moose-hoofing, etc. take advantage of different terrain and techniques. Train start procedures, start techniques, and acceleration Train finish bursts and lunges in one on one competition. Do 'overspends' on downhills Two athletes ski in line and in step. Without warning the first accelerates to max speed and holds it for about 5 seconds. The seconds reacts and hangs on as well as possible. Trade positions and do 10 -15 reps. Vary technique and try having the #2 do the unexpected and try to pass the first man.	8-10 x short bursts (10 sec) with long AR as skiing, bounding, moose-hoofing, etc. take advantage of different terrain and techniques. Train start procedures, start techniques, and acceleration Train finish bursts and lunges in one on one competition. Do 'overspends' on downhills Two athletes ski in line and in step. Without warning the first accelerates to max speed and holds it for about 5 seconds. The seconds reacts and hangs on as well as possible. Trade positions and do 10 -15 reps. Vary technique and try having the #2 do the unexpected and try to pass the first man. Endurance emphasis quickness workouts on skis and rollerskis: A lap of 3-5 minutes on which one sets up cones to mark where there is a burst of 100% max and where to slow it back down. These should be short of 5-10 seconds and there should be 4-6 bursts in a lap. Ski the lap 3-6 times with eventually a short pause between laps. The pause should be short enough that one is breathing hard underway, but is not building lactate. It is important that one goes easy between each burst. The burst sections should occur in varied terrain situations; up, down, curves, etc.
Comments: Remember that at this age there should be spenst or quickness elements in every single workout. Team games or participation in other sports give some excellent "free" quickness training. Track and field in the short distances, hurdles and field events like broad jump is a good adjunct to ski training. Most track drills with short intense bursts and long pauses can be very good for skiers.		

5. How to ensure that the training is having the desired effect?

The daily training log ought to be a part of the game at the latest from the start of the junior (17-20) years. It becomes a valuable tool for ensuring the quality of the work and productive conversation between coach and athlete.
Before the junior years the habit of responding to the work can be inculcated with a simple log or school plan book that helps with planning, documenting, and evaluating work. It is not recommended for younger athletes that the training is too "systematic", but that it is pleasurable, fun and often steered by the athletes themselves.

The training effect should be checked through regular "control workouts", or tests that occur at the same time in the training cycle. If one is not getting the desired effect then the activities must be adjusted. Set interval sessions under stable conditions (ground surface, weather etc,) can give good indications as to whether or not there is progress, and these should be carried out 1-2 times per month from the U-16 class on. This is simply done. Shorter times with the same pulse over a set course, or longer distances in a set time are good indicators and goals for measuring progress.

Higher speed at the same pulse on the treadmill, or a lower pulse and lactate level at the same speed also indicate progress. Test runs over a set course ought to be done every other month from age15 on, provided other endurance competitions of set distances are not part of the picture. 10-20 minute uphill runs, 5-15 minute poling uphill are good workouts that also say a lot about an athlete's progress.

In order to be able to realistically compare the results from test to test, and from year to year one needs to be well rested and have carried out about the same training loads before each test. Below are some tips and advice for accurate testing;

Similar preparation for the test:

The last two days before the test should not contain training with a heavy load or intensity
Avoid food for the last two hours before testing
Otherwise normal daily life before hand; enough sleep, regular work at the job or school, normal healthy diet

Similar execution of the tests:
Test at the same time of day
Test on the same course or in the same place
Test with the same type of clothing, shoes, etc.

Use the same warm up routine
Test in the same manner (a standardized procedure)

Regular testing can reveal at an early stage whether an athlete is achieving the expected gains or is incorrectly trained. Poor training is recognized mainly by "flat" or negative performance in tests and competitions. At fault commonly are;

Too much training

Too little training

Too intensive training

Training content that is not directed toward the demands of the sport

Training that is not periodized optimally

Several elite athletes have taken it easy for a few months only to turn in top performances just a few weeks after their bodies have returned to training. **Most important is that the body has the possibility to bring itself back to 100% preparedness, and is ready to get the max out of the training it does.** (Translator's bold type)

Measurement of the resting pulse is the best method to find out whether the athlete is tired, and headed for over training or illness. It is therefore recommended that from the junior years on xc skiers take the pulse daily, preferably before breakfast.

The testing should be done at the same time and with the same routine from day to day. Go to the bathroom right after you wake up, then hook up the HR monitor and go lie back down for a few minutes. Measure the pulse. Its important to use the information correctly. The resting pulse, just like the max pulse, is an individual thing Well trained athletes often have a low RP (under 40 bpm) which can go even lower as their form improves with training. It is often the case that the RP will drop over the training season up to 5 bmp as top condition settles in. An increase in RP of 5 or more bpm can indicate that the body is not functioning at 100%.

A higher pulse can be a warning of stress, overtraining, or the early stages of illness. If the RP is over 5 beats above the norm, one should pay close attention to the body's signals out over the training day.

6. Technique training for younger athletes

Good technique is extremely important in XC skiing and development of technique should begin as early as possible. The method must fit the age group and shift with increasing age and experience, but at every stage the organized workouts should be planned with technique goals in mind. The athletes need to work toward technical mastery in the workouts. One should use variety in training and emphasize different aspects with increasing age.
Translator's Note:
The spirit of this is not to "hut-two-three-four, V1,V2!!" cram technique at kids, but to take advantage of things that their bodies can develop best at various ages; at first things that are the foundations of good technique later. Balance, long glide, quickness, balance, balance at speed, spacial orientation, moving coordination etc.

The organization and content of training is designed in accordance with the level of preparedness of the individual athletes. The future's technique develops with the clubs and divisions together with the athletes. Coaches therefore must be constantly developing along with the athletes.

[Pages 59-63 describe technique specifics and needs in the two disciplines.]

Requirements for Technique Development

Thousands of hours of training are required to develop solid xc technique. Both physical and mental requirements are developed parallel with technique, and at the core is the proper choice of training methods and terrain. It also takes time and patience. It is important that the coach is willing to stick with his ideas and motivates the athletes to carry out the training to the best of their abilities. When the targets are successfully ticked off new elements can be introduced. If after a good try progress doesn't occur the methods and approaches must be re-thought.
[Translator's Note; This is put forth in the spirit of the coach being as much a student of the sport as the athlete; not holding stubbornly to an "I am the way…" commitment to a method, but to have researched, observed, and thought out what is the target and an individual's best way to reach it, to have designed work outs accordingly, and to give them time to work. At the same time if they are in need of adjustment the coach needs to spot that and revise.]

The physical, coordinative, and mental skill requirements must be trained simultaneously with technique on skis and roller skis. Technique training has to be integrated into "regular" training. This is significant in development of the motor skills and physical abilities need to perform with good technique over long periods of time.

This means that ALL xc specific training is also technique training. For example during r-ski sessions the selection of wheel speed, terrain, and technical challenge fit the same elements one wishes to influence and improve on snow. Moose hoofing and ski walking are important motion forms for skiers and ought to be executed with a strong focus on good diagonal technique [i.e. if you are only focusing on the endurance and aerobic benefits, you are casting away a simultaneous opportunity to improve efficiency and speed]. It is more important to maintain good tech, than to go fast in dry land work. With r-skis, and ski imitation training athletes should strive for the feelings they sense on skis, almost to "feel the snow' during a session. Strength and base training is training the physical and technique foundations that enable the transfer of power to movement. This work is often done in a gym and includes both general and specific exercises. "General" can be typical stabilization work. More specific exercises, that replicate xc ski movement are referred to as "imitation." For many strength training can be necessary for the development of better technique. In this type of work the athlete should find positions and exercises that are directly transferable to the movements one wants to develop on skis. Thus one becomes strong, snappy, fluid in the "right muscles" and avoids inexpedient movement patterns becoming reinforced.

Methodology

Situation governed and task governed learning are the usual teaching methods for children and youth. Situation governed learning occurs when the situation with which the athlete is faced gives instruction. The situation must therefore be facilitated so the athletes teach themselves basic skills in order to develop good technique, such as games or courses with jumps, and curves that challenge balance and turning skills. In such cases it is the "terrain that teaches" so the body discovers the most effective solution to the challenge. It is important to have careful planning and facilitation of these workouts so the athletes are trained in the most important technical and physical abilities. There is no use of instruction or explanation.
Task governed learning occurs when the workout activity provides technique instruction. For example the task of "glide as far as you can on one ski" challenges balance, kick and weight shift.

Technique develops best when the selected tasks are prioritized in appropriate terrain. Choose easier terrain when the task is training high speed skating over a longer period of time. If the goal is to improve second gear (V1), choose tough uphills.

Instruction, guidance, and 'awareness action' on a task are methods that are increasingly used with increasing age. "Awareness action" means that the athlete develops an individual understanding of technique and experiences the execution and changes in it. This is an important method that is introduced

gradually such that the athlete learns to take personal responsibility for technique development when the coach is not present.

Even though much technique learning occurs unconsciously, and one improves without being able to explain why, it is important to take some time to find an cause for the improvement. This provides an understanding of how the training or the tasks have moved things forward. This process can be most motivational for the athlete, giving them more consciousness in regard to the training process. It sets them up to make independent and proper choices later on.

It is good to prioritize one or two of the most important learning tasks in each technique. In order to make progress the execution of training sessions must be of the highest quality, and the focus held consciously and goal oriented toward the most important aspects. The coach needs to focus both on the prioritized tasks agreed upon with the athlete, but still manage to create variations and progressions in the training content so improvements in the different aspects become more and more solid and automatic. Finish a workout with raising the athlete's awareness of which tasks will be prioritized in individual planning in the future.

Positive feedback to the athlete at the *right time* is the most effective method to achieve progress and learning. It is important to reinforce things that are going well. Positive feedback when the athlete performs poorly in a workout, confuses the athlete and destroys the authority of the coach. It is important that the coach's feedback matches the athletes feeling about a session. If an athlete doesn't carry out a workout in accordance with the selected task, he or she ought to be alerted to the fact through concrete and easily understood feedback.

It is ultimately up to the athlete to find the right technique in coopetition situations. The feeling or sense for the right choices must be developed so that the athletes themselves can further improve technique on their own. The best xc athletes have themselves taken responsibility; they have taken ownership in the process of technical improvement and they have trained independently at the proper tasks. Simultaneously it is important to maintain a close dialog between trainer and athlete so that the coach understands the athlete's targets and can give germane feedback.

<u>The "Whole" Method</u> means training the whole movement and is practiced by assembling and making automatic smaller individual movements. In The "Parts" Method the whole movement is broken down in to bits that one learns or practices one at a time, and then brings together into the whole movements. In some cases it is good to use the Parts method in order to make the athlete aware of a technical "key" that can help the whole movement be better. Often one switches between Whole and Parts methods within the same workout.

An effective example of the Parts method is to ski or roller ski without poles. This

isolates the 'kick' in the legs and develops balance, the sense of grip in the kick , and endurance strength in the legs. Poling in rolling terrain is good upper body training both technically and physically. Poling both on uphills and in easy terrain is good for learning to use the "fall" momentum and to stabilize hip and abdominal muscles such that the power is transferred to the poles and the ground. Poling with a single pole is often used by the top skiers to develop side to side stability and control in the gluteus and back.

Team learning can be an effective manner to fine tune technique; athletes work together to learn from each other's strengths. Following other athletes in a specific technique can be hugely helpful in learning from their skills and in finding out when one's own tech is optimal. Since so much of xc training is done without the coach immediately present, it can be good to divide into training teams of two or three athletes that work together, knowing the tasks and encouraging each other to keep the proper focus for a workout,

Using film is a distinct aid for technique training because you get feedback on whether or not what you feel coincides with what you actually do. Analysis of film makes it possible to study individual elements more thoroughly in order to strengthen them. Remember to only prioritize the most important things and not to get lost in details.

7. To be a Coach for Young Athletes

The basic principles for the exercise of the coaches role are same for young and older athletes. The difference in work with youth is that the coach sees the athletes less often, and has the responsibility for more of them. **It is important to make training sessions into an overall learning arena.** Training needs to be extra well organized, must have the focus on development of the most important requirements of the sport and encourage cooperation between parents and other coaches who influence the athletes. The athletes understanding of the training itself and their awareness of their response to training should be gradually developed. The coach's role shifts from being a teacher to being a sounding board and an advisor. It does not mean that a trainer turns the athlete out or ignores them. Regardless of age or skill level the coach needs to take time to get to know the athletes and to develop a relationship with them.

Top athletes have always taken responsibility for their own development, but they also have had someone to lean on; a coach, a friendly ear, a mentor.

Even though XC is largely an individual sport athletes are still dependent on a team that functions optimally if they are to succeed as a senior, and in xc skiing there is almost no one who has become an elite skier all alone. Being a positive contributor to a team is something that should be learned early on. This regards give and take, and a good reminder is that no one earns a better and constructive environment than that to which they are willing and eager to contribute.

Goal Processes

Development of goal setting is a central part of a coach's work with young athletes, and is especially important with the approach of the junior years and the decision to go for it in XC. There are two conditions that are important concerning goal processes; goal orientation and goal setting. Goal Orientation describes whether goals are directed towards tasks, processes, or results. Task goals are pointed at improving the tasks that are relevant for the athlete, for example weight shift in classic technique. Process goals are directed at improving the processes that are connected to training, for example further developing the ability to focus on the moment in a competition. Result oriented goals are directed at concrete competition results. They are a natural and necessary part of the sport but a high result goal focus and low task goal focus is not favorable for improving performance. One needs to be directed toward results, processes, and tasks. Result goals should provide fuel and clarity for the future, and task and process goals should lead toward the proper and necessary focus in the individual's training process.

In daily training the task and process goals are the most important.

Planning

Good planning is necessary for achieving expected progress, and is an important process in learning from one's own experience. With younger athletes period plans ought to be developed with consideration of the content of common or team workouts such that these can be coordinated with other activities and training/competition in other sports. With juniors (translators note: remember that in Norway *juniors* are 17-20 years of age. The choice to be a skier has largely been made) all training is directed toward becoming the best possible xc skier, but in every case the training plans should ensure an individual structure that develops the whole athlete.
It is an advantage if there is continuity on the coaching side, or that there is a close and positive dialogue when there is a change.

Implementation

The coach's main responsibility is to ensure that the implementation of training sessions is deliberate, goal directed, and effective. The coach must have thought carefully through what requirements each workout is meant to improve. For kids and younger skiers good training quality means that there is a lot of broad and appropriate activity throughout the whole session. In the case of juniors and seniors a lot of training occurs without the coach 'right there', and the job of the coach is to stimulate the athletes to implement their own training with the highest possible quality, self-awareness, and focus. This requires a thorough understanding of the tasks and demands that lie behind good performance in xc skiing. These must be clearly defined with regard to an athletes level of ambition, and place on the development staircase. It is often said that coaches who know the requirements and which have a common thread in the work to develop athletes, have a clear training philosophy. Such trainers will also find it easier to come across as clear and practical.

On a team every individual athlete's needs must be met while the team is used to strengthen the effect of individual training. This can be effective when the team members individual strengths are used in training design.

Using Feedback

The trainer ought to be openly supportive of good training solutions, but should also be willing to confront the athlete when poor or ineffective choices are made. In most cases the athlete will know the answer. It can be motivating for them to be told "Good choice. It seems smart." In other cases an athlete can be about to make the wrong choice, for example to train when one is sick. this is when the trainer needs to be willing to confront the athlete with the reality that the illness will likely get worse and last longer if training is carried out. Following are some simple rules for feedback:
1) Be well prepared, and take enough time in precise observation of the

athlete's technique or physical performance so that you the coach are certain of a thought before you give it as feedback.
2) Feedback should contribute to improving performance. Avoid creating too much reflection and thinking during an effort. This takes focus from the task and hinders performance.

3) Give feedback only on the things that are part of the athletes' main focus for the workout; things that are explained and agreed on with the athlete beforehand.

4) Be specific and concrete about what you observe. Avoid general feedback like "that looks good".

5) Be constructive and solution oriented. Avoid directing attention to things the A can do little or nothing about, for example the conditions, or the competition.

6) Give feedback as soon as possible after an observation.

7) Avoid too much info, and exaggerations that muddy the water and make unclear the message.

8) Remember that your own (you, the coach) body "talks". It doesn't help to say something positive when your whole manner shouts out disappointment.

9) Repeat, repeat, and repeat the most important of the important things. However avoid disturbing the athletes' focus by talking too much during a workout.

Evaluation
In evaluation it is important to be on the lookout for the potential to be better, and not to be searching for mistakes and shortfalls. The evaluation generally should concern itself with the following:

1. What are we doing that is going well? What were our strengths today?
2. What do we need to work on in order to perform better?

Learning happens first when an athlete has changed a behavior. Evaluation is an important factor in securing learning. There are two different types: immediately during a situation, or when the athlete and coach have had a little time and distance after a performance.
Both athlete and coach are scientists-they seek explanations for why something happened as it happened. Therefore they are motivated to find explanations from that they experience. The ability to understand why things happened is critical to future performance.

Coach/Athlete Consultations

The conversations between coaches and athletes should first and foremost contribute to clarifying a situation here and now, clarify future crossroads, and stimulate reflections on the basis of experiences along the way. Such conversations between athlete and coach create a common understanding and awareness and learning for both. Most meetings between coaches and athletes occur during daily training. The workout is not the time in which to go into the inner workings either of the training process nor of the personal condition. In the consultation however it is important to take the time to go in depth into the athlete's views. This means being committed to understanding what thoughts and feelings the athlete has attached to the issue that is the focus. It is important for the trainer to be able to see the issue from the athlete's point of view.The basis for this is the athlete's need to be able to make decisions and to use one's competence and experience in one's own learning process. This is hugely stimulating for the athlete's inner motivation, which in turn is crucial if one wishes to succeed. It is important that the athlete is encouraged to talk, especially early in the conversation. In concluding the visit the trainer should summarize the discussion in a few clear points, both sport-specific and from personal conditions that engage the athlete and thereby influence performance. The points should be followed up later, so the athlete is able to consistently re-visit and work on them.

Motivation is best when the individual is involved in influencing the training process. The goal is for the athlete to develop a strong sense of ownership in his / her own improvement. Only the athlete has the prerequisite to be able to 100% understand his own body and his own situation. It is therefore an important principle in xc training that an athlete is given the bases for, and trained toward being able to make his own choices and to act independently. In the end the athlete should have a clear picture of the facts, both of that which is going well, and that which needs work. An athlete who knows how technique, endurance, and mental readiness are on a daily basis and who knows what is needed for training and prioritization to reach daily goals is also in a place to make good decisions.

Team Meetings

A coach always needs to pose the question of when he or she should have a meeting with the whole team. "What are my goals for the meeting?" Generally communication with the whole team has three possible purposes:
1) To steer the team in a specific direction
2) To establish a common understanding of the issue in focus
3) To stimulate free and open reflection on the issue we are talking about

The coach behavior will be influenced by the goals of the meeting. If it is to move the whole team in a certain direction, it is crucial to make it as clear as

possible. Too much beating around the bush or ambiguous information leads to uncertainty on the part of the team. Vagueness from the trainer, leads to a sense of insecurity and a lack of self confidence, and clarity leads further to confidence and the sense of can-do. This is particularly important before a competition.

Developing a strong training environment

To create a good development arena, trainers, and team leaders need to early on develop a strong culture of *learning* among all the coaches, athletes, and the support organization of a team characterized by confidence, respect, openness, and loyalty.

In every training environment it is important that people have respect for each other, and that there is a mutual sense of confidence, loyalty, and openness. A condition for learning is a mutual willingness to share experiences. In a group that is characterized by openness, and mutual exchange of expertise, every individual member gains more knowledge. All the athletes have something to learn from the competition for no one is best at everything. Openness lays out a huge potential for development.

Successful XC cultures show themselves to have a strong focus on a "development oriented milieu", which means there is an understanding of what it takes to succeed, and a continuous developing and sharpening of these capacities. There is a high level of knowledge of what the demands of the sport are and how those should be raised to continuously higher levels of mastery. A knowledgeable atmosphere is constantly seeking development and thus educates the whole training group. This ought to occur in each training session in both formal and informal meetings of teammates, coaches, team leaders, and parents. It is important to create good arenas, or opportunities in order for this competence development to take place within the team.

It is important to secure continuity in the training process with a long sighted perspective and secure conditions where the athlete relates to only a few individual training personnel. In situations in which the athlete is involved in several training environments, the over-arching responsibility for the big picture training plan needs to be explained clearly. Training ought to have a consistent trace thread. IT is especially important that this is clarified with changes in teams and coaches which often occur during the junior years. Competent understanding of an athlete's training background, strengths and weaknesses are important to pass on. There ought to be a system of knowledge and ability exchange from club to division, to national teams. XC is a sport that is constantly changing. Successful programs are adaptable and innovative. Their milieu inspires athletes to bust through their own boundaries with the help of old and new training methods.

Positive interaction and communication among coaches, support organizations

and athletes are typical features of solid programs. If communication is to succeed it is important that divisions of the whole team are not too big and that they use enough time together, have clear "rules of the game", and time and space to give honest feedback to each other.