



## Long Term Athlete Development

### Introduction

Sport Canada's Long Term Athlete Development (LTAD) is a key part of the Canadian Sport for Life (CS4L) movement to improve the quality of sport and physical activity in Canada. Through improved athlete training and better integration between all stakeholders in the sport system, CS4L aims to provide optimal training, competition, and recovery regimens from childhood through all phases of adulthood.

We see sport and physical activity as something all Canadians can do to promote wellness and the health of our communities.

Sport Canada's LTAD Guide provides a general stage-by-stage process that considers current knowledge on growth and development and the trainability of fundamental motor abilities. From this process, **Pentathlon Canada** has generated a sport specific LTAD model. The model recognizes the need for verity in the early stages of sport and the need for further collaboration with participating sports bodies.

A LTAD model is intended to be a guide to athletic development for both our age-group and elite athlete development systems. This initiative will influence all stages of an athlete's development, such as entry into the sport, high performance development and lifelong sport fitness

### Guiding Principles of **Pentathlon Canada's** LTAD

1. That our programming directs athletes towards doing the right thing at the right time
2. That parents and coaches acknowledge that stage specific outcomes are necessary before an athlete moves further in the sports stages
3. That opportunities to join training programs are individualized based on the acquired skills

To assist coaches and parents, specific information has been provided for each developmental phase, whether it is in the development of future international competitors or regional participants.

## **LTAD Stages**

Science, research and decades of experience all point indicate that kids and adults will get active, stay active, and even reach the greatest heights of sport achievement if they do the right things at the right times. This is the logic behind the Long-Term Athlete Development model (LTAD). The seven stages describe what athletes need to be doing at specific ages.

- Stage 1: Active Start (0-6 years)
- Stage 2: FUNdamentals (girls 6-8, boys 6-9)
- Stage 3: Learn to Train (girls 8-11, boys 9-12)
- Stage 4: Train to Train (girls 11-15, boys 12-16)
- Stage 5: Train to Compete (girls 15-21, boys 16-23)
- Stage 6: Train to Win (girls 18+, boys 19+)
- Stage 7: Active for Life (any age participant)

## General Principles

- Components of athletic ability should be encouraged at all ages.
- The LTAD places training during times when the athlete is most receptive to the development stage
- Both boys and girls have similar athletic ability changes and growth between ages 4 and 11
- Most fundamental athletic and sports skills should be in place before puberty
- Athletes aged 11 to 15 show large variations in size, growth rate, development and sports performance
- Peak Height Velocity (PHV) is the period of growth and development when the individual's growth is undergoing the most rapid period of change. PHV should assist in determining the athlete's level of readiness for physical training and corresponding training loads
- After puberty, growth diminishes steadily
- The timing and duration of opportunities to perfect performance are dependent on PHV and are greater post puberty
- Adult athletic capabilities, which are not exhibited until puberty, should not be trained in child athletes

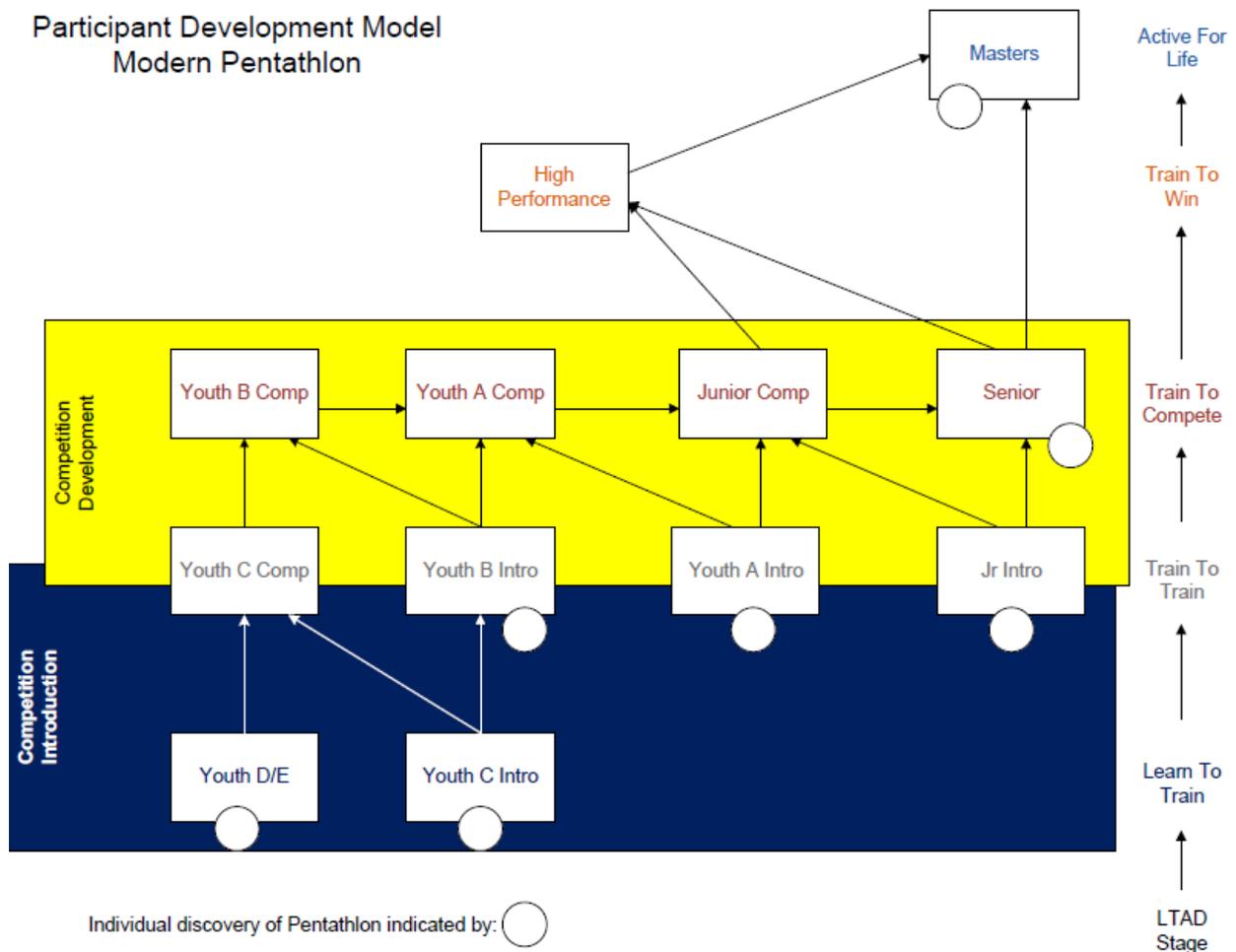
**Pentathlete Development**

Pentathletes typically come into Modern Pentathlon from other disciplines (i.e. triathlon, swimming, equestrian, etc.). As such, the majority of pentathletes start in the Learn to Train and Train to Train development stages.

Athletes in the Train to Compete and Train to Win stages are typically working with the National Sport Organization (Pentathlon Canada) and the national coach.

As such, the Pentathlon Provincial Organizations specific training clinics and programs focus on the Learn to Train and Train to Train stages. Competition is offered for Stages 3 to 7 (ages 8 to 99+).

Figure 1 depicts the typical development model for pentathletes.



**Figure 1: Participant Development Model**

### **Stage 1: Active Start (0-6 years)**

This early stage engages children in daily active play, which develops the movement skills that are the foundation for sports skills at older ages. Play should be unstructured and active incorporating the ABCs of movement – Agility, Balance, Coordination and Speed.

It is the fundamental movement skills and fundamental sport skills that form the basis of physical literacy.

An early active start enhances development of brain function, physical coordination, gross motor skills, and posture and balance. An active start also helps children to build confidence, social skills, emotional control, and imagination while reducing stress and improving sleep.

During the first three years of life, brain growth is extremely rapid. The learning done in early years creates more brain cell connections than in later years. Among its other benefits, physical activity during the Active Start stage:

- Helps children learn to enjoy being active, learn to move efficiently, and improves coordination and balance.
- Creates neural connections across multiple pathways in the brain.
- Enhances development of brain function, coordination, social skills, gross motor skills, emotional development, leadership and imagination.

#### **Activities at this stage should include:**

- Active play for at least 60 minutes a day, and up to several hours per day for toddlers and preschoolers. Toddlers and preschoolers should not be sedentary for more than 60 minutes at a time except while sleeping.
- Provide organized physical activity for at least 30 minutes a day for toddlers and at least 60 minutes a day for preschoolers.
- Learn to swim lessons for every child to promote safety around water, and as an effective motor skill activity.
- Ensure that children acquire movement skills that build towards more complex movements.

#### **Tips for parents**

Make play active and fun every day. Your child will build confidence and positive self-esteem as they build strong bones and muscles.

It is important to participate in the activity and provide a safe and stimulating environment.

Benefits include improves flexibility, good posture and balance, improves fitness, reduces stress, improves sleep and promotes healthy weight.

## **Stage 2: FUNdamentals (girls 6-8, boys 6-9)**

During the FUNdamentals stage, children should continue to develop fundamental movement skills, including the ABCs of Agility, Balance, Coordination and Speed.

It is at this stage that the foundations of physical literacy are laid. This concept is extremely important, as physical literacy is the foundation of lifelong participation and enjoyment of physical activity. For example, hand and foot speed can be developed during this stage, and if missed, body speed later in life may be significantly compromised.

Activities should be in a fun and challenging multi-sport environment. A variety of sports and physical activities should be introduced throughout the year, developing broad interests and limit premature specialization.

Activities can be well-structured to develop basic skills, but must remain fun rather than competitive.

During this stage, athletes will learn teamwork, positive attitudes towards activity and personal interaction skills. The focus should be on fair play and club-level events to introduce rules and reinforce the self confidence gained in the Active Start stage.

### **Activities at this stage should include:**

- 30-60 minute focused sport sessions building from 1 to 6 sessions per week of high repetition, low intensity activity. This should approach a total of 10 hours per week towards the end of the stage.
- 1-2 of hours should be general athletic skills with an emphasis on running, jumping and throwing
- Strength development using own body weight (e.g., rope climbing, sit-ups, push-ups, etc.)
- Swimming should include basic skills, such as strokes, turns and starts for up to 3 hours a week.
- Club level fencing sessions can be introduced at the Yellow level.
- Introduction to horseback lessons with a focus on safety and building confidence may be introduced at this level.

### **Tips for parents**

All physical activity performed for general aerobic and anaerobic lactic development whether at school, clubs or community centers should be in a safe fun environment. Part of this is learning to “read” the movements going on around them and make sound decisions during games.

Club level sports can be useful at this stage and can introduce instruction. Canada’s national sport bodies offering programs that specifically address these goals such as the 'I Can Swim' program, the 'Run, Jump, Throw' program, soccer, skating, gymnastics. Beginner level fencing programs and the Canadian Pony Club are two options for introduction to pentathlon specific disciplines.

### **Stage 3: Learn to Train (girls 8-11, boys 9-12)**

Pentathlon competition level: Youth D and E

The Learn to Train stage ends when the growth spurt begins because growth spurts disrupt coordination and motor control, making it more difficult to pick up and develop new sport skills.

This is the Golden Age of Learning for specific sport skills because athletes are converting their fundamental movement skills into fundamental sport skills.

The brain is approaching adult size and complexity, and refined skill performance is easier to develop. While the emphasis should still be on general sports skills suitable to a number of activities, coaches can begin training according to more formalized methods and teaching practicing skills.

The guide is 70% practice and no more than 30% competition.

Athletes entering puberty later are at an advantage because their Learn to Train stage lasts longer resulting in better sport performance in the long term. But these late bloomers can get left out of sports programs where coaches and parents put too much emphasis on competition outcomes. It is important for these late bloomers to have equal opportunity to train and develop within the sport.

#### **Activities at this stage should include:**

- Roughly 11 hours per week of physical activity is desirable near the end of this stage, split between 2-3 sports throughout the year.
- Children should not focus only on one sport for an entire year.
- Flexibility becomes increasingly important as the individuals approach their period of most rapid growth and development.
- The introduction of the warm up, cool down, mobility, nutrition and mental skills begin here
- Basic shooting skills and safety should be taught at this stage
- Club fencing in the Yellow and Orange levels in 1-2 sessions a week
- Swim should progressively refine swimming skills – strokes, turns, starts, underwater skills. This is done at a swimming club with 4-6 sessions per week for 60-90 minute sessions
- Riding lessons should include introduction to jumping (small jumps and courses)

#### **Tips for parents**

Many children at this age may have developed a preference for one sport and it is tempting to specialize. This should be avoided in most sports. Premature specialization promotes one-sided development and increases the likelihood of injury and burnout.

To maximize the long-term development of their athletic capacities, they need to engage in a broad range of activities, playing at least 2-3 different sports through the year.

Pentathletes should also engage in team oriented sports to promote teamwork, creativity and quick judgment. Soccer, water polo, and field hockey are good examples as they improve cardiovascular activity and develop leg strength.

**Stage 4: Train to Train (girls 11-15, boys 12-16)**

Pentathlon competition level: Youth C and B

The Train to Train stage is defined by the onset and end of the adolescent growth spurt, generally considered as ages 11 to 15 years for females and 12 to 16 years for males.

At this stage, athletes are ready to consolidate their basic sport-specific skills and tactics and it is a major fitness development stage. Because physical changes take place faster than at younger ages, athletes must be constantly monitored. Growth spurts affect athlete skills and movement abilities. It is the coaches' responsibility to explain why their motor skills and movement abilities are affected and that will pass with time.

PHV is an important marker for determining which physical capacities can be trained effectively and safely during this stage. For example, aerobic training should be a priority after reaching PHV.

Competing in formal settings should still be secondary to the time allocated to training skills and physical capacities and are critical to the long-term development of top performers and lifelong participants.

**Activities at this stage should include:**

- Emphasis on flexibility to accommodate the rapid growth of bones, tendons, ligaments, and muscles.
- Competition is used to develop strategic and tactical understanding to develop the learning process and not the competitive outcome.
- Focus on two sports using talent identification
- 6-12 sessions per week of 60-120 minute sessions
- Swimming should include 12-24 hours of pool time a week,
- Fencing at a recognized club at the Green and Blue levels
- Continuation of shooting skill development and transitioning to focus on combined event.
- Competitive running through school programs or local clubs

**Tips for parents**

- Watch that the training program does not include too much competition; this could result in a plateau during later stages of development. A 60:40 percent training to competition ratio is ideal. Athletes need to learn to cope with the physical and mental challenges of competition.
- Look for year round swim clubs to support swimming goals.
- At this stage, fencers should be building their equipment kit, including electronic epee
- Athletes should have the basic shooting skills and safety knowledge to compete and will start to move the focus from precision target shooting to combined event.

**Stage 5: Train to Compete (girls 15-21, boys 16-23)**

Pentathlon competition level: Youth B and A, Junior

In the Train to Compete stage athletes choose one sport (for Modern Pentathlon this will include all 5 disciplines) in which they will train to build sport-specific skills and physical capacities. Generally, athletes training at this level are aiming to compete in national and international events and are maximizing the physical, mental, cognitive, and emotional capacities.

Because of the high-volume and high-intensity of training throughout the year, competition schedule and annual periodized training, tapering and recovery plans are needed. This is beyond a community sport program and should only involve committed athletes who have been recruited for their talent and ability to pursue an elite pathway.

**Activities at this stage should include:**

- Prepare for the distractions of elite sport, such as travel, weather, different competition venues, media, spectators, and difficult opponents.
- perform their skills under a variety of competitive conditions during training
- modeling high-level competition in training
- Emphasize individual preparation that addresses each athlete's individual strengths and weaknesses.

**Tips for Parents**

- Athletes enter this stage if they have chosen to specialize in Modern Pentathlon and excel at the highest level of competition possible.
- Coaches should also include nutrition, sport psychology, recovery and regeneration, injury prevention, and injury management into the training program
- Tapering means reducing both intensity and volume in training as athletes approach the date of major competition events. Tapering allows athletes to peak for major competitions, ensuring that they will perform at their best.
- Athletes should be competing not only in Modern Pentathlon competitions but also in other discipline specific competitions such as fencing tournaments.
- Support athletes with balance between sport, athletic and social demands
- Match coaching methods to individual leaning style

**Stage 6: Train to Win (girls 18+, boys 19+)**

Pentathlon competition level: Junior and Senior

The Train to Win stage is the final stage of the LTAD high-performance stream, with a focus on medals and podium performances.

These are full-time athletes identified for their talent to pursue high-intensity training to win international events.

The previous LTAD stages have developed and optimized the skills, tactics, and ancillary capacities of each athlete. Athletes have now realized their full genetic potential. They must now train to maximize and maintain their competitive performance at the highest level.

**Activities at this stage should include:**

- Coaches should be developing a multiple periodization training plan to accommodate the extremely high training volumes and maximize
- Performance potential on competition day.
- Coaches must allow frequent preventative breaks to prevent physical and mental burnout.
- training to competition ratio should be adjusted to 25:75, with the competition percentage including competition-specific training activities.
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**Tips for Parents**

- At the Train to Win stage, world-class athletes with or without disabilities require world-class training methods, equipment, and facilities that meet the demands of the sport and the athlete.
- As athletes approach the end of their competition years a plan must be made to prepare the athletes for retirement, which does not involve fulltime training but does involve lifelong sport participation at the amateur and recreational levels.
- Modern Pentathletes at this stage are typically training under the guidance of the National Coach or Development Coach.

### **Stage 7: Active for Life (any age participant)**

Active for Life is the final LTAD stage and the final destination of all Canadians. In this stage, athletes and participants enjoy lifelong participation in a variety of competitive and recreational opportunities in sport and physical activity.

Generally considered 12 years+, this stage can be entered at any age, beginning with developing physical literacy in infancy, and evolves to being Competitive for Life and/or Fit for Life through all phases of adulthood.

Under ideal circumstances, athletes and participants enter the Active for Life stage of LTAD at one of two times:

1. After developing the physical literacy ending at the Learn to Train stage
2. After having exited at the high-performance training and competition stream (Train to Train, Train to Compete, and Train to Win stages)

While some athletes are still involved in very high-performance competition, they are not leading to the Olympics or World Championships. Recognizing this, the LTAD recognizes two streams of sport and physical activity within Active for Life:

1. Competitive for Life, where participants may still want to compete at a relatively high level in competitive sport leagues at the community or regional level.
2. Fit for Life, where participants are not competing at a high level or not competing at all, but want to develop and maintain their physical fitness.

## **Ten Key Factors which form Long-Term Athlete Development (LTAD)**

Sport Canada's has based LTAD on sport research, coaching best practices, and scientific principles summarized by 10 Key Factors that are essential to athlete development.

### **1. 10-Year Rule**

Research has shown that it takes 10,000 hours of quality training for athletes to achieve their full potential and perform at an elite level usually accumulated over at least 10 years of training and competing.

Not all of these “training hours” will involve training directly in their sport. Many of the hours will include generalized components such as flexibility training and fitness training (e.g. running, gym workouts). By the time an athlete has chosen to specialize in one sport – usually around age 14 – they should begin formal daily training for that sport.

In a comprehensive review of U.S. Olympians who competed between 1984 and 1998, the research revealed the following facts:

- U.S. Olympians began participating in their sport at the average age of 12.0 years for males and 11.5 years for females.
- Most U.S. Olympians reported a 12- to 13-year period of training and development from introduction to their sport to making the Olympic team.
- U.S. Olympians who won medals tended to be 1.3 to 3.6 years younger than their teammates when they were introduced to their sport, suggesting that medalists benefited by receiving motor skill development and training at an earlier age. (Note: This does not say that they specialized in their sports at a young age. Caution must be taken not to fall into the trap of premature specialization, since it can actually have negative effects on the athlete's long-term development.)

### **2. FUNdamentals**

To build the foundation for physical literacy, children need to be introduced to the FUNdamentals - movement skills and sport skills that are learned through FUN activities. This physical literacy is necessary to develop high performance athletes and stay active with recreational activity.

Research strongly suggests that the FUNdamentals should be learned before the adolescent growth spurt begins. After the start of the growth spurt, it becomes much more difficult for the body to develop fundamental skills and the ABCs of agility, balance, coordination and speed.

### **3. Specialization**

There are right times and wrong times to specialize in any one sport or physical activity. Modern Pentathlon disciplines are early start and late specialization.

Late-specialization sports such as running, fencing, shooting and equestrian riding have better success if athletes participate in a range of different sports and activities prior to their teen years.

Athletes have greater success in early-specialization sports such as swimming if they begin to specialize in those sports during their elementary school years.

In most sports, athletes should not specialize until they are between the ages of 12 to 15. Prior to that age, they should participate in a wide range of sports to ensure they become good, well-rounded athletes who have acquired physical literacy which is offered through Modern Pentathlon training.

#### **4. Developmental Age**

LTAD looks mainly at two types of “age”. The first is **chronological age**, which refers to the number of years and days elapsed since birth. This is the typical definition of age used by schools, sports and recreation programs.

The second is **developmental age**, which refers to the child’s stage of physical, mental, emotional and intellectual maturity. Two children of the same chronological age can be several years apart in developmental age.

LTAD requires the identification of early, average, and late maturers in order to help to design appropriate training and competition programs for each athlete. The beginning of the growth spurt and the peak of the growth spurt are especially important to program design.

**Peak Height Velocity (PHV)** refers to the point in time where a child is growing at the fastest rate – the peak of their growth spurt.

PHV in girls usually occurs at between the ages of 10 and 14 or even more years earlier or later than average. PHV in boys is more intense than in girls and on average occurs about 2 years later (around 14 years of age).

Boys experience a large gain in strength about a year after PHV as a result there is pronounced late gain in strength characteristics of the male athlete. As with girls, the developmental sequence for male athletes may occur 2 or more years earlier or later than average.

Early maturing athletes may have as much as a 4-year development advantage over their late-maturing peers. Eventually, those who mature late will catch up when they experience their growth spurt.

#### **5. Trainability**

The LTAD plan aims to make use of athletes most sensitive periods, when practice and training will have the greatest effect on important skills and physical abilities that will impact athletic performance through the lifespan.

These sensitive periods of accelerated adaptation to training affect five different areas of physical development called “the Five S’s”:

- **Stamina** (endurance)  
The optimal window for aerobic capacity training is recommended before athletes reach PHV; PHV offers optimal trainability; and post PHV is when aerobic power can be introduced.
- **Strength**  
The optimal window for strength trainability is immediately post PHV for girls and 12 to 18 months after PHV for boys.
- **Speed**  
For boys, speed training windows occur between the ages of 7 and 9 years and 13 and 16. For girls, this is between the ages of 6 and 8 years and 11 and 13 years.
- **Skill**  
The window for optimal skill training is ages 9 and 12 for boys and 8 and 11 for girls and require the groundwork of physical literacy.
- **Suppleness** (flexibility)  
While flexibility is always trainable, it is important during PHV when suppleness can decrease, the optimal window for suppleness is between the ages of 6 and 10.

## **6. Physical, Mental, Cognitive and Emotional Development**

While athletics puts a focus on physical results, training should also consider the athlete's mental, cognitive and emotional development. Coaches need to place emphasis on ethics, fair play, and character building throughout the stages.

## **7. Periodization**

Training plans are an essential component to deliver optimal sport performance and athlete development at all stages of LTAD. Scientific research in periodization helps coaches to create logical training plans for athletes at all ages and stages of LTAD.

Simply put, periodization is time management. It outlines all annual and seasonal training within a logical schedule to bring about optimal improvements in athlete performance at the right times, while minimizing injury and burnout.

By segmenting training into months, weeks, days and sessions, athletes can use the bigger picture of the volume, intensity, frequency and training focus, especially when organizing five individual sports. For example, out of peak competition season, athletes can focus on their weaker elements to bridge their performance.

## **8. Competition Planning**

Athletes need to train and compete according to training-to-competition ratios that develop skills and fitness while preventing injury and burnout. As well, the quality of competition and the timing of competitive events need to serve the needs of the athlete – not the needs of coaches, parents and administrators.

## **9. System Alignment and Integration**

Integration between school sport, sport clubs, provincial/territorial and national sport organizations is needed for optimal athlete development programs. LTAD recognizes the importance of coaches, teachers, and recreational professionals and the necessary support of administrators, sport scientists, health, and government across multiple sectors.

## **10. Continuous Improvement**

LTAD will never be complete, but rather that it represents the best practices in coaching and athlete development of the day. With that, coaches, athletes, sport scientists, administrators and policy makers will seek ways to improve and refine it.

By focusing on continuous improvement, we will also ensure that LTAD reflects all emerging facets of physical activity, sport, recreation and education to ensure that it is inclusive of all types of activity.

A cornerstone of this improvement is ongoing education of all government levels, media, and all positions touching sports and recreation.

**Beyond The five S's of trainability identifying physical capacities, there are five general S's that complete the holistic development of the athlete.**

### **1. Psychology**

The “mental toughness” needed to train and perform is especially important to success at the high performance level as well as contributing to the overall athlete’s life skills.

To develop mental toughness, training programs should include key mental components identified by sport psychologists: concentration, confidence, motivation, and handling pressure.

As an athlete progresses through LTAD stages, mental training will evolve from:

- Having fun and respecting opponents to
- Visualization and self-awareness to
- Goal setting, relaxation, and positive self-talk.

### **2. Structure / Stature**

LTAD relies on the growth stages of the athlete, broken down into six phases associated with the sensitive periods of accelerated adaptation to training. Height should be monitored to identify the sensitive periods for training the five basic Ss (stamina, strength, speed, skill and suppleness) and adjust training programs accordingly.

Phases of Growth

Phase 1: Very rapid early growth, followed by rapid, then slow deceleration of growth until age 6.

Phase 2: Steady growth from age 6 until the onset of the growth spurt (GS).

Phase 3: Rapid growth until PHV.

Phase 4: Rapid deceleration of growth.

Phase 5: Slow deceleration of growth.

Phase 6: Cessation of growth.

### **3. Sustenance**

Sustenance addresses several areas: nutrition, hydration, rest, sleep, and regeneration all critical to the requirements of an active lifestyle. The sensitivity of sustenance increases with high-performance athletes or the athlete can experience burnout.

At the high performance level of sport, proper nutrition and correct timing of meals becomes critical. High training volumes and intensities must be sustained through correct nourishment, as appropriate nutrients must be available to the body for training and recovery.

### **4. Schooling**

LTAD recognizes the need for education in balance with sport. Managing the commitments of school sports, interaction with other sports specific training programs, study workload and relationships.

Communication and cooperation between the different coaches is essential.

### **5. Socio-Cultural**

The opportunities to travel for competition, learn about broader history, geography and cuisine and build socio-cultural awareness and enrich the lives of athletes. With planning and foresight, these activities are a positive contribution to the development of the person and the athlete.