



<sup>®</sup>**Athletics Canada**  
**Long Term Athlete Development**

SIS2003ST-DENIS

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# Long Term Athlete Development

## Introduction

The Long Term Athlete Development (LTAD) model is a framework for an optimal training, competition and recovery schedule for each stage of athletic development. Coaches who engage in the model and its practices are more likely to produce athletes who reach their full athletic potential.

The LTAD model has been developed based on the research of the Canadian Sport Centres LTAD expert group. The principles of this research have been adopted by Athletics Canada as the framework for the proper management of youth and adolescent growth and development processes, and identified the critical periods of accelerated adaptation to training.

The Federal, Provincial and Territorial Ministers of Sport identified LTAD as the framework for sport development in Canada. Ministers agreed to proceed with the implementation of this new approach to sport and physical activity in consultation with National, Provincial and Territorial Sport Organizations. Through the improvement of physical literacy (fundamental skills such as running, jumping, and throwing), the LTAD model will help develop a lifelong involvement of Canadians in physical activity and sport participation as well as producing future athletes.

At the early stages of development, it is imperative that sport development programs are designed around critical periods of accelerated adaptation to training. These periods of development represent the time when children are ready and able to develop fundamental sport skills and abilities such as running, jumping and throwing. In addition they are able to improve their speed, agility and balance, which are related sport skills that will serve them well in track and field as well as in other sports.

Children who do not develop their fundamental motor skills by age 12 are unlikely to reach their genetic athletic potential. A lack of fundamental motor skills may mean the difference between a day on the couch versus a day at the soccer pitch or the difference between a gold medal performance and a 16th place finish at the Olympics.

Establishing a core set of motor skills early in life enables children to gain a sense of achievement and establish a positive relationship with sport and physical activity. Successful and positive experiences with sport at a young age, coupled with the acquisition of transferable sports skills, will enable children to become proficient in a number of different sports.

Proficiency in many types of physical activity may increase the chances of lifelong participation in physical activity, which could increase longevity and overall quality of life. The LTAD framework ultimately strives to produce elite and consistent performers; however, it also seeks to provide opportunities for all children to grow into confident, healthy and active adults.



Developing fundamental skills at a young age and refining competitive skills at higher levels of development are important for able bodied athletes as well as athletes with a disability. This document is designed to be generic in nature and therefore does not delineate between able-bodied athletes and athletes with a disability as the athlete development continuums do not differ significantly. The differences that do exist will be covered in future publications (Phase 2 and Phase 3). Phase 2 and Phase 3 will be available in two versions, one that discusses the needs of able-bodied athletes and one that discusses the needs of athletes with a disability.

The multi stage approach employed by the LTAD model draws attention to the length of time required to develop an elite athlete. Research has shown that it takes between 8 and 12 years of training for a talented athlete to reach elite levels. This has been summarized by the “10 year or 10,000 hour rule” and equates to approximately 3 hours of practice each day for 10 years.

The US Olympic Committee (2001) surveyed US Olympic athletes from 1988 to 1996 and concluded that it took between 10 and 13 years of practice or training just to make the Olympic team and between 13 and 15 years for those athletes who won a medal.

While the intensity required at the outset of the athlete development continuum is not the same as the

intensity required at the end, the common thread among all stages of development is the coach. More specifically it is the coach’s attention to the rate at which athletes grow and develop and their ability to make adjustments to the overall training program that contributes to success.

## Athletics Canada Long Term Athlete Development Pathway

- Active Start
- FUNDamentals (Fundamentals 1)
- Learning To Train (Fundamentals 2)
- Training to Train (“Building the Engine”)
- Learning to Compete (“Challenge of Competition”)
- Training to Compete (“Heat of the Battle”)
- Learning to Win (“Consistent Performance”)
- Winning for a Living (“Performing when it Counts”)
- Retainment/Active for Life (“Dealing with Adversity”)



# Why we need a Long Term Athlete Development Model

The current system for Canadian athlete development emphasizes winning and competing, instead of maximizing the windows of accelerated adaptation to training and developing fundamental sport skills. The current emphasis on outcome (winning) as opposed to process (skill development) is seen as a shortcoming in the Canadian sport system. Such practices may lead to one-sided preparation, early burn out, lost potential or over-training as noted through the practices identified by the Canadian Sport Centres LTAD Expert Group.

- **Developmental athletes over-compete and under-train**
- **Adult training and competition programs are superimposed on developing athletes**
- **Training methods and competition programs designed for male athletes are superimposed on female athletes**
- **Preparation is geared to the short-term outcome of winning, and not to the process**
- **Chronological rather than developmental age (maturity) is used in training/competition planning**
- **Coaches largely neglect the critical periods of accelerated adaptation to training**
- **Fundamental movement skills and sport skills are not taught properly**
- **The most knowledgeable coaches work at the elite level; volunteer coaches work at the developmental level where quality, trained coaches are essential**
- **Parents are not educated about LTAD**
- **Developmental training needs of athletes with a disability are not well understood**
- **In most sports, the competition system hinders athlete development**
- **There is no talent identification system**
- **There is no integration between physical education programs in the schools, recreational community programs, track clubs and elite competitive programs**
- **Sports specialize too early in an attempt to attract and retain participants**

The development and implementation of the LTAD model will enable Athletics Canada to positively effect the development of athletes in track and field. Introducing young athletes to fundamental motor skills at an early stage provides them with the opportunity to perfect their skills before demanding competitive schedules are introduced and winning becomes an important training outcome.

Numerous sport organizations in Canada and many other countries around the world are now showing significant interest in a LTAD model. Investment in the implementation of LTAD will secure long term success for Athletics by using this strategy to influence delivery.

Coaches are urged to become familiar with the maturation principles for young athletes and apply these principles to training, competition and recovery protocol. In practice, all coaches working with young people have to concern themselves with the health and well being of the athlete and their development.



# The Long Term Athlete Development Framework

The LTAD Framework is a sport development framework. It is a system of training, competition and recovery based on developmental age or maturity level rather than the chronological age of an individual.

The implementation of sport programs that follow a LTAD model will enable coaches to develop individualized programs based upon each individual and take advantage of the critical periods of accelerated adaptation to training. It will also ensure that athletes develop to their full potential. The LTAD framework is athlete-centred, coach-driven and supported by administration, sport science and sponsors.

The general Canadian LTAD model suggests that athletes will move through 7 stages of development on their way to optimal elite performance. The Athletics Canada LTAD model is a 9-stage process that takes into account two additional stages related to the late specialization nature of Athletics. The additional stages are a ‘Learning to Compete’ stage, and a ‘Winning for a Living’ stage which acknowledge that some elite athletes will have the opportunity to compete professionally.

It is important to note that the Active for Life Stage can be entered at any time. The Active for Life Stage provides sports with a guide to ensure that opportunities for continued participation are provided for those who do not wish/are unable to progress through all the Stages.

The entry level to Athletics can span many years and Athletics is considered to be a “late entry” sport. Children may show an aptitude for sport at very young ages but to compete at the elite level requires long term development targeted towards peak performance at physical maturity.

It is also desirable to screen children against pre-established criteria as they enter sport. This practice should allow young athletes to progress through the developmental stages and stabilize skills. Such actions should enhance future performance. As athletes develop coaches will identify the event group and specific event best suited to the talent of each athlete. Retention of each individual is essential, as it will increase the opportunity for athletes to attain excellence over time.

## The 9 Stages include:

1. Active Start
2. FUNDamental
3. Learning to Train
4. Training to Train
5. Learning to Compete
6. Training to Compete
7. Learning to Win
8. Winning for a Living
9. Active for Life



# Trainability - Applying the Long Term Athlete Development Model

The terms “adaptation” and “trainability” are often used interchangeably in coaching. However, the difference between them is significant.

**Adaptation** refers to changes in the body as a result of a stimulus that induces functional and/or morphological changes in the organism. The degree of adaptation is dependent on the genetic endowment of an individual. However, the general trends or patterns of adaptation have been identified by physiological research and various adaptation processes such as adaptation to muscular endurance or maximum strength have been defined.

**Trainability** refers to the faster adaptation to stimuli and the genetic endowment of athletes as they respond individually to specific stimuli and adapt to it accordingly. Trainability has been defined as the responsiveness of developing individuals to the training stimulus at different stages of growth and maturation.

**A critical period of development** refers to the point in the development of a specific capacity when training has an optimal effect. Other factors are readiness and critical periods of trainability during growth and development of young athletes, where the stimulus must be timed to achieve optimum adaptation with regard to motor skills, muscular, and/or aerobic power.



## STAMINA (ENDURANCE)

The optimal window of trainability occurs at the onset of Peak Height Velocity (PHV). Aerobic capacity training is recommended before athletes reach PHV. Aerobic power should be introduced progressively after growth rate decreases.

## STRENGTH

The optimal window of trainability for girls is immediately after PHV or at the onset of menarche, while for boys it is 12 to 18 months after PHV.

## SPEED

For boys the first speed training window occurs between the ages of 7 and 9 years and the second occurs between the ages of 13 and 16. For girls, the first speed training window occurs between the ages of 6 and 8 years and the second window occurs between the ages of 11 and 13 years.

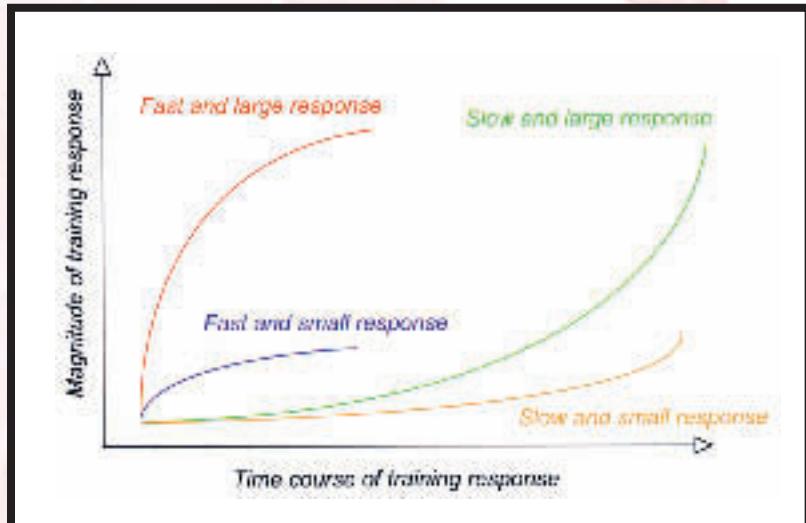
## SKILL

The window for optimal skill training for boys takes place between the ages of 9 and 12 and between the ages of 8 and 11 for girls.

## SUPPLENESS (FLEXIBILITY)

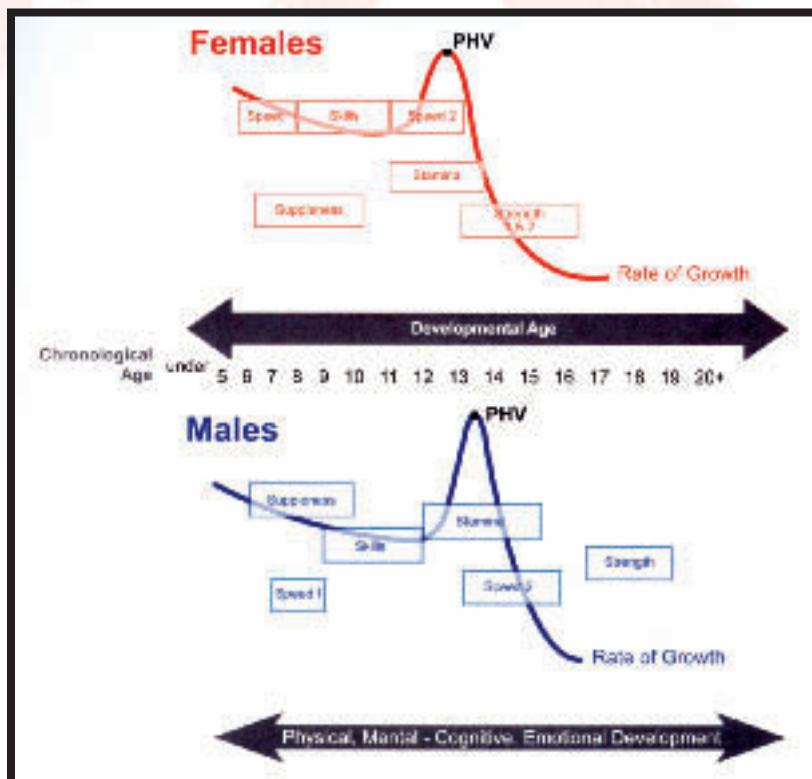
The optimal window of trainability for suppleness for both genders occurs between the ages of 6 and 10. Special attention should be paid to flexibility during PHV.

# ALL SYSTEMS ARE ALWAYS TRAINABLE



## Variation in Training

(adapted from work by Bouchard et.al., 1997). The five Basic S's of Training and Performance are Stamina (endurance), Strength, Speed, Skills and Suppleness (Flexibility). (Dick, 1985)



## Male/Female PHV

This chart indicates the Windows of Optimal Trainability for Females and Males. Two windows----stamina and strength---are based on the moving scales of the onset of the growth spurt and PHV. The other 3 windows ----speed, skill, and suppleness---are based on chronological age.

The trainability of the different systems for children and youth with a disability is not well understood. Applying this information to specific athletes with a disability is a good example of coaching being an art as well as a science.

# The 9 Stages of Long Term Athlete Development

## STAGE 1: ACTIVE START STAGE

### Chronological age:

- Males 0-6, and
- Females 0-6

### Objectives:

- To make play and physical activity fun and exciting and an essential component of daily routine throughout life

In the earliest years parents are the primary support system for their children. Later daycares, kindergarten and community programs have a significant impact on children.

It is extremely important that adults surrounding children are educated regarding nutrition and the importance of daily physical activity to allow for optimal development.

Children should be continually active without being sedentary for more than 60 minutes at a time except when sleeping. Growth and development should be enhanced through playful exploration of risks and limits within safe environments.

There is no introduction to coaching in this stage.

Ideally children begin to be exposed and focus on proper basic fundamental skills such as running, jumping, wheeling (for children in wheelchairs), twisting, kicking, throwing and catching. Some organized physical activity is desirable to help provide an active movement environment combined with an introduction to well-structured gymnastics and swimming programs.





## **STAGE 2: FUNDAMENTAL STAGE (FUNDAMENTALS 1)**

### **Chronological age:**

- **Males 6-9 and**
- **Females 6-8**

### **Objectives:**

- **To begin teaching agility, balance, coordination and speed (ABC's)**
- **To continue to instill the importance of daily play and physical activity**



The fundamental motor skills of running, jumping, throwing (RJT) wheeling (for children in wheelchairs), twisting, kicking, throwing and catching need to be taught through active movement combined with well-structured gymnastics and swimming programs to develop agility, balance, coordination and speed for athleticism.

An emphasis on flexibility to develop and/or maintain an optimal range of motion in combination with the introduction of whole body strength development begins in this Stage. Efficient technique and individual postural components of the movements performed through activities is vital for future success.

Ideally these sessions are supervised to minimize injuries and the evolution of bad habits. Equipment such as "Swiss" balls and medicine balls can be incorporated with whole body weight exercises.

This first window of trainability for speed development (girls: 6-8; boys: 7-9) should focus on agility, quickness and segmental speed in a multi-directional manner with movements lasting less than 5 seconds.

An introduction to simple rules involving safety and etiquette can begin during this time.

During this stage, over the course of 4-10 weeks depending on the program, children are encouraged to participate in several sports, multi-skilled activities and play team games to enhance decision-making. This should approach a total of 10 hours per week towards the end of this stage. 1-2 of these hours should be general athletic skills with an emphasis on running, jumping and throwing. This helps develop a solid base of general physical skills required to support all round athletic ability.

All physical activity performed for general aerobic and anaerobic alactic development whether at school, clubs or community centers should be in a safe fun environment. Activities should be all-inclusive with no formal competition or periodization at this Stage.

## STAGE 3: LEARNING TO TRAIN STAGE (FUNDAMENTALS 2)

### Chronological age:

- Males 9-12, and
- Females 8-11

### Objectives:

- To continue to enhance ABC's to develop overall sports skills
- To begin to integrate physical, mental, cognitive and emotional components within a well-structured program
- To develop physical literacy

This is a major Stage for trainability of motor learning in both males and females. The focus should be to continue building a general base of FUNDamental motor skills and to introduce all athletics event group areas, which will further enhance motor skills of RJT.

Due to growth, gender differences become more apparent during this stage. Awareness of individual physical changes is essential to help provide the guidelines for sequencing of training activities. Formal musculoskeletal screening should begin to help monitor individual patterns of development.

This is an ideal time to introduce testing and monitoring methods.

Strength development should continue as noted in Stage 2 with the addition of light bounding. Flexibility becomes increasingly important towards the end of this Stage as the individuals approach their period of most rapid growth and development.

Sessions continue to require supervision to minimize injury and prevent bad habits. Good postural balance, coordination and alignment have a positive influence on biomechanical efficiency and therefore performance.

Speed development should continue to focus on agility, quickness and segmental speed in a multi-directional manner with movements lasting less than 5 seconds. General aerobic development should continue to be through fun and games, complementing speed development.



The introduction of the ancillary capacities (warm up, cool down, mobility, nutrition and mental skills) for successful performance needs to begin during this Stage.

A total of 11 hours per week of physical activity is desirable near the end of this Stage, as are 2-3 sessions per week of general athletics event group skills. Continued participation in other sports is still encouraged as is the participation in multi-skilled activities and games but the number of activities should begin to decrease towards the end of the Stage.

General talent identification begins during this stage but the numbers of competitions are left open with no formal periodization.



## **STAGE 4: TRAINING TO TRAIN STAGE ("BUILDING THE ENGINE")**

### **Chronological age:**

- **Males 12-16, and**
- **Females 11-15**

### **Objectives:**

- **To develop endurance, strength and speed**
- **To develop athletics-specific skills and fitness**



This is the most challenging and critical Stage as it encompasses both opportunity and vulnerability in terms of growth and development. This is the period where individuals tend to change physically at faster rates than when they are younger.

When Peak Height Velocity (PHV) occurs the bones grow first, sometimes rapidly which puts increased stress on connective tissues. Flexibility, posture and technique become very important. At this time of accelerated

growth, these elements can be compromised through a reduced range of motion, which can create abnormal movement patterns. Supervision and monitoring becomes critical as these changes occur.

Physiological, psychological and medical monitoring of growth and development will target the deceleration of growth in late maturers. Regular musculoskeletal screening is essential and anthropometric measurements are introduced where appropriate.

Training needs should be identified during this Stage through regular monitoring of PHV.

Speed development (girls: 11-13; and boys: 13-16) will have an increased emphasis on anaerobic alactic power and capacity training during this Stage.

Aerobic training should begin to focus on capacity at the onset of PHV and formal aerobic power training begins at PHV (deceleration of growth).

Formal weight training is introduced to develop general strength for girls at the onset of menarche and boys 12-18 months after PHV.

Ongoing development of the ancillary capacities should progress with the intention of further integrating the physical, mental, cognitive and emotional aspects, which support performance.

Planned training and competition modeling is introduced towards the end of this stage. Programming becomes more structured with defined taper and peak periods, which requires ongoing evaluation and modification. Introduction of event area specific training begins at this time.

During this Stage, over the course of 4 weeks to 10 months depending on the program, other sports are reduced to 1 or 2. Training should approach a total time of 12 hours per week towards the end of the stage, involving 4-7 sessions of physical training and activity. 3-5 of these sessions should be in athletics event specific areas.

## **STAGE 5: LEARNING TO COMPETE ("CHALLENGE OF COMPETITION")**

### **Chronological age:**

- **Males 16-18 plus, and**
- **Females 15-17 plus**

### **Objectives:**

- **To develop event specific area physical preparation**
- **To introduce event specific protocols to identify strengths and weaknesses**
- **To implement event area specialization**
- **To integrate physical, mental, cognitive and emotional development**

This is a stage of more specialization and competition.

Single or double periodization is typically used. Coaches should however evaluate and modify as needed.

Streaming of athletes into one event group area (throws, jumps, sprints, endurance) or specific event, should be done as advanced motor skills become evident. Speed, strength, aerobic capacity and power are optimized as required; however, in the case of specific speed endurance, further development should be based on event specific requirements.

The number of athletics sessions per week will increase to 5-9 as participation in other sports declines to 2 or less sessions per week.

The practice to competition ratio is 90/10 and the length of the Athletics season can be anywhere from 8 weeks to 10 months. The number of competitive opportunities in the season becomes event-specific and dependant upon the type of periodization. If single periodization is used the number of competitions should be 10-15. If double periodization is used the number would be 12-18.

The athlete is introduced to the concept of the Performance Enhancement Team towards the end of this stage.





## **STAGE 6: TRAINING TO COMPETE ("HEAT OF THE BATTLE")**

### **Chronological age:**

- **Males 18-21 +/-, and**
- **Females 17-21 +/-**

### **Objectives:**

- **To optimize event specific preparation for competition**
- **To refine event area specialization**
- **To continue with integration of physical, mental, cognitive and emotional development**
- **To conduct event-specific testing and monitoring**



Within this Stage all types of periodization are used (single, double, and multiple) and event-specific motor skills are refined. All physical capabilities continue to be developed along with the advancement of mental preparation to deal with the stress of high-level competitions.

Competition modelling and mental preparation are optimized (at the national and international competitive level), as are all ancillary capacities.

The number of athletics training sessions per week rise to 6-15 as participation in other sport activities ceases. The practice to competition ratio is still 90/10 however the length of the athletics season is year-round with a traditional 1-month transition, or rest period. The number of competitions is similar to those in Stage 5.

It is critical, at this stage, that the Performance Enhancement Team is now integrated and implemented in preparation for performance at the national or international level.

Lifestyle education is strictly athlete-directed, and the athlete might loosely begin to think of him/herself as a “full-time athlete” in preparation for Stage 7.

## **STAGE 7: LEARNING TO WIN (“CONSISTENT PERFORMANCE”)**

### **Chronological age:**

- **Males 20-23 +/-; and**
- **Females 20-23 +/-**

### **Objectives:**

- **To maximize event specific preparation for high performance results**
- **To introduce a formal Performance Enhancement Team**
- **To continue with integration of physical, mental, cognitive and emotional development**
- **To learn to compete when it counts**

This is the Stage where the athlete becomes a “full-time athlete” and all energy and resources are directed at supporting the athlete to excel at the highest levels. The enhancement of all tactical, technical, physical and mental capabilities is maximized as required.

All testing and monitoring systems are in place and maximized to the fullest with the intention of preparing the athlete physiologically, psychologically and medically for the highest possible results at the international level.

The full integration of the Performance Enhancement Team is absolutely critical.

The athlete is learning to become a full-time athlete.





## **STAGE 8: WINNING FOR A LIVING ("PERFORMING WHEN IT COUNTS")**

### **Chronological age:**

- Males 23+/-; and
- Females 23 +/-

### **Objectives:**

- To maximize event specific preparation for results at the Olympic and World level
- To maximize of training, competition and recovery activities in support of a professional athletics career
- To attain competitive repeatability, when it counts
- To work with a professional support team
- To plan for retirement from athletics competition



It is at this Stage that all systems, including physical preparation, testing or monitoring and others which are supportive in nature, are fully maximized and refined to ensure excellence at the highest levels (i.e., the Olympic Games and World Championships).

The athlete may begin to plan for retirement or begin to prepare for entrance into the “real world” near the end of this Stage.

## **STAGE 9: ACTIVE FOR LIFE ("DEALING WITH ADVERSITY")**

### **Chronological age:**

- Males any age
- Females any age

### **Objectives:**

- To make preparations for their integration into society

This Stage relates to when athletes have fully withdrawn from main stream competitive sport. It is a critical stage to consider as high-level performers adjust to life without the high-level competitions that have provided a focus and structure for so much of their lives. Without this structure and the attention associated with success, it is easy to see how some athletes experience difficulties adjusting to this Stage of their lives.

There are many opportunities to stay in sport and their expertise and knowledge, as a former athlete, can be used in many fields such as coaching, mentoring, administration or officiating. It is a time to consider whether to compete at the Masters level or an opportunity to take up new sport and hobbies that they may not had the opportunity or time to try when competing.

This is a stage that is not addressed in great detail by coaches or others although it is a critical stage for the athlete if they are to consider lifelong participation in sport.



# Summary

Coaches who incorporate Long Term Athlete Development (LTAD) principles and practices into their programming are more likely to produce athletes who reach their full athletic potential as well as experience success against competitors from around the globe.

When LTAD practices are employed fundamental elements of sport development programs are designed around critical periods of accelerated adaptation to training. These periods of development represent the time when children are ready and able to develop fundamental sport skills and abilities

such as running, jumping and throwing. In addition they are able to improve their speed, agility and balance, which are related sport skills that will serve them well in track and field as well as in other sports.

With a dedication to the model and practices, Canadian Athletics will move to the forefront of world of Athletics. Canada has talented coaches, officials and administrators who can assure our status on the world front in Athletics. The Long Term Athlete Development Model is a fundamental tool for this success.



# Glossary of Terms

**Adaptation:** refers to a stimulus or a series of stimuli, which induces functional and/or morphological changes in the organism. Naturally, the level or degree of adaptation is dependent on the genetical endowment of an individual. However, the general trends or patterns of adaptation are identified by physiological research and the facts and guidelines of the different adaptation processes, such as adaptation to muscular endurance or maximum strength, are clearly delineated.

**Adolescence** structurally begins with acceleration in the rate of growth in stature, which marks the onset of the adolescent growth spurt. The rate of statural growth reaches a peak, begins a slower or decelerative phase, and finally terminates with the attainment of adult stature.

**Aerobic Capacity:** the total amount of energy that one can produce aerobically in the presence of oxygen.

**Aerobic Power:** the rate at which energy can be produced aerobically.

**Anaerobic Alactic Capacity:** the total amount of energy that one can produce without the presence of oxygen.

**Anaerobic Alactic Power:** the rate at which energy can be produced by the ATP-CP system: it is maximal effort.

**Ancillary capacity:** refers to the knowledge base and experience base of an athlete and includes warm up and cool down procedures, stretching, nutrition, hydration, rest, recovery, restoration, mental preparation and taper and peak. This is the ‘how, when and what to do’ to enhance training and performance. When athletes reach their genetic potential and physiologically cannot improve anymore, performance can be improved by using the ancillary capacities to full advantage.

**Anthropometric Measurements:** regular, periodical measurement of standing height, sitting height, arm span and weight to monitor growth. This helps predict the onset of PHV

**Bounding:** the simplest form of jumps training, consisting of low amplitude work using mostly ankles with very little knee or hip involvement.

**Chronological age:** refers to the number of years and days elapsed since birth. Growth, development and maturation operate in a time framework: that is, the child’s chronological age. Children of the same chronological age can differ by several years in their level of biological maturation.

**Competition Modeling:** creating competition models to assist the athlete to maximize his/her abilities and to perform at the highest possible level, also developing favorable competition tactics for success.

**Connective Tissue:** tissue that connects organs or joints in the body i.e. ligaments, cartilage, fascia.

**Critical periods of development:** a critical period refers to a point in the development of a specific behavior when experience or training has an optimal effect on development. The same experience, introduced at an earlier or later time, has no effect on, or retards later skill acquisition

**Development:** acquisition of behavioral competence, learning of appropriate behaviors expected by society, i.e., culture specific

**Developmental Age:** the age determined by the physiological factors of maturation in conjunction with the training age (years of participating in sport).

**Flexibility:** the ability to conduct movements at certain joints with appropriate range of motion.

**Formal Weight Training:** introduction of external loads, mostly in the form of dumbbells or barbells, in the training protocol with the objectives of strength and power development.

**Growth and maturation** are often used together, sometimes synonymously. However, each refers to specific biological activities.

**Growth:** increase in the size of the body as a whole and of its parts

**Maturation:** progress towards the biologically mature state. Maturation differs from growth in that although biological systems mature at different rates, all individuals reach the same endpoint and become fully mature

**Menarche:** onset of first menstruation cycle.

**Musculoskeletal Screening:** The assessment of an individual's postural alignment, movement patterns and neuromuscular balance. This helps direct efficiency of movement along with the development of proactive injury prevention approaches

**Onset of PHV:** the beginning of the growth spurt.

### **Performance Enhancement Team (PET):**

(PET): the group of professionals (physician, physiologist, nutritionist, physiotherapist, biomechanist, massage therapist and psychologist) assisting the athlete in collaboration, lead by the coach, to achieve elite levels of performances.

**Periodization:** the structuring of short and long term training, competition and recovery periods to provide optimum performances at the required time or time series.

- Single Periodization: one preparatory and one competitive period within the year
- Double Periodization: two preparatory and two competitive periods within the year
- Triple Periodization: three preparatory and three competitive periods within the year
- Multiple Periodization: competing all year round while maintaining physical and technical skills

**Periods:** preparation, competition and transition times

**Phase:** generally "General" preparation phase, "Specific" preparation phase, "Pre Competition" phase, "Competition" phase and "Transition" phase comprising of 4-6 mesocycles whereby a Mesocycle is usually comprised of 2-4 microcycles and whereby a Microcycle is usually a week.

**PHV:** the maximum rate of growth (the growth spurt) in height, which tends to last between 2.5 and 3 years in most adolescents. PHV is usually experienced between the ages of 12 to 15 for males and 11 to 14 for females. Early or late maturers might differ from the ages above.

**Physical literacy:** the ability to perform fundamental and specialized movement skills and the knowledge, understanding and ability to analyze sport and physical activity

**Posture:** the static or dynamic positional states of the body maintained via the individual's neuromuscular skeletal system.

**Power:** the ability to generate the highest possible force in the shortest possible time.

**Puberty:** refers to the point at which an individual is sexually mature and able to reproduce.

**Range of Motion:** maximal movement amplitude at certain joints.

**Readiness:** refers to the child's level of growth, maturity, and development, which enables him/her to perform tasks and meet demands through training and competition. They also referred to "readiness and critical periods" of trainability during growth and development of young athletes, as the stimuli has to be timed to achieve optimum adaptation with regard to motor skills, aerobic capacity, aerobic power, muscular endurance and strength.

**Screening:** evaluation of physical, technical, tactical and mental potential of an athlete

**Skill:** is the ability to carry out a task with maximum certainty and minimum expenditure of energy and time.

**Skill Development:** is the action supported by a pattern of abilities that is learned and developed through practice and has the potential to endure.

**Speed:** is the ability to react to a stimulus or signal in the shortest possible time (speed of reaction), and/or to perform a movement at the highest tempo (speed of movement).

**Speed Development:** is the action supported by a pattern of abilities to develop speed through practice and has the potential to endure.

**Speed Endurance:** the ability to maintain high levels of speed in relation to maximal speed or to maintain a high degree of muscle contraction speeds during repeated movements.

**Strength:** the ability to generate force through a single maximum voluntary contraction.

**Strength Development:** action supported by pattern of abilities to develop strength through practice and has the potential to remain enduring.

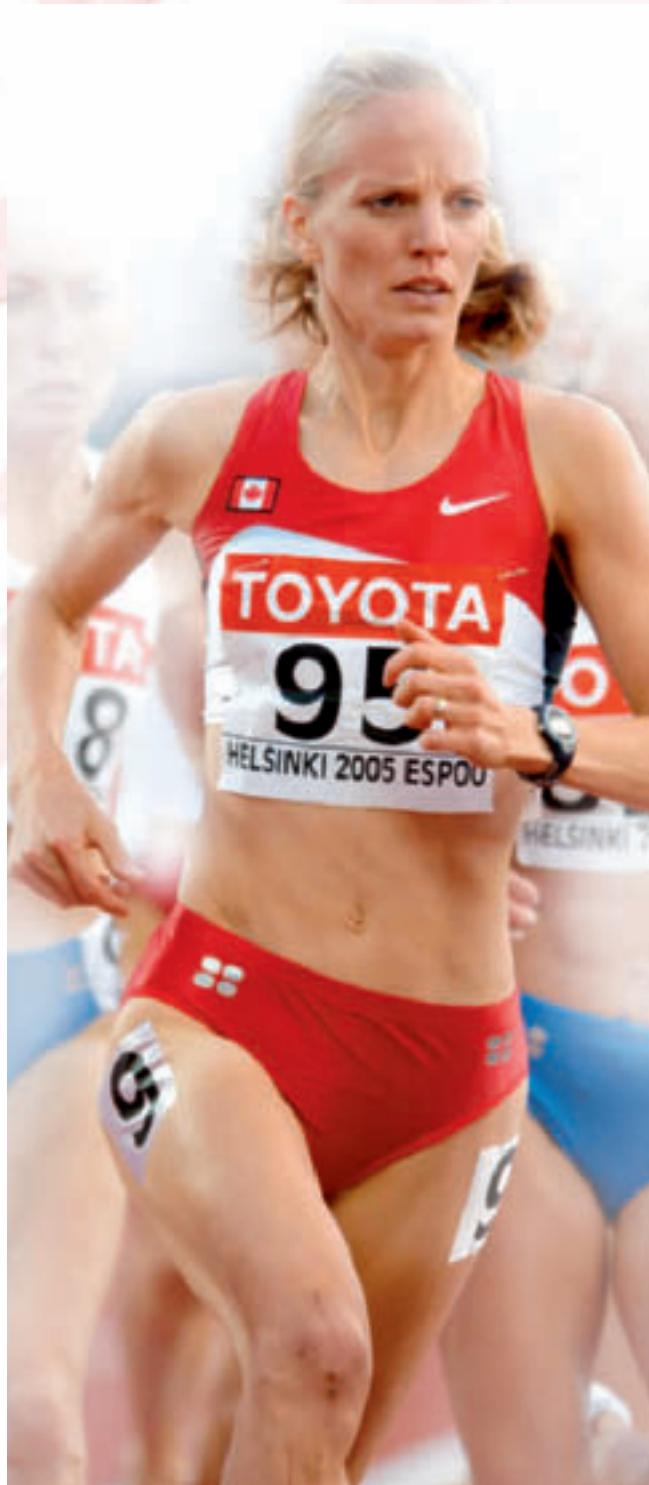
**Technique:** the integration of movement patterns while performing various skills. The better the technique the more efficient the performance.

**Testing and monitoring:** regularly scheduled field and laboratory testing, medical and psychological evaluations

**Trainability:** refers to the genetic endowment of athletes, as they respond individually to specific stimuli and adapt to it accordingly. Malina and Bouchard defined trainability as “the responsiveness of developing individuals at different stages of growth and maturation to the training stimulus.”

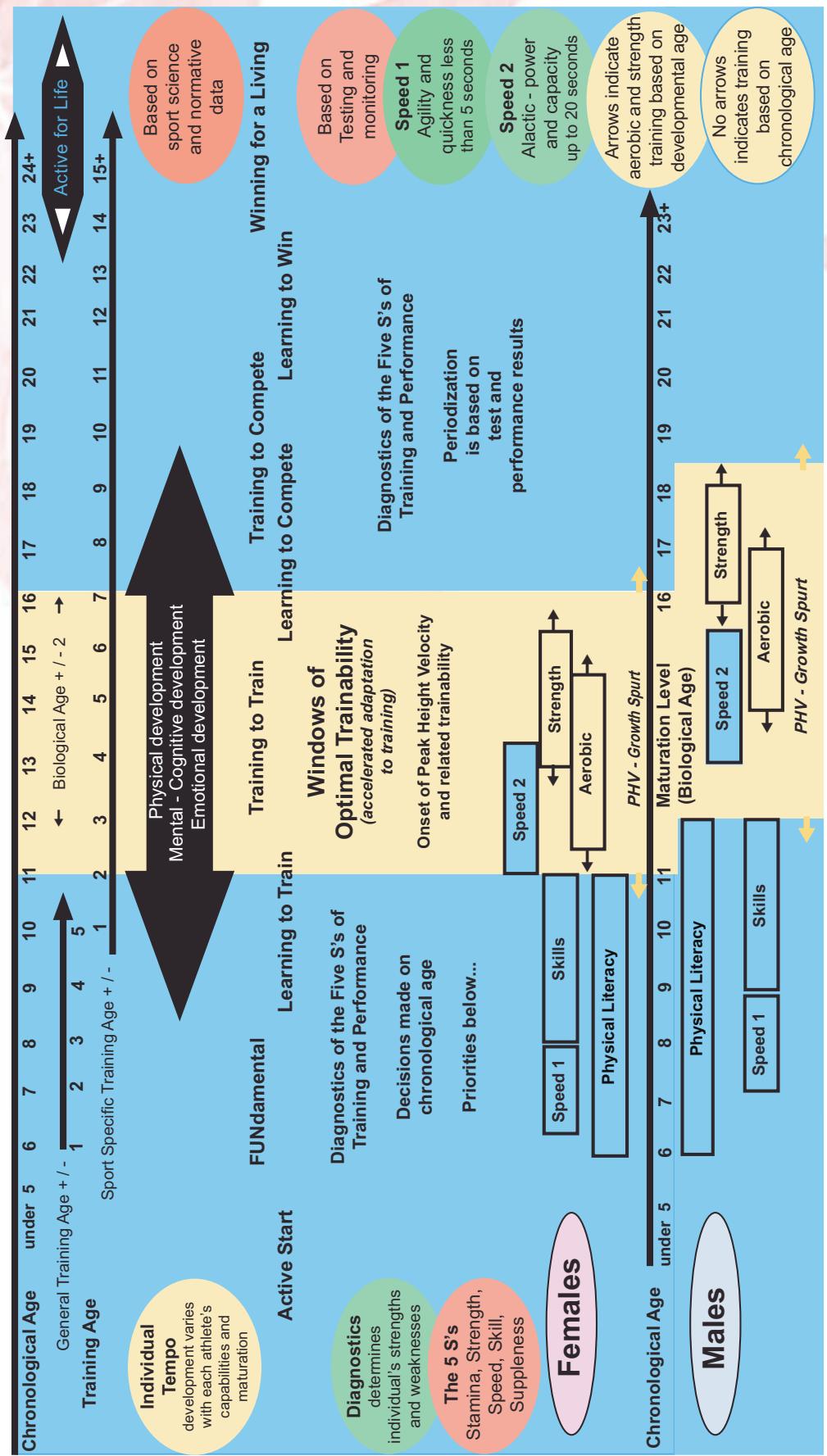
### **5 S's of Training and Performance:**

- Stamina (Endurance)
- Strength
- Speed
- Skill
- Suppleness (Flexibility)



## Athletics Canada - Optimal Trainability

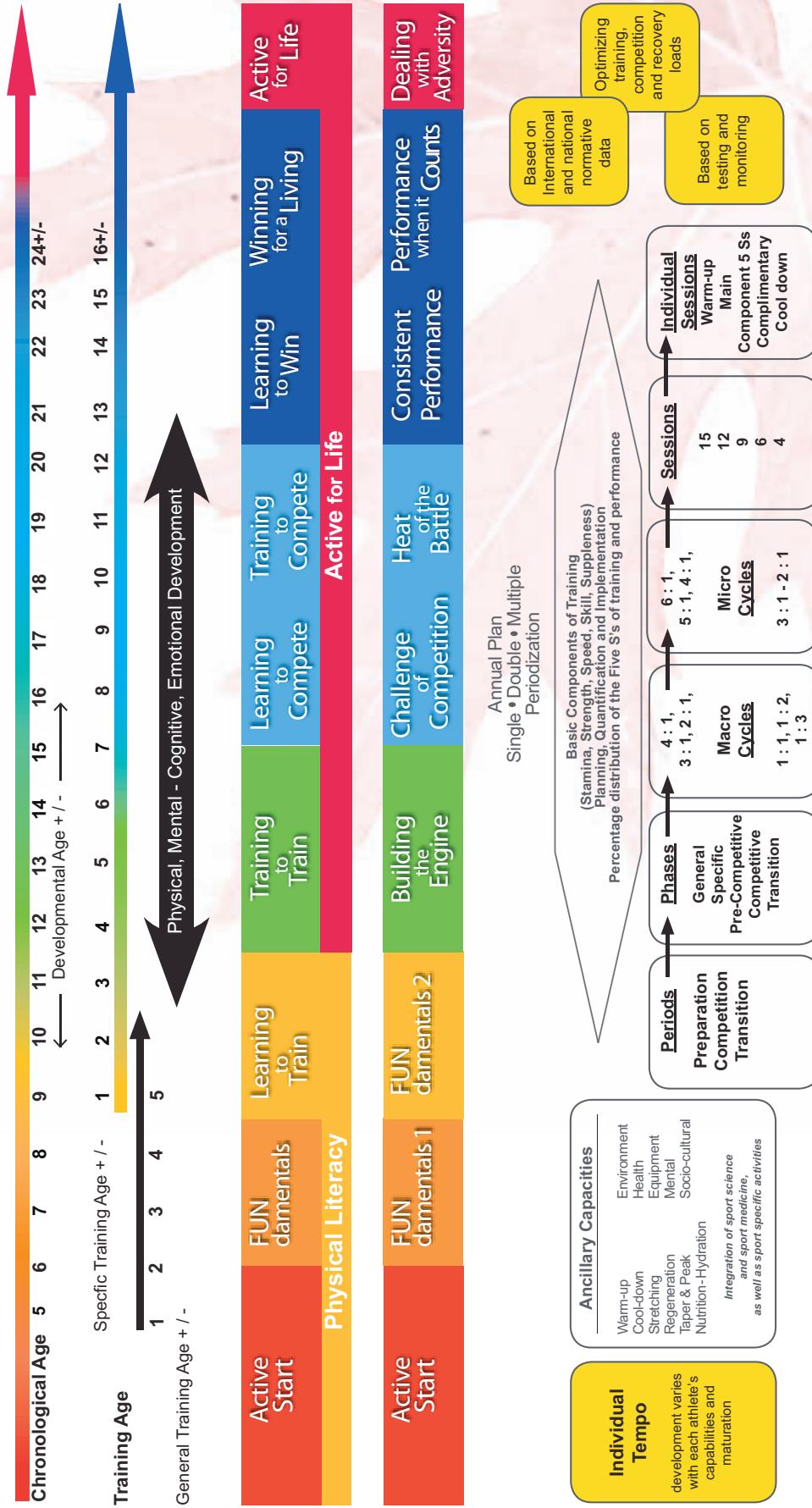
(Balyi, Gramantik, Gmitroski, Kaye and Way, 2006 ©)



(ABC's = Agility Balance Coordination Speed + RJT = Run Jump Throw + KGB's = Kinesthesia Gliding Bouyance Striking w/object + CPK's = Catching Passing, Kicking Striking w/body)

## Athletics Canada - Long-Term Athlete Development - Periodization

(Balyi, Gramantik, Gmitroski, Kaye and Way, 2006 ©)



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