



LONG TERM ATHLETE DEVELOPMENT STRATEGY



SWIMMING TO WIN;
WINNING FOR LIFE!

NAGER POUR GAGNER;
GAGNER POUR LA VIE!





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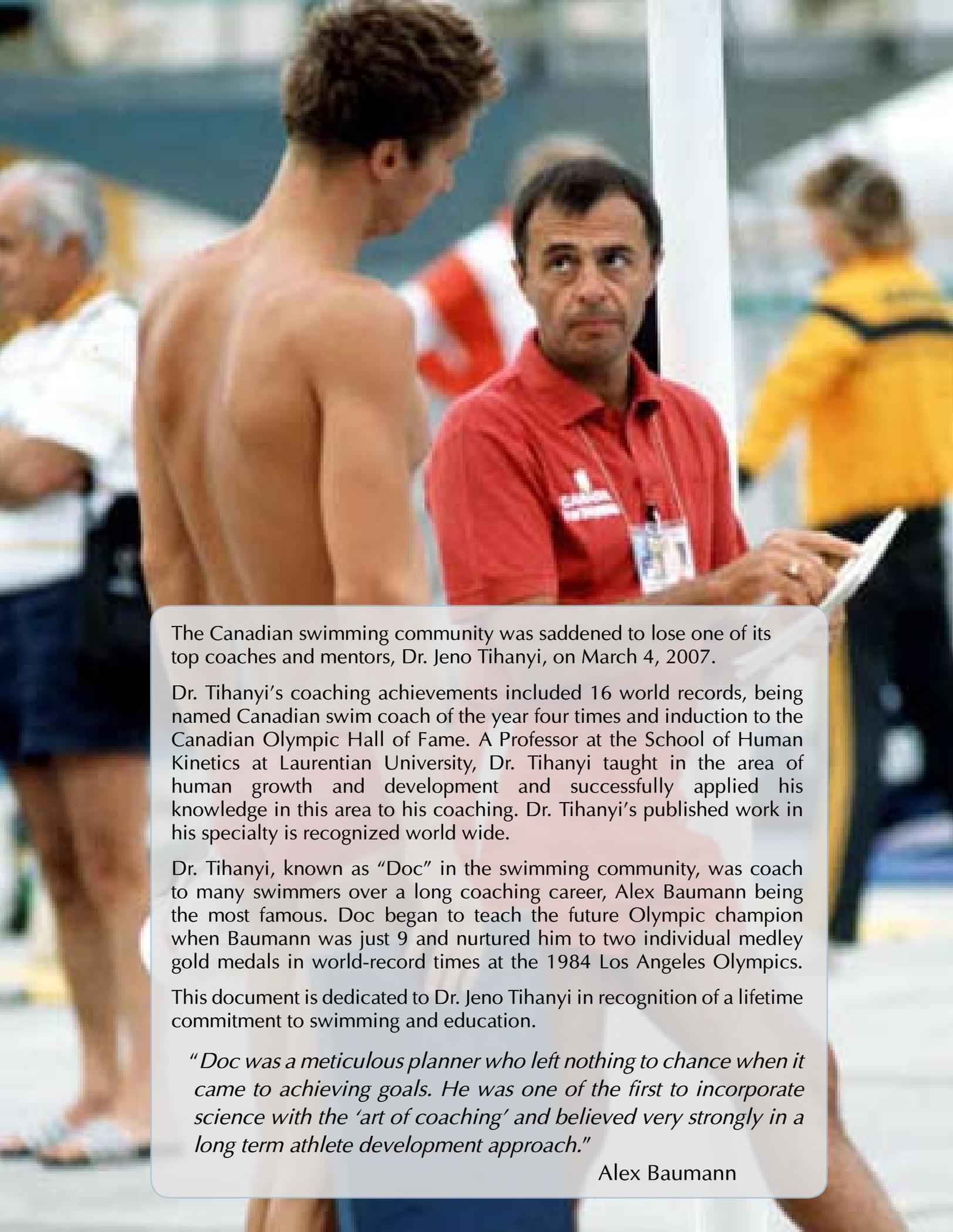
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The Canadian swimming community was saddened to lose one of its top coaches and mentors, Dr. Jenő Tihanyi, on March 4, 2007.

Dr. Tihanyi's coaching achievements included 16 world records, being named Canadian swim coach of the year four times and induction to the Canadian Olympic Hall of Fame. A Professor at the School of Human Kinetics at Laurentian University, Dr. Tihanyi taught in the area of human growth and development and successfully applied his knowledge in this area to his coaching. Dr. Tihanyi's published work in his specialty is recognized world wide.

Dr. Tihanyi, known as "Doc" in the swimming community, was coach to many swimmers over a long coaching career, Alex Baumann being the most famous. Doc began to teach the future Olympic champion when Baumann was just 9 and nurtured him to two individual medley gold medals in world-record times at the 1984 Los Angeles Olympics.

This document is dedicated to Dr. Jenő Tihanyi in recognition of a lifetime commitment to swimming and education.

"Doc was a meticulous planner who left nothing to chance when it came to achieving goals. He was one of the first to incorporate science with the 'art of coaching' and believed very strongly in a long term athlete development approach."

Alex Baumann

LTAD Strategy: Key Objectives

The Long Term Athlete Development Swimming strategy (LTADS) objectives include the following observable outcomes:

- 1 Clubs and coaches will be provided with a developmentally appropriate structure for the development of skills across physical, technical, tactical, mental and lifestyle categories.
- 2 A National competitive structure will be implemented that provides appropriately scheduled competition and progressive challenges through an athlete's career.
- 3 The LTADS will provide enhanced high performance success at the international and domestic level. Better skilled and more athletic athletes will be produced, and more athletes will continue in the sport to ages where they are able to reach maximum potential.
- 4 LTADS reinforces the coach, parent and administrator's primary role - to create a sport experience that provides each young participant with the opportunity to achieve success to their highest capabilities, and to continue a life of active living.
- 5 A national sport system for swimming will be created that truly supports the vision of Swimming Canada: *Swimming to Win - Winning for Life*.

In support of these objectives, the following additional documents will be created

LTADS - Competition Review

....a full review of the Canadian swimming competitive structure, with recommendations in support of the long term athlete development strategy

LTADS - Stage Skills Checklists

....a stage by stage description of activities and skills that a child/athlete should be exposed to, and methods of benchmarking their achievement.

LTADS - Implications for Clubs and Parents

....issues for Clubs and Parents to consider, based on the implementation of long term athlete development strategies at a Club level

LTADS - NCCP Integration

....all NCCP coaching certification materials will be fully reviewed and aligned with long term athlete development terminology and messaging

PREFACE & ACKNOWLEDGEMENTS

Swimming Canada is pleased to introduce the Long Term Athlete Development Strategy for Swimming. This document has been created as a guide for the coaches, administrators and parents of the swimming community across Canada.

This document would not have been possible without the support of the Long Term Athlete Development Expert Group and the support of Swimming Canada staff, especially Ken Radford, who first published his thoughts on these matters in 2000. As with many things in the sporting community, new concepts that involve change can be slow to be adopted, but are never possible without the leadership of those looking to lead the change.

I would also like to thank Alain Lefebvre from Fédération de natation du Québec, who has taken the concepts presented within Ken Radford's initial document and implemented them across Québec. We are seeing very strong results from Québec and Alain's feedback on this document has been very helpful.

Finally, we offer a great deal of gratitude to Dr. Jenő Tihanyi for the leadership and unwavering commitment he had to this topic, and indeed this project. Doc's work with Swim Ontario and his expectation of quality in this project has challenged the editor at many stages, but I trust and hope the final product would have been given the 'thumbs up' from one of our countries very best.

Andrew Moss

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Alignment to Swimming Canada's Strategic Plan

The Strategic Plan directs the activity of the swimming community towards the achievement of long and short term objectives through five Strategic Imperatives:

ELITE *To implement a sustainable reliable program focused on performance*

A successfully implemented long term athlete development strategy will deliver athletes to the National team with greater potential for improvement at an age where optimal performance is possible. An effective development strategy will also deliver athletes with advanced abilities across all physical, technical, tactical, psychological and lifestyle skill sets. These athletes will provide greater depth to the National Team across all disciplines, and will provide Canada with an improved opportunity for elite success against an ever improving competitive field.

SPORT SYSTEM *To implement a nationally aligned and integrated sport system that fully optimizes individual potential*

A long term athlete development strategy that is aligned at Club, Provincial/Territorial and National levels, delivers the "integrated sport system" directed by the strategic plan. While this document and the supplementary materials to follow are important, it will be the successful determination of roles, responsibilities and funding of the implementation of the athlete development strategy that will determine its success.

PEOPLE DEVELOPMENT *To implement a harmonized, accountable system that is committed to the development and recognition of individuals who support the development of our athletes (coaches, administrators at all levels, officials and parents)*

The long term athlete development strategy provides a framework that will direct the development of programs to support all participants involved in the athlete development process.

PARTNERSHIPS *To generate collaborations that maximize opportunities for Canadian swimming*

The successful implementation of a long term athlete development strategy will require partnerships and professional alliances with groups that in the past may have been considered as "competitors" for our athletes. These groups will include learn to swim providers and associated swimming organizations such as summer, high school, synchro, waterpolo, diving, triathlon and masters. Swimming must also realize that the delivery of some vital motor skill requirements to young developing swimmers can be best accomplished through the expertise provided by programs delivered by sports such as gymnastics and athletics. Finally, as athletes fully realize the effects of maturation, our sport must look at complimentary sport experiences for athletes looking for alternate opportunities to pursue their sporting and social objectives.

BUSINESS MANAGEMENT *To implement an accountable and innovative approach to build a sustainable and nationally aligned business structure to ensure performance oriented swimming.*

A successfully implemented long term athlete development strategy provides greater member retention as well as powerful sponsor opportunities. The strategy also directs investment to appropriate programs delivered by the stakeholders identified as responsible for each stage of development.

Long Term Athlete Development

II Key Factors

LTAD focuses on the general framework of athlete development with special reference to growth, maturation and development, trainability, and sport system alignment and integration. It incorporates information from a number of sources. It draws on the experiences of various athlete development projects that have been implemented by a variety of National Sport Organizations in Canada and around the world since the mid-1990s. The LTAD program also draws from the Report of the Minister of State's (Sport) Work Group on Sport for Persons with a Disability (2004).

The LTAD approach was also influenced by an analysis of the empirically tested athlete development models from the former East Bloc countries, with all the positive and negative aspects of those models. In addition, sport science has provided insight and information regarding the role of growth, development, and maturation in athletic development. These sciences include pediatric exercise science, exercise physiology, sport psychology, psychomotor learning, sport sociology, and nutrition. An analysis of the literature on organizational development has also contributed significantly.

This document is supported by the coaching and exercise science literature. We have chosen to write this document in the language and context of coaches and sport leaders. Although some generalizations may seem to be too vague from a scientific point of view, the directions drawn from the literature have been made to support the notion that coaches operate in an ever changing environment, and their artfulness in implementing the LTAD Strategy is critical.

We recognize that many of the subjects covered in this initial document for swimming are significant and complex subjects. We have made a decision to launch the Swimming Canada Long Term Athlete Development Strategy in staged chapters, ensuring each topic can be fully developed, while maintaining a readable and easy to reference format.

While much of the content is applicable, we have also drawn on the expertise of the Sport Canada LTAD expert group for LTAD implementation considerations for athletes with a disability by providing "No Accidental Champions", the LTAD resource book for athletes with a disability. As well, a specific resource for coaches, "Coaching Athletes with a Disability", produced by the Coaches Association of Canada, has been included.

1

The 10 Year Rule

Scientific research has concluded that it takes a minimum of 10 years and 10,000 hours of training for a talented athlete to reach elite levels. This factor is supported by The Path to Excellence, which provides a comprehensive view of the development of U.S. Olympians who competed between 1984 and 1998. The results reveal that U.S. Olympians begin their sport participation at the average age of 12.0 for males and 11.5 for females.

The FUNdamentals

The development of a comprehensive repertoire of movement and sport skills – otherwise known as physical literacy - should be considered a requirement for the early stages of sport involvement for a young child. The skills to be developed are the ABC's (Agility, Balance, Coordination, Speed), RJT (running, jumping, throwing), KGB (kinesthetics, gliding, buoyancy, striking with a body part) and CKs (catching, kicking, striking with an implement). In order to develop basic movement literacy, participation in as many sports as possible is encouraged.

Partnerships with other sport providers, or FUNdamentals based programming within a Swim Club, are encouraged to activate this group of entry level participants.

2

Developmental Age

The terms growth and maturation are often used together and sometimes synonymously. However, each refers to specific biological activities. Growth refers to observable step-by-step changes in quantity and measurable changes in body size such as height, weight, and fat percentage. Maturation refers to qualitative system changes, both structural and functional, in the body's progress toward maturity such as the change of cartilage to bone in the skeleton.

Development refers to “the interrelationship between growth and maturation in relation to the passage of time. The concept of development also includes the social, emotional, intellectual, and motor realms of the child.”

Chronological age refers to the number of years and days elapsed since birth. Children of the same chronological age can differ by several years in their level of biological maturation. Developmental age refers to the degree of physical, mental, cognitive, and emotional maturity. The relative developmental age can be determined by skeletal maturity or bone age after which mental, cognitive, and emotional maturity is incorporated.

LTAD requires the identification of early, average, and late maturers in order to help to design appropriate training and competition programs in relation to optimal trainability and readiness. The beginning of the growth spurt and the peak of the growth spurt are very significant in LTAD applications to training and competition design. Specific disabilities may dramatically change the timing and sequence of childhood and adolescent development.

Currently, most swimming training and competition programs are based on chronological age. However, athletes of the same chronological age between 10 and 16 can be 4 to 5 years apart developmentally. Thus, chronological age is a poor guide to segregate adolescents for competition.

Training Age refers to the age where athletes begin planned, regular involvement in training. The tempo of a child's growth has significant implications for athletic training because children who mature at an early age have a major advantage during the Training to Train stage compared to average or late maturers. However, after all athletes have gone through their growth spurt, it is often later maturers who have greater potential, provided they experience the same quality coaching throughout the early phases. Coaches and parents must maintain a focus on process and mastery of skill for the late maturer, providing the background for success later in their career.

3

4

Specialization

Swimming skills should be introduced at very early ages, and refined through the key motor learning Fundamentals stage. The important balance at these early stages is one of skill development versus performance development. Our sport has seen many examples of athletes undertaking adult oriented training programs at these early stages, being “age group” stars, but never heard from again later in their careers. In fact, likely the most determining factor to elite success is the extent to which the technical, physical and psychological attributes of a physically literate child are affected by adolescence. Except in rare cases where athletes reach elite performance prior to adolescence, most elite performers in swimming are into their 20’s before reaching their maximum performances.

The impact of this? Talent and elite potential are extremely difficult to assess until children fully realize adolescence. Prior to this stage, the key focus should be on the development and mastery of skills, and the acquisition and expression of a love for the sport.

Peak Height Velocity

The long term athlete development strategies referenced in these and other documents refer to age at peak height velocity as a key reference point for readiness. Age at peak height velocity refers to the age when the rate of increase of height reaches its maximum. In order to use this measure effectively, regular anthropometric monitoring is required.

Recommended frequency of measurement is every three months. In order to effectively monitor the rate of change, it is very important that the frequency of measurement is consistent, and started at an early enough age to identify important PHV changes at pre-puberty ages.

5

Trainability

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 are identified by physiological research, and guidelines are clearly delineated of the various adaptation processes, such as adaptation to muscular endurance or maximum strength.

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 aerobic power.

6

Mental, Cognitive and Emotional Development

Training and competitive and recovery programs should consider the mental, cognitive, and emotional development of each athlete. Beyond the physical, technical, and tactical development — including decision-making skills — the mental, cognitive, and emotional development should be enhanced. A future publication supporting the Swimming Canada long term athlete development strategy will cover this important consideration in much more detail.

7

8

Periodization

Simply put, periodization is time management. As a planning technique, it provides the framework for arranging the complex array of training processes into a logical and scientifically-based schedule to bring about optimal improvements in performance. Training components are broken into weeks, days, and sessions. The sequences are specific depending upon priorities and the time available to bring about the required training and competition improvement. In the context of long term athlete development, periodization connects the stage the athlete is currently in to the requirements of that stage.

Calendar Planning for Competition

Optimal competition calendar planning at all stages is critical to athlete development. At certain stages, developing the physical capacities take precedence over competition. At later stages, the ability to compete well becomes the focus. Considerations for the competition plan:

- Optimal competition frequency and length of competitive season should be reviewed for all stages of LTAD
- The appropriate level of competition is critical to the technical, tactical, and mental development at all stages.
- Coaches and athletes should select individual competition schedules based on the athlete's developmental needs

The current system of competition is based on tradition and an 'adult' competition model and leads athlete, parent and coaching behaviours. Following a full review of the competitive structure across all Provincial and National levels, and with the input of involved stakeholders, a national competitive structure document will be published.

9

System Alignment and Integration

As outlined previously in the alignment of the long term athlete development strategy to Swimming Canada's strategic plan, LTAD is the core business of national, provincial/territorial, and local sport organizations. LTAD is a tool for change towards full system alignment and integration. A seamless, sport-specific LTAD should include ongoing measurement of national and international normative data, both sport specific and sport science.

10

Considerations for athletes with disabilities are being developed, taking into account the specific needs of individuals with a congenital or acquired disability. Aligned with the LTAD strategy is a sport-specific system of competition that provides for the appropriate competitive needs of developmental athletes during FUNdamental, Learning to Train, and Training to Train stages.

LTAD has a strong impact on the coaching education curriculum. Developmental readiness will replace ad hoc decision-making about programming preparation. The NCCP program is under thorough review and LTAD will be fully integrated.

Continuous Improvement

The concept of continuous improvement, which permeates LTAD, is drawn from the respected Japanese industrial philosophy known as Kaizen. Continuous improvement ensures that LTAD responds and reacts to new scientific and sport-specific innovations and observations and is subject to continuous research in all its aspects. LTAD, as a continuously evolving vehicle for change, reflects all emerging facets of physical education, sport, and recreation to ensure systematic and logical delivery of programs to all ages.

Swimming Canada will undertake ongoing monitoring and evaluation of LTAD changes with all stakeholders.

11

SPORT SYSTEM REVIEW

In reviewing the Canadian swimming system with a long term athlete development view, many of the traditional ways in which the sport is conducted can be improved. Examples of these opportunities include:

Observation: The system of competition often inhibits optimal training and performance. Calendar planning and competitive structures are most often based on tradition and the role of competition as a fundraiser, not on technical knowledge related to training and athlete development.

LTADS proposes a balance of training and appropriate competition for each athlete. The upcoming LTADS Competition Review guide will address this in detail.

Observation: Swimming administrators and coaches, who tend to turnover frequently, primarily focus on short-term planning issues related to training and competition. Long term planning, talent identification, recruitment, retention and retirement strategies are largely ignored.

LTADS provides a long term plan for administrators and coaches, allowing for a consistent philosophy of delivery when personnel changes happen.

Observation: Canada is considered to be a world leader in coaching education, women in sport development, ethics, anti-harassment issues, doping control and athlete assistance. However, our sport falls far behind many competitors in the area of short- and long-term periodization.

LTAD planning and periodization strategies will be fully integrated into National Coaching Certification Program. Our objective is to have swimming at the leading edge of periodization knowledge and application by 2012.

Observation: The most experienced and knowledgeable coaches work at the elite level. Volunteers or entry level coaches work with swimmers at Stages one through three. Very few coaches have the opportunity to shape or guide a swimmer through a career. Stages one through three are the most critical to long term athlete development. Coaching at these levels requires knowledgeable and experienced coaches who can correctly implement a developmentally appropriate training program, who can teach the full array of competitive skills and who can instill a lifetime love for the sport.

LTADS integration into NCCP will see "expert" coaches trained and recognized at each stage of athlete development. The Club system will be educated as to the value of these "expert" positions.

Observation: Performance recognition at pre-puberty ages, when based on chronological age, tends to reward early developers based on their physical advantage. Parents and coaches must encourage and nurture average or late developers long enough to benefit from their eventual maturity.

The LTADS Competition policy requires awards for aggregate scoring across multiple events, personal best improvement and individual performance.

Observation: Parent and swimmer education regarding important long term athlete development principles and associated parameters (peak height velocity, maturation, nutrition etc) is often ignored.

LTADS and the supporting documentation will strive to close this information gap. Efforts to expand our knowledge and understanding of these topics will be ongoing.

SPORT SYSTEM REVIEW

Observation: The basic components of athleticism (FUNdamentals) are not being implemented in a systemic manner at early ages in schools or sport clubs.

Opportunities exist for swim clubs to address this shortcoming through partnerships with gymnastic and athletics programs.

Observation: There is limited application of gender specific training program design. The generic approach often seen is inappropriate in light of the physiological and developmental differences between the genders.

LTADS provides specific training emphasis and timing information to support the differing developmental pathways of females and males.

Observation: Adult training and competitive programs are superimposed on young athletes. This is detrimental as the balance between competition and learning is inappropriate and disregards the principles of childhood development.

Appropriate technical benchmarking during an athletes development should provide feedback to their needs, not simply the results of adult oriented competition that are based more on developmental age then technical mastery.

LTADS provides specific physical, technical, tactical, mental and lifestyle benchmarks, as well as a suggested balanced and individualized approach to competition. Competition policies and structures will be covered in the LTADS Competition Structure document.

Observation: Optimal trainability is disregarded during the 'critical' or 'sensitive' periods of athlete development - a very small percentage of coaches use anthropometric measurements to identify Peak Height Velocity or fitness training that optimizes the periods of accelerated adaptation to training. Therefore, young athletes are not introduced to skills at the time when they are developmentally ready to learn them.

LTADS provides a simple to use PHV measurement and tracking tool, and encourages the use of appropriate monitoring across an athlete's career.

Observation: A focus on winning rather than optimal development currently characterizes the competitive schedule and preparation of the developing athlete. Early introduction to individual event "champions' and specialization is identified among other gaps in the current competitive system.

The LTADS Competition policy requires a qualification policy based on individual medley and aerobic freestyle events for swimmers 14 years and younger. The policy also requires a balanced approach to awards with aggregate scoring across multiple events, personal best improvement recognition, and individual performance awards.

Observation: Segmenting of athletes into performance categories at pre-puberty ages may create false impressions of potential or lack thereof to swimmers, coaches and parents.

Competition structures at pre-puberty ages should attempt to keep athletes of similar age and gender together with limited emphasis on individual event performance levels. Competition policies and structures for pre-puberty athletes will be covered in the LTADS Competition Structure document.

UNDERSTANDING GROWTH AND DEVELOPMENT

While all individuals follow a predictable pattern of physical growth, the rate of this growth varies by individual.

- Prior to the onset of the growth spurt, children (on average) grow about 6 cm (2.5 in) per year, and gain about 2 kilograms (5 pounds) per year.
- Peak height velocity occurs on average at approximately 12.5 years for females and 14 years for males.
- Athletes of the same chronological age can vary by as much as 5 biological years, especially during adolescence. Therefore, with two 11-year-old swimmers, one may be 10 and the other 15, biologically.

Recommendation: Parents, clubs and coaches must educate athletes regarding growth variations. The individual patterns of each athlete must be considered when looking at how athletes are grouped within the club, and into the design of training program. To ensure an accurate record of growth is available, the recommendation is to have a record of standing and sitting height, as well as arm span, recorded every three months.

Performance can be heavily influenced by maturity, which is out of the athlete's control. Some young athletes, therefore, have a performance advantage over others.

- Initially, early maturers have a physical size advantage and often perform better than late maturers. These individuals experience more early success due to a physical growth advantage and not necessarily enhanced skills or abilities.
- Conversely, late maturers experience failure and frustration because they are physically "behind" their same-age (chronological) peers.
- Adolescent awkwardness due to rapid physical growth affects performance, especially for early maturers.
- Late maturers often catch up to or exceed the performance of early maturers by the mid-teen years, but only if they have stayed with the sport. Some drop out because of a lack of early performance success or, worse, are cut from the team.
- Tracking of "outstanding" performers in elementary school found that only 25% were still outstanding in later years, suggesting that early success does not predict later success.

Recommendation: Often, late maturers will catch up with early maturers in terms of performance, and success will be harder to achieve. Parents, clubs and coaches must help early maturers keep success in perspective. One means of doing this is to have early maturers compete at times, against athletes with the same abilities regardless of age. Additionally, take active steps to keep late maturers involved as they often leave the sport because of low perceptions of competence due to little early success. Be creative in helping them experience some success.

Gender differences in physical growth and in the timing of the growth spurt contribute to the overall difference in the height and body shapes of females and males.

- Girls reach peak height velocity (growth spurt) on average between 11 and 13 and boys between 13 and 15
- Hormonal differences in males and females cause body composition changes in adolescence, changes which are out of the athlete's control but which may impact performance (positively and negatively).
- Because males are in childhood growth longer and have a more intense growth spurt at puberty, adult males generally have a greater percentage of their height in their legs.

Recommendation: Males and females differ in the growth and development process; both when the growth spurt occurs and ensuing physical changes. It is important to take these differences into account when training adolescent males and females as well as to educate them on the developmental process. Because of the numerous and sometimes drastic changes, it is crucial to allow time for young athletes to get comfortable (physically and emotionally) with their changed bodies. Additionally, adaptation to the growth changes lags behind so expect it to take some time for the athlete to be able to take advantage of changes.

THE PHYSIOLOGY OF GROWTH AND DEVELOPMENT

It is important for swimmers, coaches and parents to have an understanding of the biological/physiological development of a young athlete. This knowledge should be used to maximize the child's potential over the long term. There are three primary physiological performance components that undergo quantitative changes (increased size or capacity) and qualitative changes (increased efficiency) with growth and development. The components include aerobic capacity, anaerobic capacity, and muscular strength, power and endurance.

Aerobic Capacity

- $\dot{V}O_2\text{max}$, the ability to take in, transport, and utilize oxygen, is the common parameter used to measure aerobic capacity
- $\dot{V}O_2\text{max}$ shows significant growth from 11-13 years for females and 12-14 for males. This time frame, when significant growth can occur (sensitive period), should be maximized in the training program to develop the athlete's long term potential. The athlete is able to rapidly increase workload during this sensitive period.
- Pre-pubescent athletes show significant improvements in long duration, low intensity events and are able to enhance the utilization of their aerobic capacity.

Recommendation: Coaches should optimize aerobic training during this "sensitive period" (11-13 yrs for females / 12-14 yrs for males) to maximize athlete's aerobic development. It is suggested that pre-pubescent athletes (ages 9-12/14) focus on longer distances (i.e., longer repeats and longer competitive events) for reasons related to both skill development and aerobic capacity development. Performance can be influenced by maturity, which is out of the athlete's control. Some young athletes, therefore, have a performance advantage over others.

Anaerobic Capacity

- Anaerobic training involves high intensity, brief activities (repeats on long rest or 25yd. sprints or less).
- It has been found that high volume pre-pubescent anaerobic work results in insignificant long-term anaerobic improvement for young athletes (10-13 years). It may result in short-term time drops.
- However, higher aerobic work during this time results in increased performance across all distances not just longer distances.
- Increased anaerobic load early leads to potential maladaptation in young athletes...it is said to "tax their tank" and their ability to adapt.
- A gradual increase in the proportion of anaerobic work beginning at ages 12-14 for girls and 13-15 for boys maximizes development and enhances performance, BUT only if preceded by ample aerobic work.

Recommendation: Coaches need to first develop the athlete's aerobic capacity and then gradually increase anaerobic load for maximum development of anaerobic capacity

Muscular strength, power and endurance

- A frequently asked question is whether young athletes should be strength training. It is suggested that you can see muscular gains and adaptations but only if strength training is done under the right scenario -- with close supervision to ensure proper technique.
- Prior to puberty, the gains come from neuromuscular changes not changes in muscle size. With increases in steroid hormones (puberty), we see gains due to changes in muscle size (predominantly in males).
- As muscle size increases, so does strength. But, typically there is a year lag time between size/mass increases and maximum effects of strength gains in young athletes.
- Additionally, the translation of land-based strength, power, and endurance to pool performance can vary from half a year up to two years.
- The age of 14-15 is when peak gains occur; quantitative muscular changes can occur with proper training - "window of time where they are plastic". However, it is not until half a year up to two years later that this will be translated into an increase in strength.

Recommendation: First, keep in mind that young athletes are not miniature adults. Because of hormonal and biological differences between children and adults, children will not increase muscle size through strength training. However, neuromuscular adaptations can occur. It is only after puberty that muscle growth occurs. Keep in mind that the ability to translate muscular work to swimming velocity is the key, as our concern is helping children swim faster. Therefore, we must ensure that strength training is implemented or modified to meet this objective.

LTAD GENDER CONSIDERATIONS

In looking at development research across a wide variety of disciplines, from academics to the arts, to athletics, gender seems to be a common factor influencing development.

The research suggests that while there are some gender-related differences that are advantageous for swimmers, coaches and parents to be aware of, ideally, we want to strike a balance between developing a sensitivity to gender-related differences, but not go so far as to form incorrect stereotypes and over-generalizations.

Given this, it seems beneficial to summarize some of the more relevant gender-related differences and draw some implications or practical suggestions from this information:

Puberty

Boys reap the benefits of testosterone that is in full throttle at this time. There is an increase in muscle development due to increased testosterone -- as testosterone is a protein anabolic that helps build up muscle by building up the protein that makes up the muscle. Concurrent with this increase in muscle mass is a decrease in percent body fat. All these changes are seemingly advantageous to the male swimmer.

For girls, puberty brings about an increase in the hormone estrogen. This increased estrogen is going to aid in laying down more adipose tissue and breaking down protein. Unlike boys, development during puberty for girls can initially have a negative effect on swim performance.

Recommendation: The training programs for girls during puberty should focus on maintaining their muscular stature, and offset the natural physiological changes that are occurring. Additionally, all involved must remember that increased adipose deposits for woman is nature's way. It is not necessarily a change in her diet, changes in her training, or lack of willpower, but is part of her development as a female that, to a large degree, is out of her control.

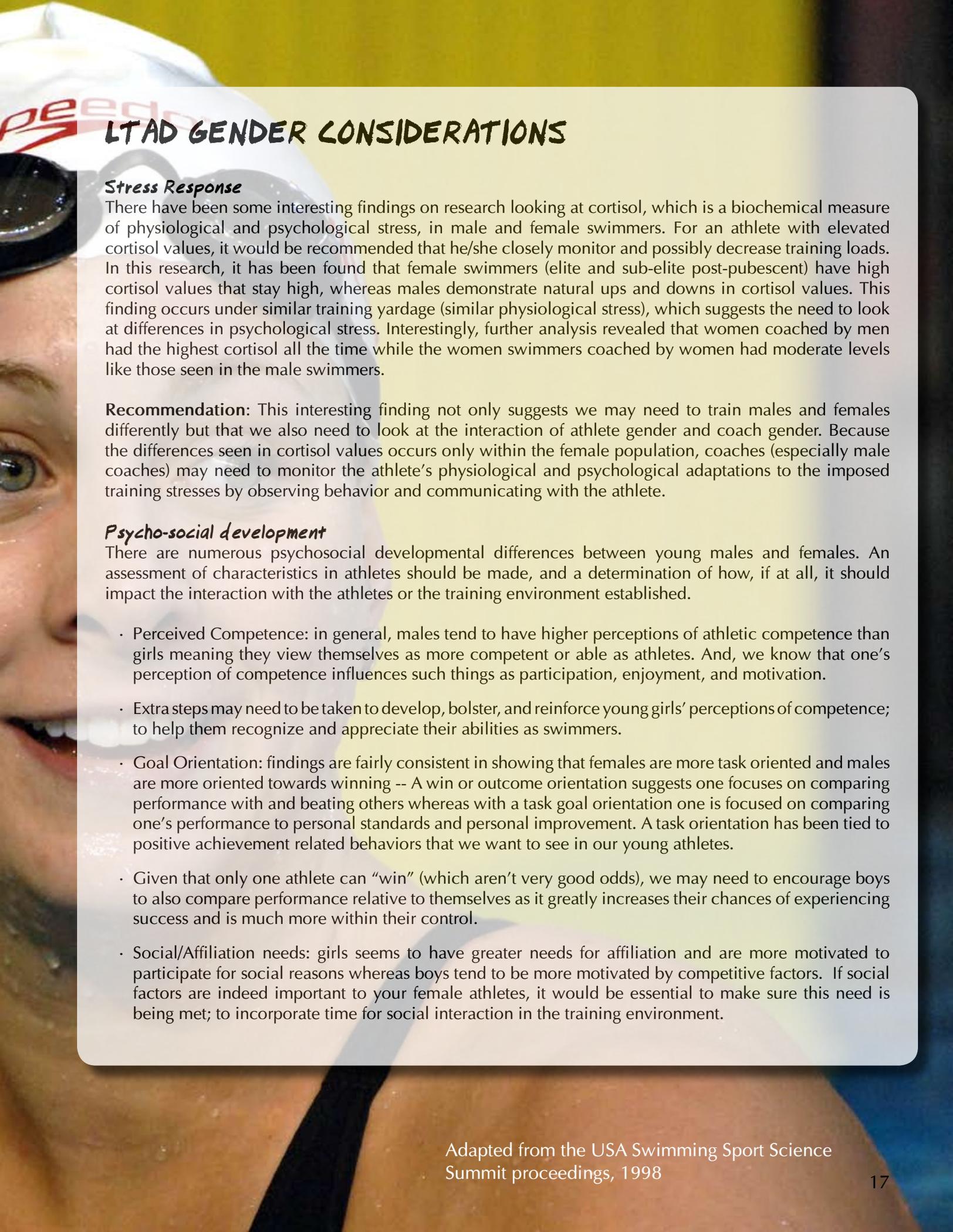
As an aside, it has been suggested that because females tend to have less muscle mass than males during and after puberty, females may not need to taper as much in preparation for competition.

Sensitive Periods

From a physiological and growth perspective, boys and girls are different in terms of the timing of their 'sensitive periods' with girls maturing physiologically about two years ahead of boys. Remember, this sensitive period is a time when significant growth (aerobic development) can occur under the right conditions (training loads). While girls tend to mature earlier and thus have an earlier 'sensitive period', the real physiological variable is not gender but rather the start of the growth curve. This increase in height velocity towards a maximal peak height velocity, is really what should determine when to increase the aerobic phase. However, it is easier to understand and use this information when one knows that females tend to hit this growth phase at age 11-13 and males around age 13-15.

Because males tend to reach their growth spurt about two years after females, they are in childhood growth longer, which adds greater length to their legs. This leg length discrepancy tends to be what accounts for the height difference between males and females -- how might longer legs impact performance in the water?

Recommendation: We need to take advantage of these sensitive periods when training young athletes in order to maximize development. When entering this growth phase, which tends to happen earlier for females, coaches need to think about increasing aerobic training to maximize their capacities.



LTAD GENDER CONSIDERATIONS

Stress Response

There have been some interesting findings on research looking at cortisol, which is a biochemical measure of physiological and psychological stress, in male and female swimmers. For an athlete with elevated cortisol values, it would be recommended that he/she closely monitor and possibly decrease training loads. In this research, it has been found that female swimmers (elite and sub-elite post-pubescent) have high cortisol values that stay high, whereas males demonstrate natural ups and downs in cortisol values. This finding occurs under similar training yardage (similar physiological stress), which suggests the need to look at differences in psychological stress. Interestingly, further analysis revealed that women coached by men had the highest cortisol all the time while the women swimmers coached by women had moderate levels like those seen in the male swimmers.

Recommendation: This interesting finding not only suggests we may need to train males and females differently but that we also need to look at the interaction of athlete gender and coach gender. Because the differences seen in cortisol values occurs only within the female population, coaches (especially male coaches) may need to monitor the athlete's physiological and psychological adaptations to the imposed training stresses by observing behavior and communicating with the athlete.

Psycho-social development

There are numerous psychosocial developmental differences between young males and females. An assessment of characteristics in athletes should be made, and a determination of how, if at all, it should impact the interaction with the athletes or the training environment established.

- Perceived Competence: in general, males tend to have higher perceptions of athletic competence than girls meaning they view themselves as more competent or able as athletes. And, we know that one's perception of competence influences such things as participation, enjoyment, and motivation.
- Extra steps may need to be taken to develop, bolster, and reinforce young girls' perceptions of competence; to help them recognize and appreciate their abilities as swimmers.
- Goal Orientation: findings are fairly consistent in showing that females are more task oriented and males are more oriented towards winning -- A win or outcome orientation suggests one focuses on comparing performance with and beating others whereas with a task goal orientation one is focused on comparing one's performance to personal standards and personal improvement. A task orientation has been tied to positive achievement related behaviors that we want to see in our young athletes.
- Given that only one athlete can "win" (which aren't very good odds), we may need to encourage boys to also compare performance relative to themselves as it greatly increases their chances of experiencing success and is much more within their control.
- Social/Affiliation needs: girls seems to have greater needs for affiliation and are more motivated to participate for social reasons whereas boys tend to be more motivated by competitive factors. If social factors are indeed important to your female athletes, it would be essential to make sure this need is being met; to incorporate time for social interaction in the training environment.

PEAK HEIGHT VELOCITY

A key tool in the identification of an individual athlete's stage of development is the monitoring of the rate of change in height of, and the determination of two key points:

1. Start of the growth spurt
2. Point at which maximum rate of height change has been reached (Peak Height Velocity = PHV)

The growth spurt can last from 1.5 years to 5 years.

Why is it important to know when PHV occurs?

Each athlete grows at a different rate; therefore a coach can have, on the same team or training group, early, average and/or late maturers. All coaches should be monitoring PHV as part of an overall athlete monitoring program.

How to monitor PHV?

Due to seasonal variations and for consistency purposes, experts are recommending that all measurements are taken in the morning at a consistent time. (measures are more reliable after a rest day).

STEP 1

As soon as the athlete turns 6 years of age (or as soon as they are available to your program to initiate), the coach should be measuring standing height every three months on a consistent interval (ie. exactly 3 months).

It is also advised that sitting height and arm span be included, to identify changes that may affect the proper execution of technical movements. Measurement of arm span should be done in a standing position, with the arms extended horizontally. Measurements of sitting height should be done while the athlete is sitting on the floor next to a wall with bent knees (90 degrees).

STEP 2

Produce charts to display all three measurements with change in height/length on the vertical axis and age on the horizontal axis (with 3 month indicators).

** an Excel tracking spreadsheet is available from Swimming Canada

STEP 3

PHV is the highest point of growth acceleration. After PHV is attained, a deceleration in growth will happen. Continue to monitor growth for 24 to 36 months after PHV.

WINDOWS OF OPTIMAL TRAINABILITY

Within an athlete's development, particular 'windows of opportunity' exist for maximum return on a training activity. The important periods occur as a result of the biological and neuromuscular changes occurring in the child, allowing an enhanced response to the training stimulus. The degree of response to any training stimulus is also affected by other factors such as psychological readiness and previously established skill acquisition.

The 5 Basic S's of Training and Performance are Stamina (Endurance), Strength, Speed, Skill and Suppleness (Flexibility). The information below details windows of optimal trainability for each of these areas.

Stamina (Endurance) : The window of optimal trainability occurs at the onset of PHV. Aerobic capacity training is recommended before athletes reach PHV. Aerobic power should be introduced progressively after growth rate decelerates.

Strength : The optimal window of trainability for girls is immediately after PHV or at the onset of the 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 window 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. It is very important that young children have exposure to short duration, agility and speed of movement exercises during these windows of optimal trainability.

Skill : The window for optimal skill training takes place from initiation at Active Start, through the age 11 for girls and 12 for boys.

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.

SPECIALIZATION

There has been a noticeable change in high performance results over the past twenty years. While the occasional international performance may come from an athlete of relatively early chronological ages (14-16), the norm for international results continues to rise at a relatively steady pace. The charts below, courtesy of Nick Thierry of SwimNews Magazine, show the average age of the top 8 and top 16 swimmers at the World Championships (lcm) and Olympic Games since 1988. The increased number of education and training opportunities available to men and women of University age and older, and the increased funding available for high performance athletes, has allowed for a prolonged high performance (Compete to Win) phase for many athletes. Importantly, we have also seen that performance improvements are possible through these advanced years of competition. Our athlete development system must demonstrate a patience that would allow the young swimmers of today, an opportunity to still be participating at these ages.

	Free					Back		Breast		Fly		IM	
Females	50	100	200	400	800	100	200	100	200	100	200	200	400
Top 8	22.5	20.5	20.5	20.2	20.2	21.2	20.2	20.6	19.7	21.8	20.4	20.4	19.4
Top 16	22.2	20.8	20.8	20.1	19.8	20.5	19.7	20.8	19.9	21.6	20.3	20.3	19.6
Males	50	100	200	400	1500	100	200	100	200	100	200	200	400
Top 8	24.9	23.3	22.1	21.5	21.4	22.5	22.6	22.5	22.0	22.8	22.1	22.3	21.9
Top 16	24.2	23.4	22.1	21.5	21.7	22.3	22.2	22.6	22.8	22.8	22.1	22.2	21.6

Stages of Development

1

Active Start

2

FUNDamentals

3

Learn to Train

4

Train to Train

5

Train to Compete

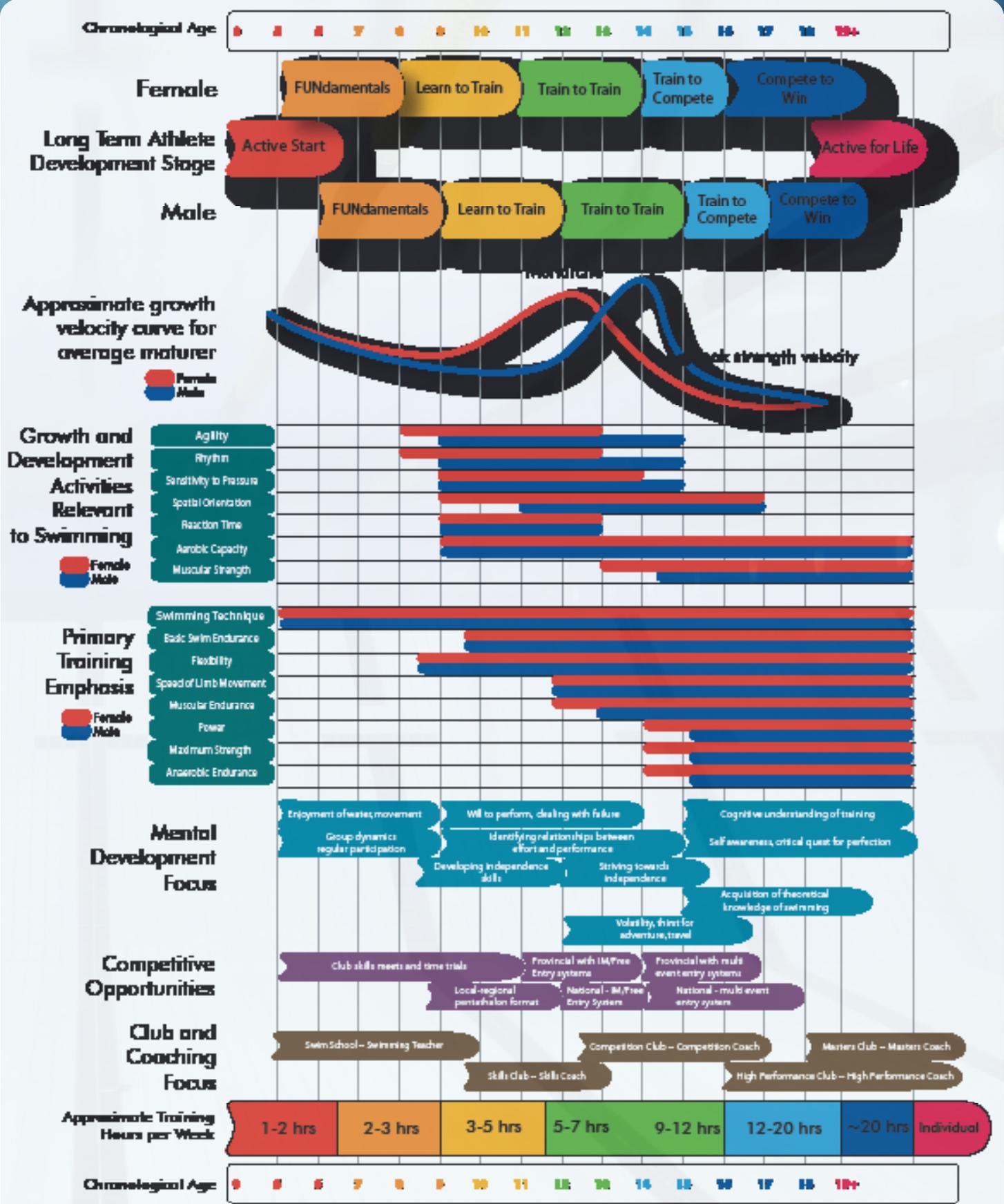
6

Compete to Win

7

Active for Life

LONG TERM ATHLETE DEVELOPMENT OVERVIEW



ACTIVE START

Learn fundamental movements and link them together into play

Chronological ages 0 to 6

Provide every young child with an active start to their life

Provide every young child with appropriate safety skills around water

Physical activity is essential for healthy child development. Among its other benefits, physical activity enhances development of brain function, coordination, social skills, gross motor skills, emotions, leadership, and imagination.

- helps children to build confidence and positive self-esteem.
- helps to build strong bones and muscles, improves flexibility, develops good posture and balance, improves fitness, reduces stress, and improves sleep.
- promotes healthy weight.
- helps children learn to move skillfully and enjoy being active.

Physical activity should be fun and a part of the child's daily life, not something required. Active play is the way young children are physically active.

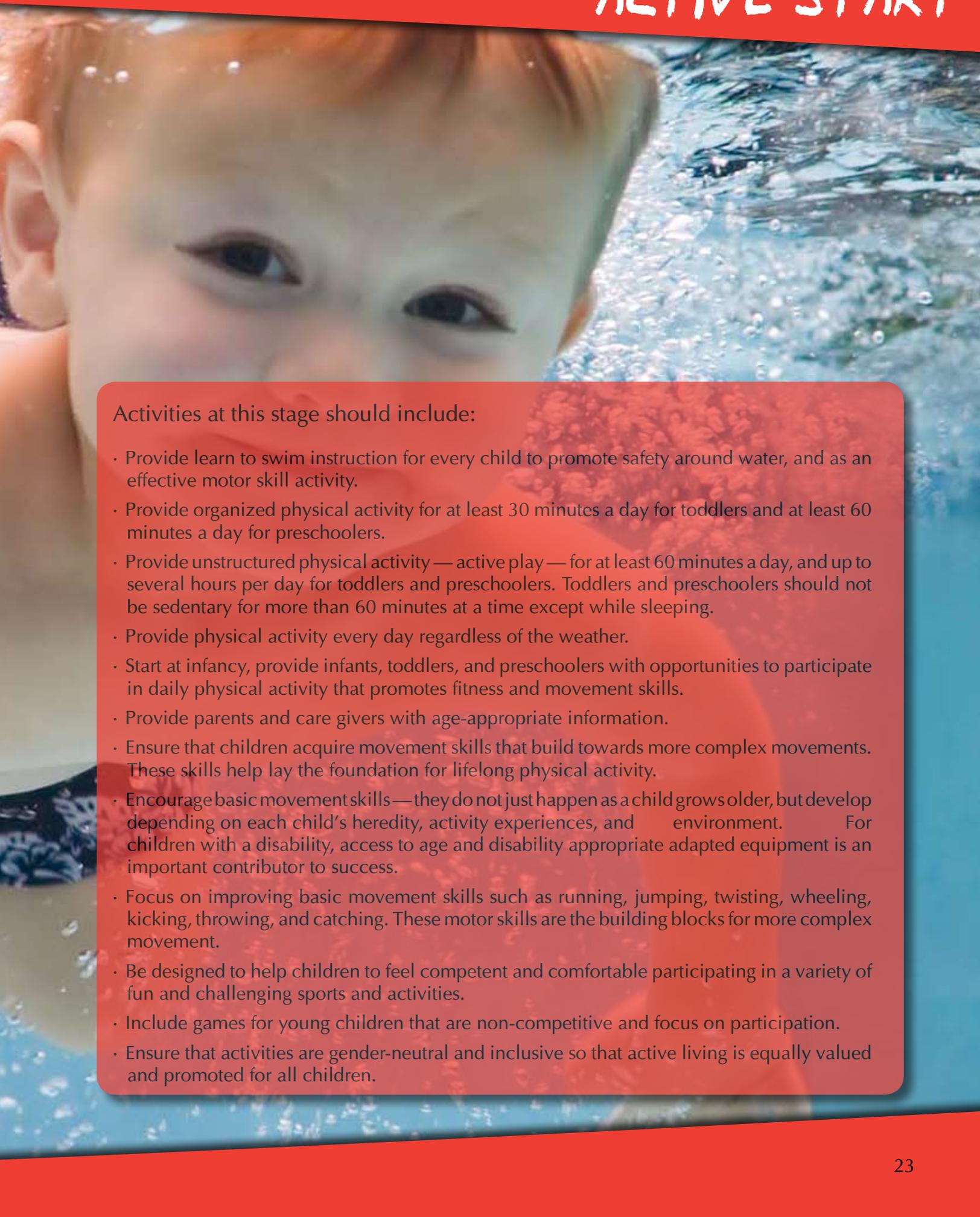
Organized physical activity and active play are particularly important for the healthy development of children with a disability if they are to acquire habits of lifelong activity.

Because this is a period when children rapidly outgrow their mobility aids, communities need to find effective ways — equipment swaps or rentals, for example — to ensure that all children have access to the equipment they need to be active.

A young child's safety around water should be a primary objective of every parent, accessing an effective learn to swim program at this stage is a requirement.

Qualities of an effective learn to swim program are:

- Prepared and enthusiastic instructors
- Progression from class to class
- Tracking of progress from session to session – don't start from scratch each session!
- Appropriate challenge for each individual and high ratio of activity to rest within class time



Activities at this stage should include:

- Provide learn to swim instruction for every child to promote safety around water, and as an effective motor skill activity.
- Provide organized physical activity for at least 30 minutes a day for toddlers and at least 60 minutes a day for preschoolers.
- Provide unstructured physical activity — 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 physical activity every day regardless of the weather.
- Start at infancy, provide infants, toddlers, and preschoolers with opportunities to participate in daily physical activity that promotes fitness and movement skills.
- Provide parents and care givers with age-appropriate information.
- Ensure that children acquire movement skills that build towards more complex movements. These skills help lay the foundation for lifelong physical activity.
- Encourage basic movement skills—they do not just happen as a child grows older, but develop depending on each child's heredity, activity experiences, and environment. For children with a disability, access to age and disability appropriate adapted equipment is an important contributor to success.
- Focus on improving basic movement skills such as running, jumping, twisting, wheeling, kicking, throwing, and catching. These motor skills are the building blocks for more complex movement.
- Be designed to help children to feel competent and comfortable participating in a variety of fun and challenging sports and activities.
- Include games for young children that are non-competitive and focus on participation.
- Ensure that activities are gender-neutral and inclusive so that active living is equally valued and promoted for all children.



FUNDAMENTALS

Physical Literacy and Introduction to Sport

Enjoyable, challenging and progressive experiences

Chronological ages - Female: 5 to 8 Male: 6 to 9

This stage is important for:

- basic movement skills agility, balance, coordination
- running, throwing, jumping and catching
- water safety and movement skills
- short speed effort through agility exercise
- strength development using own body weight

Amount of physical activity, including non-swimming (progression by age):

- 1-3 sessions per week rising to 4-6 sessions
- 30-60 minute sessions
- high repetition, low intensity activity focus

Competition

- Formal competition not necessary
- Participation in introductory club-based competitive events with introduction of rules, ethics and fair play

Venues:

- Learn to Swim providers, gymnastics and athletics programs
- Swimming Canada clubs providing a balanced Fundamentals program
- FUNdamental Sport Clubs
- Schools

Activities at this stage should include:

PHYSICAL

- Promote overall physical development and mobility in and out of the pool
- Include running, jumping and throwing skills
- Promote agility, balance, coordination and speed (ABC'S) in and out of the pool
- Develop short duration speed and endurance through FUN games in and out of the pool
- Develop linear, lateral and multi-directional speed in and out of the pool

TECHNICAL

- Teach basic swimming skills – all strokes, turns, starts
- Teach basic skills of different sports – aquatic and non aquatic sports
- Provide knowledge of the basic use of swimming equipment

TACTICAL

- Introduce simple rules and ethics of sport
- Introduce basic racing opportunities and understanding of competition

MENTAL

- Reinforce a positive attitude to sport
- Introduce concept of self confidence
- Introduce concentration skills
- Encourage positive reinforcement from coaches and parents
- Introduce the concept of perseverance

LIFESTYLE

- Promote involvement in multiple sports
- Promote and teach safety
- Be based on enjoyment and fun
- Promote fair play
- Foster a positive attitude towards activity and participation
- Promote teamwork and personal interaction skills

LEARN TO TRAIN

Multi Sport Skill Development

Enjoying, challenging and progressive experiences

Chronological ages - Female: 8 to 11 Male: 9 to 12

Readiness to advance determined by skill competency and measured increase in PHV

This stage is important for:

- further development and consistent demonstration of movement skills
- further development and consistent demonstration of all swimming skills
- expert instruction on technical and physical skills
- pre-growth spurt focus on repetition of skill towards mastery
- monitored flexibility training daily
- development of positive attitudes to self, others and sport

Amount of physical activity, including non-swimming (progression by age):

- 4-6 sessions per week
- 60-90 minute sessions
- Pool time (hrs): 4-7
- Pool Volume: 8-14 km
- Participation in 2-3 other sport activities through a year
- high repetition, low intensity skill focus
- some intensity progression to challenge skill acquisition

Competition objectives:

- Modified competition and introduction to competitive structures and events
- Competitive rewards focused on broad skill development and aerobic development
- Competition schedule guideline: 3 below athlete's level of competitions – 2 at athlete's level of competitions – 1 above athlete's level of competition
- Suggested 1-2 cycles through per season

Venues

- Year round swim clubs with multi-sport programming
- Seasonal swim club with 2-3 other sport seasons
- School sports

Activities at this stage should include:

PHYSICAL

- Continue to develop Agility, Balance, Coordination, Speed (ABC'S) in and out of the pool
- Continue to develop speed and endurance through fun games in and out of the pool
- Involve medicine ball, Swiss ball and own-body exercises for strength as well as hopping bounding exercises
- Introduce basic flexibility exercises
- Introduce concepts of warm-up and stretching

TECHNICAL

- Include a strong emphasis on skill development
- Progressively refined swimming skills – strokes, turns, starts, underwater skills
- Teach basic practice skills – lane etiquette, pace clocks, etc..

TACTICAL

- Include modified swimming meets – measuring aerobic skill mastery, short duration speed
- Provide an introduction to basic racing principles – pacing strategies, splitting goals

MENTAL

- Introduce concept of mental preparation
- Promote understanding of the role of practice towards goals
- Continue to promote concept of perseverance
- Continue to develop concept of self confidence
- Continue to develop concentration
- Promote positive reinforcement for effort and achievement

LIFESTYLE

- Promote involvement in multiple complimentary sports
- Promote sport as a lifestyle commitment
- Provide knowledge of the changes puberty will bring
- Introduce discipline and structure
- Promote an understanding of the relationship between effort and outcome
- Continue to promote teamwork and personal interaction skills

4

TRAIN TO TRAIN

Building the Engine for Future Performance

Enjoying a lifestyle of sport and activity

Chronological ages - Female: 11 to 14 Male: 12 to 15

Readiness to advance determined by measured steadying of PHV and mastery of sport skills

This stage is important for:

- further development and mastery of sport skills
- aerobic system development (on-set of growth spurt to peak PHV a critical window)
- maintenance and consolidation of skill, speed, and flexibility
- strength development (females immediately after peak PHV/males 12-18 months following peak PHV)
- learning the mental skills required to deal with competition
- ongoing monitored flexibility training

Amount of physical activity, including non-swimming (progression by age):

- 6-12 sessions per week
- 60-120 minute sessions
- Pool time (hrs): 12-24
- Pool Volume: 24-30 km/wk building to 40-50 km/wk
- Participation in 1-2 other sport activities through a year
- high volume, aerobic capacity focus from onset of PHV to peak PHV
- speed intensity following peak PHV

Competition objectives:

- 3 below athlete's level competitions – 2 at athlete's level competitions – 1 above athlete's level competition
- Suggested 1-2 cycles through per season
- competitive rewards focus on continued development across multiple distances and strokes
- development of individualized competitive modalities such as warm up, warm down
- introduction to multiple racing tactics

Venues

- year round swim clubs
- seasonal swim club with 1-2 other sport activities
- school sports

Activities at this stage should include:

PHYSICAL

- Emphasize general and balanced physical conditioning
- Prioritize aerobic training after the onset of Peak Height Velocity (PHV)
- Initiate strength training in females after PHV and with the onset of menarche.
- Initiate strength training in males 12-18 months after PHV
- Focus on shoulder, elbow, core, spine and ankle stability
- Continue flexibility training
- Include frequent musculoskeletal evaluations during PHV

TECHNICAL

- Further develop and consolidate swimming specific skills
- Include an individualized approach to address strengths and weaknesses

TACTICAL

- Include early stages of specific race tactical preparation
- Teach and observe different individual racing tactics

MENTAL

- Introduce goal setting skills (short and medium term)
- Introduce imagery skills (practicing and improving technique and self-confidence)
- Introduce relaxation skills (deep breathing)
- Teach patience and self-control
- Continue to develop concentration
- Continue to promote positive reinforcement

LIFESTYLE

- Teach basic nutrition and hydration needs
- Promote use of training and performance diary/log
- Introduce skills of time management
- Introduce athlete understanding of planning and periodization
- Promote use of rest and recovery techniques
- Continue to promote teamwork and personal interaction skills
- Promote positive communication
- Promote discipline and personal responsibility
- Build awareness of Peak Height Velocity and windows of optimal trainability

5 TRAIN TO COMPETE

Competitive performance development

Building self confidence

Chronological ages - Female: 14 to 16 Male: 15 to 18

Readiness to advance determined by performance and mastery of competencies

This stage is important for:

- Individualization of physical training approach – based on a post peak PHV assessment
- Advanced physical, technical, tactical skills
- Ability to compete at high levels under various environments
- Maintenance of flexibility
- Development of autonomy, independence and individual responsibility
- Lifestyle skill awareness and development
- Individualized strength development based on a post peak PHV assessment
- Competitive performance state management

Amount of physical activity, including non-swimming (progression by age):

- 8-12 sessions per week
- 90-120 minute sessions
- Pool time (hrs): 16-24
- Pool Volume: 40-50+ km/wk
- Specialization to chosen performance sport – balanced out of training activities
- Individualized training focus with volume and intensity based on specialty and periodization focus

Competition objectives:

- 3 below athlete's level competitions – 2 at athlete's level competitions – 1 above athlete's level competition
- Suggested 1-2 cycles through per season
- Competitive modeling of peak performance objectives
- Fully developed and individualized competitive modalities such as warm up, warm down, nutrition, ancillary capacities
- Refinement and implementation of multiple racing tactics

Venues

- Year round swim clubs
- University swim clubs

TRAIN TO COMPETE

Activities at this stage should include:

PHYSICAL

- Involve event and individualized specific intensive physical conditioning
- Continue to develop shoulder, elbow, core, spine and ankle stability
- Focus on optimum preparation: tapering and peaking

TECHNICAL

- Require a high level of proficiency in all swimming skills
- Require sport-specific technical and racing skills under competitive conditions and at high intensity
- Develop an individualization of skills: 'personal style'
- Require consistency and control under a variety of environments
- Involve competition simulation training

TACTICAL

- Focus on event and distance specific tactical preparation
- Involve principles of aggressive and passive tactical strategies
- Develop an athlete's ability to plan and assess competition
- Develop an athlete's ability to adapt to different competitive situations
- Develop an athlete's ability to observe and adapt to opponents

MENTAL

- Promote personal responsibility and involvement in decision-making
- Refine focus and thought control – self talk/verbal cues (dealing with distractions and negative thoughts)
- Refine goal setting skills (short, mid and long term)
- Consolidate performance routines and pre-competition preparation
- Refine imagery skills (competition, different situations/problems, practicing strategies)
- Develop skills for anxiety control and relaxation (Progressive Muscle Relaxation, Hypnosis)

LIFESTYLE

- Allow for individualization of ancillary supports
- Involve refined self-monitoring
- Plan career/long term sport options
- Increased knowledge on hydration and nutrition
- Focus on preparation for different environments e.g. heat/cold/rain/altitude
- Refine injury prevention, rest and recovery strategies
- Promote ongoing personal development
- Focus on integration of sport, career and life goals
- Address economic and independence issues

6 Compete to Win

Peak performance on the day

Optimized program towards peak performance at specific moments

Chronological ages - Female: 16 + Male: 18 +

High performance career at this level to retirement

This stage is important for:

- Optimized approach built around longer term competitive schedule and annual training plan
- Advanced physical, technical, tactical skills
- Ability to compete at consistent high levels under various environments
- Assume leadership role within group settings
- Regular short breaks within competition and training plans
- Self directed programming with coaching support
- Lifestyle refinement – planning for post high performance career

Amount of physical activity, including non-swimming (progression by age):

- 10-15 sessions per week
- 90-150 minute sessions
- Pool time (hrs): 20-24
- Pool Volume: 40-50+ km/wk depending on specialization
- Specialization to chosen performance sport – balanced out of training activities
- Individualized training focus with volume and intensity based on specialty and periodization focus

Competition

- Advanced competitive schedules
- Competitive modeling of peak performance objectives
- Fully developed and individualized competitive modalities such as warm up, warm down, nutrition, ancillary capacities
- Refinement and implementation of multiple racing tactics

Venues

- Year round swim clubs
- University swim clubs

Activities at this stage should include:

PHYSICAL

- Focus on the maintenance and possible improvement of physical capacities with a view to maximizing performance
- Continue to promote shoulder, elbow, core, spine and ankle stability
- Focus on a fully individualized approach
- Provide frequent prophylactic (preventative) breaks

TECHNICAL

- Ensure refinement of sports specific skills
- Include event-/competition-specific training skills that are automatic/second nature
- Develop the ability to improvise with skills

TACTICAL

- Develop effective competition strategies
- Adapt strategies to situation
- Model all possible aspects of performance in training
- Race to strengths, exploit weaknesses of opponents

MENTAL

- Promote independent decision-making
- Develop athletes capable of working in a team environment and evaluating advice from outside sources
- Consolidate well developed, refined and individualized mental skills and routines
- Promote refocusing plans/coping strategies
- Promote the will to win and drive for competition
- Consolidate the ability to concentrate and refocus

LIFESTYLE

- Increase knowledge on all areas related to personal well being
- Include rest and relaxation. Frequent breaks
- Require well developed self-monitoring
- Require a well developed and integrated support network/structure
- Include a fully integrated sport, career and life plan

7 SECOND CAREER

ACTIVE FOR LIFE

Second sport career - Sport as a lifetime activity

Opportunity to pursue complimentary sport activity

Chronological age - any age

Transition to second career sport or active lifestyle plan

This stage is important for:

- Consideration of complimentary activities to continue competitive activity
- Review of event / commitment based on post-PHV physical and mental status
- Implementation of active lifestyle plan for de-training process
- Self directed programming
- Lifestyle refinement –post competitive training

Amount of physical activity, including swimming (progression by age):

- Determined by chosen activity and schedule – should commence at 60-80% of training level and can decrease gradually to steady state
- Specialization to second sport career focus or non-specialized active living
- Individualized training focus

Competition

- Dependant on chosen path – recreational competitive opportunities suggested

Venues

- Sport clubs for second career choice
- Recreational competitive sport clubs – Masters, Triathlon
- Health Clubs, etc...
- Outdoor activity

Transition to a second sport career may involve reintroduction to a previous stage, with new sport-specific requirements. For those moving to retirement, and an active lifestyle, these important activities should be considered:

PHYSICAL

- Continued active lifestyle through sport participation
- Endurance training
- Strength training
- Flexibility training

TECHNICAL

- Retain learned skills and develop new ones

TACTICAL

- Recreational or masters oriented perspective to competition

MENTAL

- Relaxation
- Readjustment to new active living environment

LIFESTYLE

- Pursue personal and family goals more strongly
- Pursue further education/career development
- Possible engagement in administration, coaching, media/PR
- Seek transition support, if required
- Reset goals

Glossary

The terms “growth” and “maturation” are often used together and sometimes synonymously. However, each refers to specific biological activities. Growth refers to “observable, step-by-step, measurable changes in body size such as height, weight, and percentage of body fat.” Maturation refers to “qualitative system changes, both structural and functional in nature, in the organism’s progress toward maturity; for example, the change of cartilage to bone in the skeleton.”

Menarche is the beginning of the menstrual function; especially the first menstrual period of an individual

Peak height velocity (PHV) is the maximum rate of growth in stature during growth spurt. The age of maximum velocity of growth is called the age at PHV.

Peak strength velocity (PSV) is the maximum rate of increase in strength during growth spurt. The age of maximum increase in strength is called the age at PSV.

Physical literacy refers to the mastering of fundamental motor skills and fundamental sport skills.

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

Readiness refers to the child’s level of growth, maturity, and development that enables him/her to perform tasks and meet demands through training and competition. Readiness and critical periods of trainability during growth and development of young athletes are also referred to as the correct time for the programming of certain stimuli to achieve optimum adaptation with regard to motor skills, muscular and/or aerobic power.

Skeletal age refers to the maturity of the skeleton determined by the degree of ossification of the bone structure. It is a measure of age that takes into consideration how far given bones have progressed toward maturity, not in size, but with respect to shape and position to one another.

Trainability refers to the genetic endowment of athletes as they respond individually to specific stimuli and adapt to it accordingly. Malina and Bouchard (1991) defined trainability as “the responsiveness of developing individuals at different stages of growth and maturation to the training stimulus.”

Glossary

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

Adolescence is a difficult period to define in terms of the time of its onset and termination. During this period, most bodily systems become adult both structurally and functionally. Structurally, adolescence begins with an 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. Functionally, adolescence is usually viewed in terms of sexual maturation, which begins with changes in the neuroendocrine system prior to overt physical changes and terminates with the attainment of mature reproductive function.

Ancillary Capacities refer to the knowledge and experience base of an athlete and includes warm-up and cool-down procedures, stretching, nutrition, hydration, rest, recovery, restoration, regeneration, mental preparation, and taper and peak. The more knowledgeable athletes are about these training and performance factors, the more they can enhance their training and performance levels. When athletes reach their genetic potential and physiologically cannot improve anymore, performance can be improved by using the ancillary capacities to full advantage.

Childhood ordinarily spans the end of infancy — the first birthday — to the start of adolescence and is characterized by relatively steady progress in growth and maturation and rapid progress in neuromuscular or motor development. It is often divided into early childhood, which includes pre-school children aged 1 to 5 years, and late childhood, which includes elementary school-age children, aged 6 through to the onset of adolescence.

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. The integrated nature of growth and maturation is achieved by the interaction of genes, hormones, nutrients, and the physical and psychosocial environments in which the individual lives. This complex interaction regulates the child’s growth, neuromuscular maturation, sexual maturation, and general physical metamorphosis during the first 2 decades of life.

Critical periods of development refers to a point in the development of a specific behaviour 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 refers to “the interrelationship between growth and maturation in relation to the passage of time. The concept of development also includes the social, emotional, intellectual, and motor realms of the child.”

Selected Bibliography

- Hansford, C., Fundamental Movements, Presented British Canoe Union, National Conference, Nottingham Dec. 2004.
- Harsanyi, L. "A 10-18 éves atletak felkészítései modellje." Budapest: Utanpotlas-neveles, No.10, 1983.
- Haywood, K.M. Life Span Motor Development. Champaign, IL. Human Kinetics, 1993.
- Health Canada. (2002a, November 22). Statistics & public opinion. Canada's physical activity guides for children and youth. Retrieved December 8, 2004, from www.phacaspc.gc.ca/pau-uap/pagguide/child_youth/media/stats.html
- Health Canada. (2002b, November 22). Canadian Paediatric Society, College of Family Physicians and Canadian Teachers' Federation call for urgent action to boost physical activity levels in children and youth. Canada's physical activity guides for children and youth. Retrieved December 8, 2004, from www.phacaspc.gc.ca/pau-uap/pagguide/child_youth/media/release.html and www.centre4activeliving.ca/Publications/WellSpring/2004/December.html#Snactivity accessed January 10, 2005.
- International Gymnastics Federation. Age Group Development Program. CD Rom. 2000.
- MacDougall, J.D., Wenger, H.A. and Green, H.J. (Eds) Physiological Testing of the Elite Athlete. Movement Publications, Inc. Ithaca N.Y., 1982.
- Malina, R.M. and Bouchard, C. Growth, Maturation, and Physical Activity. Champaign, Ill.: Human Kinetics, 1991.
- McWhorter, W., Wallman, H. W., & Alpert, P. T. (2003). The obese child: Motivation as a tool for exercise. *Journal of Pediatric Health Care*, 17, 11-17.
- Nadori, L. Az edzes elmelete es modszeretana. Budapest: Sport, 1986.
- National Coaching and Training Centre: Building Pathways in Irish Sport. Towards a plan for the sporting health and well-being of the nation. Limerick, Ireland, 2003.
- Norris, S.R., & Smith, D.J. 2002. Planning, Periodization, And Sequencing of Training And Competition: The Rationale For A Competently Planned, Optimally Executed Training And Competition Program, Supported By A Multidisciplinary Team. In M. Kellmann (Ed.), *Enhancing Recovery: Preventing underperformance in athletes*, pp.121-141. Champaign, IL: Human Kinetics.
- Ready Set Go (n.d.). Ready set go: The sports web site for families. Retrieved November 22, 2004, from www.readysetgo.org
- Report of the Minister of State's (Sport) Workgroup on Sport for Persons with a Disability, 2004.
- Ross, W.D. and Marfell-Jones, M.J. Kinanthropometry. In: *Physiological Testing of the Elite Athlete*. Eds. MacDougall, J.D., Wenger, H.A., and Green, H.J. Movement publications, Ithaca, N.Y., 1982. pp. 75 – 104.
- Rowland, T., and Boyajian, A. Aerobic Response to Endurance Training in Children. *Medicine and Science in Sports and Exercise*, 26(5) Supplement.
- Rushall, B. The Growth of Physical Characteristics in Male and Female Children. In *Sports Coach*, Vol.20, Summer, 1998. pp. 25 – 27.
- Sanderson, L. "Growth and Development Considerations for the Design of Training Plans for Young Athletes". Ottawa: CAC, SPORTS, Vol.10.No.2.1989.
- Tanner, J.M. "Growing Up." *Scientific American*, 1973, 9.
- Tanner, J.M. *Foetus into Man Physical Growth from Conception to Maturity*, Second Edition, Castlemead Publications, Ware, England, 1989.
- Thumm, H-P. "The Importance of the Basic Training for the Development of Performance" *New Studies in Athletics*, Volume 1. pp.47-64, 1987.
- Tihanyi, J. *Long-Term Planning for Young Athletes: An Overview of the Influences of Growth, Maturation and Development*. Sudbury: Laurentian University, 1990.
- Proceedings of the USA Swimming Sport Science Summit, December 1998.
- Valentine, J. (2003, Winter). Don't children get all the exercise they need from playing? *WellSpring* 14 (1), 6-8.
- Viru, A. Loko, J., Volver, A., Laaneots, L., Karlesom, K. and Viru, M. Age periods of accelerated improvements of muscle strength, power, speed and endurance in age interval 6-18 years. In "Biology of Sport", Warsaw, V., 15 (4) 1998, 211-227 pp.
- Viru, A. *Adaptation in Sports Training*. CRC Press, Boca Raton, 1995. 310.p.
- Vorontsov, A.R. Patterns of Growth for Some Characteristics of Physical Development: Functional and Motor Abilities in Boy Swimmers 11 – 18 Years. In: *Biomechanics and Medicine in Swimming VIII*. Eds. Keskinen, K.L., Komi, P.V. and Hollander, A.P. Jyvaskyla, Gunners, 1999.
- Vorontsov, A.R. Multi-Year Training of Young Athlete as Potential Modifier of Growth and Development (Analysis of some biological concepts). *Sport Medicine in Aquatic Sports – the XXI Century*, FINA World Sport Medicine Congress, 2002.
- Wienek, J. *Manuel d'entraînement*. Paris: Vigot, 1990.

Selected Bibliography

- Abbott A., Collins D., Martindale R., Sowerby K., Fundamental Movement Abilities Chart, Talent Identification and Development, An Academic Review, Sport Scotland University of Edinburgh 2002.
- Alpine Integration Model. Alpine Canada Alpine, High Performance Advisory Committee, 1999.
- Armstrong, N. and Welsman, J. Young People and Physical Activity. Oxford University Press, Oxford, 1997.
- Armstrong, N. and Welshman, J. Children in Sport and Exercise. British Journal of Physical Education, 28(2). Pp. 4-6, 1997.
- Balyi, I. and Way, R. "Long-Term Planning of Athlete Development. The Training to Train Phase". B.C. Coach, 1995. pp. 2 - 10.
- Balyi, I. Sport system building and long-term athlete development in Canada. The situation and solutions, in Coaches Report. The Official Publication of the Canadian Professional Coaches Association. Summer 2001. Vol.8, No.1, pp.25-28.
- Balyi, I., "Long-term Planning of Athlete Development, Multiple Periodisation, Modeling and Normative Data" in FHS, The UK's Quarterly Coaching Magazine, Issue Four, pp. 7 - 9. May, 1999.
- Balyi, I., "Long-term Planning of Athlete Development, The Training to Train Phase" in FHS, The UK's Quarterly Coaching Magazine, Issue One, pp. 8 - 11. September, 1998.
- Balyi, I., "Long-term Planning of Athlete Development, The Training to Compete Phase" in FHS, The UK's Quarterly Coaching Magazine, Issue Two, pp. 8 - 11, December, 1998.
- Balyi, I., and Hamilton, A. Long-term Athlete Development, Trainability and Physical Preparation of Tennis Players. In: Strength and Conditioning for Tennis. Eds. Reid, M., Quinn, A. and Crespo, M. ITF, London. 2003. pp. 49-57.
- Balyi, I., and Hamilton, A. "Long-term Planning of Athlete Development, The Training to Win Phase" in FHS, The UK's Quarterly Coaching Magazine, Issue Three, pp. 7 - 9. April, 1999.
- Bar-Or, O. Pediatric Sport Medicine for the Practitioner: From Physiologic Principles to Clinical Applications. New York: Springer Verlag, 1983.
- Bar-Or, O. Developing the Prepubertal Athlete: Physiological Principles. In Troup, J.P., Hollander, A.P., Strasse, D., Trappe, S.W., Cappaert, J.M. and Trappe, T.A. (Eds.), Biomechanics and Medicine in Swimming VII., London: E & FN Spon. pp. 135-139, 1996.
- Bar-Or, O. Nutritional Considerations for the Child Athlete. Canadian Journal of Applied Physiology. 26(Suppl.), pp. 186-191. 2001.
- Bar-Or, O. (ed). The Child and the Adolescent Athlete. Blackwell Science Ltd. Oxford, UK, 1996.
- Belov, E. "For Those Starting Artistic Gymnastics". Translated material of the Canadian Gymnastic Federation. 1995.
- Blimkie, C.J.R and Marion, A. "Resistance Training during Preadolescence: Issues, Controversies and Recommendations". Coaches Report, Vol.1. No.4.1994.pp.10-14.
- Blimkie, C.J.R. and Bar-Or, O. "Trainability of Muscle Strength, Power and Endurance during Childhood". In. Bar-Or, O. ed., The Child and Adolescent Athlete. London: Blackwell Scientific Publications, 1996.
- Bloom, B. Developing Talent in Young People. New York: Ballantines, 1985.
- Bompa, T. From Childhood to Champion Athlete. Toronto. Veritas Publishing Inc. 1995 Bouchard, C., Malina, R.M., Perusse, L. 1997. Genetics of Fitness and Physical Performance. Champaign, IL: Human Kinetics.
- Calgary Health Region, 3 Cheers for the Early Years (2004). Snactivity box: Activities for promoting healthy eating and active living habits for young children. Retrieved November 22, 2004, from www.calgaryhealthdregion.ca/hecomm/nal/child/DaycareToolkit.pdf
- Canadian Child Care Federation. (2001). Supporting your child's physical activity (Resource Sheet #52). Retrieved November 22, 2004, from www.cfc-efc.ca/docs/cccf/rs052en.htm
- Dick, Frank W., Sports Training Principles, London, Lepus Books, 1985
- Docherty, D. Trainability and Performance of the Young Athlete. Victoria: University of Victoria, 1985.
- Dozois, E.. (2002, November). Calgary Health Region Daycare Project: Focus group report. Prepared for the Calgary Health Region's 3 Cheers for the Early Years. Calgary, AB: Calgary Health Region.
- Drabik, J. Children and Sport Training. Stadion, Island Pond, Vermont. 1996.
- Ericsson, K.A. and Charness, N. Expert Performance. Its Structure and Acquisition. American Psychologist, August 1994., pp. 725-747.
- Ericsson, K.A., Krampe, R.Th. and Tesch-Romer. The role of deliberate practice in the acquisition of expert performance. Psychological Review, 1993, 100. pp. 363-406.
- Lynn, M. A. T., & Staden, K. (2001, Fall). The obesity epidemic among children and adolescents. WellSpring 12 (2), 5-6.



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