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## COMMENTARY ON THE LONG TERM ATHLETE DEVELOPMENT MODEL FOR BRITISH SWIMMING AND THE MISINFORMATION IT PROPAGATES

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### Introduction

Occasionally in sports, a synthesis of the thoughts and beliefs pervading a sport is revealed. In 2003 that occurred for swimming in Great Britain, when a white paper that was intended to provide guidelines and directions to coaches and administrators was released. The impact of that set of directives was evaluated and published in the *International Journal of Sports Science and Coaching* (IJSSC; Lang & Light, 2010). While minor quirks and differences occur between the programming content of the major swimming nations, to a large extent, the British production is

representative of the international belief structures of swimming. For this discussion, the content of the plan produced by British Swimming and the added tenets that were included in the journal's commentary articles will be considered to represent the "*common*" thinking in swimming. This review and reactions illustrate the extent and duration of scientific inquiry that must have been ignored to develop the unfounded and misinformed beliefs that permeate competitive swimming coaching. It will focus on the coaching of pre-pubertal swimmers.

The Long Term Athlete Development model (LTAD) has been proposed and adopted (by Canada and Great Britain) as a sports-wide set of principles that are supposed to positively influence participation, the development of athletes, and the programming of training and competitive experiences. Such a national approach to sport development is not new for Canada. Its implementation in Great Britain has been underway for some time. Lang and Light (2010) do a great service by attempting to gauge the impact of this form of bureaucratic dictate. While the sample size of those interviewed by Lang and Light is not large, the combination of the reactions published in the *IJSSC* (Arellano, 2010; Greyson et al., 2010; Holt, 2010; Treffene, 2010) and the responses of the interviewees provides a good picture of the status of swimming dogma, theory, and science as well as the fundamental shortcomings of an approach to sport such as the LTAD.

The LTAD content discussed in the various articles is largely unscientific and non-reviewed. Much smacks of sporting "*folk lore*" (hereafter referred to as "*lore*"), a compendium of beliefs unfounded in fact, and puzzling logic. As such, the combination of true and many false premises leads to an overwhelming set of false conclusions. In the administration of ill-conceived models of this type, the evaluation of users and overall impacts is rarely undertaken. The courageous writings of the authors of this set of articles surrounding the LTAD model and the even more commendable publication of those articles in the *IJSSC* provides a seldom seen forum for understanding and evaluating such a sweeping and expensive attempt to guide sporting development.

The production of a worthwhile model for guiding all sports would be, to all intents and purposes, an impossible task. When one considers the many different sports that are recognized by governments and have international federations, the attempt to treat sport as an homogeneous social enterprise is at best, baffling. Canada has had a penchant for developing government-centered control models for sports (e.g., the belated and ill-fated Game Plan '76; the institution of coaching certification of various levels of expertise and generality/specificity; the advocacy of administrative tools that required at least quadrennial plans for sports at the provincial and national levels (starting in the late 1970s); and this latest machination – the LTAD). Canada's failure to recapture its era of accomplishment (1978-1984<sup>1</sup>) through governmental "*guidance*" (a requirement for funding) casts doubt on the value of such enterprises. That Great Britain has followed suit in several sports without an in-depth evaluation of such program approaches should be of concern. One could continue at length about the processes of governmental, administrative, and centralized programs and their troublesome expense to effectiveness ratio, but that would not serve the purpose of this consideration that is limited to British Swimming. Suffice it to say, there are several weaknesses of the LTAD model and its postulation for swimming.

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<sup>1</sup> Canada's performance at the 2010 Winter Olympic Games was outstanding and very admirable and a welcome respite from past Olympic and Commonwealth Games results.

1. The model is primarily the proposal of a single individual (Balyi, 1990). It is based on a mix of research, popular non-refereed theories, and dogma associated with sports training that has many roots in the bygone era of Eastern Bloc sports programs.
2. The proposal that "*one model [the LTAD model] fits all*" sports, is preposterous. There are as many sports with great differences as there are schools of philosophical thought, psychological practice, fields of science, etc. To think that chess, track and field, ballroom dancing, synchronized swimming, competitive rock-climbing, ice-hockey, and sport-parachuting have much in common that spans the lives of potential participants boggles the mind.
3. The reliance on chronological ages as being the time-points of interest is contrary to the Principle of Individuality (Rushall & Pyke, 1991) which orients to maturational ages as being the better developmental stages for proposing programs of athlete development.
4. Unfortunately, sport knowledge is comprised of a mix of opinions, dogma, and to a lesser extent acceptable sports science. That combination largely leads to false conclusions; statements that are often proposed as the principles of guidance for coaches and participants. This feature in the LTAD is embedded in the quote from Gordon (2006):

*It is core to all we do; It is swimmer centered; It provides a clear pathway based on sound principles of growth and development; It provides a simple framework for all swimming providers and implementers; It provides guidelines for success on the world stage; It is central to the re-engineering of coach education and; You can't argue with it!!*

In the scientific literature of growth and development, there is much refereed research that warrants arguing against the underlying postulates of the LTAD and that in evidence-based fact, are wrong. It is this realm in particular, that the group of articles published in the *IJSSC* are considered in this discussion.

5. A strong case can be made, although it is seldom done, that there are scientific facts associated with exercise that differentiate children, adolescents, and adults, the latter two also differentiated by gender. The *Coaching Science Abstracts* (<http://coachsci.sdsu.edu/>) logs a considerable number of works under those classifications. There really is no excuse for persons responsible for planning and implementing exercise programs for groups and individuals not knowing the subset of specific features that are appropriate for the target group. In this presentation, some of the specific knowledges that are often ignored or unknown about children in swimming are discussed at some length to illustrate this very common shortcoming. If they were considered, the LTAD for swimming would take a very different tact particularly in its early stages.

It is not the intention of this article to comment on every arguable proposition in the articles of note. Rather, it aims to provide a sampling of evidence-based items that should influence thinking rather than beliefs and lore.<sup>2</sup> The scope of considerations will be restricted to some aspects of competitive swimming. It is the belief of this writer that there is sufficient evidenced-

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<sup>2</sup> For this commentary, beliefs are considered to be statements by individuals that are not based in facts, but may be based on a subjective selection of experiences. Lore is that statement of a concept that has been adopted unquestioningly by individuals and serves as the dogma of one or more sports (much in the same way that the dogma of religions produces many "*believable*" postulates, the majority of which are contradictory or incompatible).

based scientific information that covers all aspects of swimming training and development. It should not be necessary to go beyond objective facts to formulate long-and short-term plans for the sport and its participants. It is with that opinion as background that other beliefs in swimming will be considered and largely criticized.

[Throughout these reactions, this writer makes some sweeping statements that are not fully documented. However, the areas touched upon are fully documented with scientific references in Rushall (in preparation).]

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## LONG TERM ATHLETE DEVELOPMENT MODEL FOR BRITISH SWIMMING IS A RECIPE FOR CONFUSION

Lang, M., & Light, R. (2010). Interpreting and implementing the long term athlete development model: English swimming coaches' views on the (swimming) LTAD in practice. *International Journal of Sports Science and Coaching*, 5(3), 389-402.

This article reviews the Long Term Athlete Development (LTAD) model that represents a sports-wide set of principles that significantly influences national sports policy in England [and Canada]. An evaluation is made of how British Swimming adapted the model and how it is perceived by a limited number of swimming coaches in England (six elite and five non-elite coaches).

[Editor's Note: Categorical statements are made in this abstract/commentary with the claim of being supported by scientific works but those works are not fully referenced in this abstract or subsequent abstracts of other articles concerning this topic. The full disclosure of the confirmatory science is included in the second edition of the e-book *Swimming Pedagogy and a Curriculum for Stroke Development* by Brent S. Rushall.]

Two general concerns were revealed:

1. British Swimming's (the Amateur Swimming Association) regulations governing competitions are viewed as being contradictory to the implications of the LTAD.
2. There was an overemphasis on training volumes [a physiological emphasis] leading to a neglect of technique work [although it is included in the early stages of the model].

As was opined by other reviewers of this article, the bases of the LTAD were viewed as the singular opinions and writings of Istvan Balyi (1990), which contains some science, anecdotal stories and beliefs, and general dogma that conveys a sense of originating in the lore of Eastern Europe pre-1990. As well, more popular dogma and beliefs that pervade swimming at the turn of the century are also infused into the model.

Contrary to what is known, Balyi and the originators of the British LTAD specify skill learning as being worthy of emphasis in the pre-pubertal years with an adjustment for gender. Such a stipulation is incomplete. There are no data-based publications by experts who note chronological age differences in initial skill learning between the genders. Additionally, there is no mention of the post-pubertal male period of accelerated skill learning. The emphasis on skill learning is incorrectly limited and incomplete.

As a typical example of the appeal to unsubstantiated beliefs is the notion that it takes 10 years or 10,000 hours of deliberate practice to excel (the "*theoretical framework*" of Ericsson et al., 1993, 1994). Such a concept is too restrictive when it is applied to large diverse populations. It fails to take into account the extreme variation in ages of success at the highest levels of swimming that are currently and historically evident, as well as failing to accommodate the different demands between sports for sport-specific skills, psychological, and physiological development.

The LTAD includes the following incorrect implications.

1. Non-swimming training (e.g., complementary sports, strength work) has benefits for serious swimmers [scientific studies show they do not].

2. Aerobic and anaerobic systems are discreet in exercise [they are not – the aerobic system is always working and works near and up to maximal capacity when anaerobic work is attempted].
3. The final swimming stage (when swimmers are mature) is when the greatest volume of training and participation are programmed [which contradicts the observation that training volumes begin to lessen if intensity is maintained after maturity is achieved in the late teen years].

As is pointed out often in article, the LTAD is focused on increasing training volumes throughout a swimmer's career. Apparently, the beliefs that "*more is better*" or "*miles make champions*" or a similar statement of implication is a pathway to Great Britain's swimming success. Why that should be true of British swimming and untrue for US swimming is mystifying. Sokolovas (2000) conducted a study on better-performing US Olympic Trials (2000) swimmers. Swimming improvement over the just-completed year was correlated to a number of training factors. The following were found.

- *Female sprinters* (N = 23). The age of starting year-round swimming was positively correlated ( $r = .442$ ). The number of hours of dryland training per week was negatively correlated ( $r = -.438$ ), suggesting that the more dryland work performed, the less likely is performance improvement.
- *Female distance swimmers* (N = 11). Average yardage per week was positively correlated ( $r = .528$ ).
- *Male sprinters* (N = 22). Hours spent swimming per week was negatively correlated ( $r = -.376$ ) as was yardage per week ( $r = -.365$ ). This suggests that requiring male sprinters to swim excessively will reduce improvement potential.
- *Male distance swimmers* (N = 16). No factors were correlated significantly with improvement. The sizes of the correlation coefficients were markedly small.

These figures suggest that aspects of the "*excessive work ethic*" commonly required of swimmers by coaches [and suggested in the LTAD] is detrimental to improvements in sprinters of both genders and only related through one factor (yardage/wk) in female distance swimmers. The demands of time spent swimming and work volume do not seem to be related to improvement in swimmers in general. This is in agreement with previous work by Costill (1986) that showed individuals adapt positively with work volume increases up to a certain level and from there on no further improvements occur. Generally, the sizes of significant correlation coefficients were modest at best suggesting that training factors bear only a weak relationship to swimming improvement. [That suggests the core stipulations of the LTAD focus on a minor set of factors making performance improvements hard to attain. It would have been better for the LTAD to have focused on the features of swimming excellence (e.g., technique and psychology) throughout swimmers' careers]

*The Swimming Pathway* (British Swimming's LTAD) is structured as follows:

1. FUNDamentals (boys aged 6-9 and girls aged 5-8).
2. Learning to Train (boys aged 9-12 and girls 8-11).
3. Training to Train (boys aged 12-15 and girls aged 11-14).
4. Training to complete (males aged 15-18 and females aged 14-16).
5. Training to Win (males aged 18 and over and females aged 16 and over);
6. Retirement/Retention.

Stroke technique is to be emphasized in the first two stages. However, the overall model fails to interpret physiological growth and development and the capacities to perform of each gender and the various age-groups. Overall, each stage increases the volume and commitment to pool attendance. The highest volumes and participation are recommended for fully mature individuals [signaling the belief that more and harder training will improve a swimmer's "engine" further, despite such entities having reached their finite levels with the cessation of growth/maturation]. At much greater length, it is possible to show many false premises involved in the structure of the model. There is scientific evidence that contradicts a substantial number of the beliefs that have been infused into the LTAD (some of the more obvious ones were highlighted by Lang and Light). The model includes a "volume emphasis" which is passé and has been replaced by the recognition that intensity training, particularly race-pace interval work, is much more appropriate and beneficial for serious swimmers' performances.

The regulations of British Swimming are rightfully criticized as promoting excessive training [for 200 m races] while "protecting" young swimmers from supposedly welfare-threatening 50 and 100 m races. The reasons for such a decision must be based in beliefs and lore for they in no way reflect the knowledge-base of human growth and development as it pertains to exercise. Balyi's comment: "*Overemphasizing competition in the early phases of training will always cause shortcomings in athletic abilities later in an athlete's career*" (Balyi & Hamilton, 2004, p. 4) displays the restricted dogma that underlies sport planning of that singular source. Contrary to popular misconceptions, children and young teens are particularly adept at diffusing situations that to adults appear to be very stressful (e.g., they recover quickly from grief; the length of time that problems are considered is relatively short, etc.) and can be taught how to enjoy swimming competitions (Rushall, 1994). The adult fear of children competing in swimming races is only appropriate if children are not coached with methods appropriate for their age-group, and as was pointed out by Holt (2010) are not taught the appropriate mental skills for coping with competitions and the sport.

Overall, there is very little true research that is cited as justification for the structure and recommendations of the LTAD. Because of the preponderance of dogma and ill-formed beliefs in the LTAD, it would seem that a general approach to do the opposite of what is recommended would be a better coaching strategy for competitive swimming.

The responses of the interviewed coaches are generally critical of the LTAD, particularly its emphasis on developing a swimmer's "engine" (Istvan Balyi in Gordon, 2004). Its physiology/conditioning-centric approach to swimming is losing its appeal because of three reasons: 1) the scientific literature contradicts many of the popular beliefs/misconceptions (Rushall, September 12, 2009) that have led to incorrect/irrelevant training content; 2) the development of physiological factors is maturationally and inherently limited; and 3) at the higher competitive levels, physiological factors do not differentiate competitive rankings. However, the entrenched practices of swimming training keep emerging in the study respondents' comments. It appears that swimmers have to swim for the full period of allotted pool time [to meet the need for volume] to the extent that technique cannot be taught. Alternatives for instruction are available (Rushall, 2006). It is possible that dividing practice time into an instructional period to teach technique (possibly for half the practice session) and following that with repeated instruction while performing sane and valid interval swimming could lead to better experiences for swimmers. Such a structure would decrease the volume of

swimming but mainly by removing the irrelevant/senseless swimming "sets" that are commonplace in pools almost everywhere.

While a plea is made for opportunities to teach technique to young swimmers, the paucity of knowledge about the scientific principles involving skills is notable. The major factor concerning skill that should be embraced in sport in general is that skills/technique can always be improved across the normal range of competitive ages. Technique work is just as important with the oldest swimmers as it is with the youngest swimmers. A case can be made that technique is more important than conditioning with older swimmers because it is the factor that best differentiates successful from unsuccessful elite swimmers (Cappaert et al., 1996a; Cappaert et al., 1996b; Dutto & Cappaert, 1994; D'Acquisto et al., 2004; Millet et al., 2002). An emphasis on developing technique that is race-pace specific should be included in all LTAD substructures.

A further case can be made for emphasizing technique throughout a swimmer's career. For a long time, physiological tests were promoted as being important indicators of swimming potential. Unfortunately, the statistics supporting such an advocacy were weak and often equivocal. The feature that does lend some testing value is propelling efficiency, essentially the most efficient use of a swimmer's physical resources for particular velocities of swimming (Chatard et al., 1990; D'Acquisto et al., 2003; D'Acquisto et al., 2004; Toussaint et al., 1990). Swimming efficiency is technique dependent. As techniques improve, so do swimming performances [at all levels of swimming].

Another implied assumption that underlies some of the thinking about the LTAD, and in particular prepubescent children, is that early success does not lead to later success. There are statistics that show successful 10 and under swimmers mostly do not go on to have successful careers. It can be strongly argued that early success is not the cause of later failures and drop-outs. There are many more influential factors that affect motivation and the desire to participate in swimming that restrict the longevity of successful young swimmers in the sport.

The overall LTAD is based on chronological age. Maturation age largely determines the success of young swimmers and causes termination of participation if later-maturers, who have been making up for their growth deficiency by employing better techniques, eventually grow to have equivalent physiological capacities along with their superior techniques supplant the success status. No machinations of programming or planning will remove or cancel the problems that are caused by advanced maturation in both genders in chronological age-groups.

Toward the end of the article, Lang and Light draw attention to a long-term program devised by Australia (Australian Swimming Inc., June, 1996) and compared it to the British LTAD. Both systems suffer the same weaknesses and faults (Lang & Light, p. 400).

**Implication.** Lang and Light do swimming a great service by producing this article. It exposes many weaknesses in both the process and product of top-down directives for sport training. They opined that their "*study points toward the challenges involved in the process of adapting a general model for athlete development to specific sports*".

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## SWIMMING LORE AND MISINFORMATION IS STILL VERY PREVALENT IN HIGH LEVELS OF THE SPORT

Greyson, I., Kelly, S., Peyrebrune, M., & Furniss, B. (2010). Interpreting and implementing the long term athlete development model: English swimming coaches' views on the (swimming) LTAD in practice – A commentary. *International Journal of Sports Science and Coaching*, 5(3), 403-406.

This article is a reply commentary by "*swimming people*" to the Lang and Light (2010) article that was largely critical of British Swimming's Long Term Athlete Development (LTAD) model, *The Swimmer Pathway*. In many respects, it illustrates the dogma that is rampant in the sport. Contentious issues are discussed briefly below.

The first belief is that swimmers can only progress completely if they leave a "*smaller*" club and go on to "*a club that can provide more for them in the long term*" (p. 403). Bigger is not necessarily better. Decisions on the best situation for a talented young swimmer should involve many more factors than club size. Perhaps the best argument against the belief expressed by these authors is to use the example of the Australian Institute of Sport, which over the years has recruited many talented swimmers only to have them progress little, if at all, at huge expense. The switching of clubs is a recent phenomenon in several western countries and does not always guarantee improvement in performances. Examples of eventual long-term success by staying with one's original coach/club (e.g., Kieren Perkins, Ian Thorpe, Grant Hackett) can be weighed against examples of those who succeeded by moving to "elite coaches" and academies (particularly in the Australian state of Queensland). On this belief, the anecdotal evidence is equivocal at best.

The next belief that aerobic swimming is best for technique development is false. Slower than race-pace swimming (all aerobic-only swimming is slower than race-pace) develops techniques that are specific for slow swimming. The implication of the statement is that performing slow swimming with good technique for that velocity has something to do with swimming fast. *Slow-swimming techniques are not transferred to fast-swimming to any appreciable degree*. However, it is possible to structure interval training sets that are particularly aerobic while taxing some anaerobiosis that is recovered in rest intervals (known as "*ultra-short*" training and covered in depth in the *Coaching Science Abstracts* (Rushall, 2011)). As well, interval training promotes retention of stroke techniques better than does long or continuous training (Pelarigo et al., 2010). Usually, high-volume training has much swimming performed at irrelevant-for-competition paces. Technique work at slow paces is irrelevant for competitive performances because the technique requirements for both are different. There are other factors involved with slow swimming (e.g., it is disliked by many swimmers, particularly younger performers). The slowest swimming speed that is tolerable in productive swimming training programs is that performed at the anaerobic threshold level (Weltman et al., 2005) for 15 minutes (McMaster, Stoddard, & Duncan, 1989), because it leads to the fastest clearance of excessive lactate from the blood. Anaerobic threshold swimming is the most expedient form of recovery swimming.

A worthy statement was made concerning technique: "*At age-group levels, every swim should be focused on technique enhancement whatever the speed or distance of the swim*" (p 404). If technique is to be the major focus of swimming improvement, it needs to be presented according to sound pedagogical principles, something that is missing in the dialogues of the discussion about British Swimming's LTAD model. Unfortunately, many swimming coaches are not good

teachers because they do not follow sound teaching practices. While coaches endeavor to coach technique with general instructions, occasional personal directives, and usually a marked absence of feedback, specific technique changes are unlikely.

Another notable weakness in this response article is the lack of understanding of human physiology. The LTAD gives the semblance of the basic principles of human physiology as being:

- It comprises to a large extent two discrete systems – the aerobic and anaerobic systems. Much talk is given to aerobic training in the early stages of the LTAD with anaerobic work only being introduced at some mythical more appropriate stage.
- Swimming training can be structured to train both systems at any time in a swimmer's development without any age or gender factor needing to be considered.

Some of the more important features of human physiology that should be considered when programming short- and long-term involvements in sport [swimming] follow.

- Any form of exercise uses aerobic functioning. At no time in swimming events or training does anaerobic functioning occur without aerobic functioning also occurring (Rushall & Pyke, 1991).
- Maximum aerobic training, that is, that which trains a swimmer's capacity to function maximally in an aerobic manner, also involves anaerobic functioning. There is an overlap in the functioning of the two systems (Rushall & Pyke, 1991).
- After maturity is attained, attempts to improve aerobic functioning/capacity will not improve that factor (Rushall & Pyke, 1991).
- Little, if any, endurance training effects occur after eight weeks (Costill et al., 1991).
- Any form of exercise training is beneficial for untrained individuals; has little carry-over between sports for moderately fit performers; and when not specific to the sport of the serious swimmer, is likely to be detrimental to performance once general fitness has been maximized (Rushall, 2009).
- While humans are endowed with muscle structures of varying types, the two most mentioned ones in swimming circles are Type I (aerobic) and Type II (anaerobic) fibers. The anaerobic fibers can be converted to function aerobically but still use glycogen as fuel. The way the fibers respond to stressful exercise in adults is different to the undifferentiated response manner of prepubescent children (Mero, Jaakkola, & Komi, 1991; Prasad et al., 1995). It is incorrect to infer that the responses to types of training for fully-matured adult swimmers are similar for children. Evidence shows that children do not need to be restricted to aerobic-only [slow] swimming (Muller, Engel, & Ferrauti, 2009; Sperlich, Haegele, Heilemann, et al., 2009; Sperlich, Haegele, Achtzehn, et al., 2009).
- After puberty, the genders respond differently to swimming exercise stress (Bonifazi et al., 1993; Gravelle, & Blessing, 1995; Simmons, Tanner, & Stager, 2000). Fuel use (Braum et al., 1997; Esbjornsson, Bodin, & Jansson, 1995; Jarvis et al., 1997), fiber presence (Paradisis, Zacharogiannis, & Psycharakis, 2008), altitude (Fulco et al., 1997; Robergs et al., 1997), and physical characteristics (Hawley & Williams, 1991; Siders, Lukaski, & Bolonchuk, 1993) are three of the more common discriminatory features that require different training stimuli for the genders.

- Growth differences between the genders also require different training stimuli and emphases. Males go through two stages of accelerated skill development while females experience only one (Borms, 1986; Hewett, Myer, & Ford, 2002).
- The psychological structures of the adolescent and mature genders differ sufficiently to warrant discrete training programs, experiences, and coaching strategies (Rushall, Jamieson, & Talbot, 1976; Rushall, 1994).
- Past histories of swimming performances show that young swimmers are capable of world-best performances and need not necessarily wait until they are in their very late teens or early twenties to strive for that performance level. Adherence to the recommendations of the LTAD could unnecessarily delay the achievement paths of swimmers, causing some to drop out of the sport because signs of their "*potential*" are not fulfilled.

To ignore the differing capacities, needs, and training requirements of the different stages of maturation and the genders is to coach incorrectly a large number of swimmers. It is unacceptable to make the "*too difficult*" claim when offering a professional coaching service that is supposed to consider the welfare of young participants. The failure to recognize the individual needs of different swimmers to help them achieve their unique potentials is a shame.

Perhaps the misinformation patronized by the authors is best exemplified in their own words (p. 404):

*This shows a lack of understanding of the physiological aspects of [the] LTAD. To make solid the skills, aerobic swimming is a necessity and cannot be done anaerobically as the swimmers cannot maintain this level of swimming without the techniques becoming impaired [despite long slow swimming being less beneficial for technique development than interval training].*

*It is the long-term interest of both the swimmer and the coach to maximize the aerobic development in this period as the diaphragm and the thorax are at their peak growth rate . . . Too much anaerobic type training at this stage will result in a reduction of the swimmer's potential to be a successful senior swimmer.*

There are no published evidence-based refereed articles that support any of the implications of the above quotes [although inspiratory and expiratory respiratory muscle training appears to have some promise for improving performances in some individuals]. Contradictory researches do exist (see Borms' (1986) review).

The 10,000 hour notion of being the requirement for attaining excellence in races is stated as being a "*rule*" (p. 404) despite there being no acceptable evidence supporting the concept. This is an example of elevating an idea to the status of a "*rule*" [law] without confirmation of truth, a common event in swimming coaching. There are so many examples of world-best performers achieving well before and well after such a number that the postulation is best deemed to be false. When it is used to assert arguments in conjunction with other false premises, it should be easy to understand how the lore of swimming is expanding.

Belief-based postulations continue:

*At a certain point, just training five evenings per week will not be enough to keep pace with rivals (p. 405).*

The adherence to absolute values for every swimmer is dangerous because it contains much error in its generality. Adaptation to exercise stress is determined by the provision of overload and recovery (Rushall & Pyke, 1991). With the wide variation in individual capacities and abilities, only when work and rest are applied judiciously and individually will the needs of every swimmer be accommodated. It is highly likely that the "*absolute value*" approach to discussing training needs will harm as many swimmers as it will assist (see Howat & Robson, 1992). Such an approach is both unconscionable (but overwhelmingly ignored) and unprofessional.

Toward the end of the article, there appears to be a contradiction to the tone of the generality of training factors described earlier. It is heartening to read:

*Coaches are advised to treat the swimmers as individuals. This will increase the chances that the swimmer stays in the sport for [sic] longer (p. 405).*

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## **RACE-PACE WORK AND JUDICIOUS WORK AND RECOVERY SETS SHOULD GOVERN THE PROGRAMMING OF TRAINING SETS**

Treffene, B. (2010). Interpreting and implementing the long term athlete development model: English swimming coaches' views on the (swimming) LTAD in practice – A commentary. *International Journal of Sports Science and Coaching*, 5(3), 407-412.

Dr. Treffene has been involved with the physiological aspects of swimming since the mid-1970's. During that time, he has displayed a narrow focus on some factors and measures of physiology. In his reply article, although still narrowly focused, he does extend the implications of his acquaintance with high-level swimmers and their physiologies and offers some laudable advice.

His first important statement reflects the trend in elite swimming that has been growing noticeably since ~2004 [which is after the LTAD was formed].

*In the past there has been an over-importance placed on total distance in a weekly program as opposed to a logic behind what is done at speed and the necessary amount of low-level recovery and stroke work which in the main, generates a lower total volume (p. 407).*

This statement highlights the training needs of: 1) relevant-for-racing fast swimming as the stimulus for training overload; 2) the structuring of training around overload and recovery rather than some arbitrary volume/distance; and 3) the rejection of the still evident incorrect focus on total training volume.

The second observation that skills can be developed virtually at any age, as opposed to the LTAD implication that it is mainly between the ages of 8-12 years, is supported by principles of motor learning and many anecdotes. One could read further into this differing opinion, the implication being that technique should always be a focus of any swimming training [this position is supported by the reaction article of Professor Raul Arellano (Arellano, 2010)]. What is not learned in the pre-12 years can still be developed later in a swimmer's career although it might not be as easily adopted as in those very adaptive years.

Other statements that criticize the LTAD and are in concert with research findings (Rushall, in press) are as follows:

*. . . I strongly disagree with Balyi when he advocates predominantly high-volume, low-intensity workloads.*

*Why penalize and ignore the athletes who are born with a high percentage of fast fibers by minimizing the sprint 50 m and 100 m events at national age-group swimming championships and also the training that will optimize their potential? This goes against all we know about muscle physiology and its restricted potential for change (p. 408).*

Unfortunately, the author regresses into narrow-physiology and attempts to suggest coaching procedures at the expense of the interaction of the factors suggested with many other, often discipline-different factors that govern performance. However, within the narrow focus is one recommendation that is worthy of adoption, and is in accord with modern research into high-intensity training at all ages.

*Need for the training to be specific for the swimmer's event and the efficiency of the stroke to be developed at competitive speeds.*

. . . Swimmers should rigorously and frequently train at the pace in which they are to compete to overload the race's requirements and therefore, initiate improvements (p. 409).

One further recommendation that could be misinterpreted is:

*Conserve red and white fiber glycogen in sets and sessions outside the major sets.*

*70% of work to be done in the fat metabolism area of training (p. 410).*

The implication of this recommendation is that training sessions should include important sets that specifically prepare swimmers for their races [a variety of paces prompting different sets makes for relevant and interesting training sessions]. Those sets are interspersed with much lower-effort recovery sets, which take more training time to complete. Thus, a training session comprises relevant-to-racing specific training and recovery swimming. However, the article's recommendation of absolute rest periods between different types of specific-stimulus work [largely based on heart rates which is a very dubious procedure] thwarts the important implications of specific and recovery swimming sets in training sessions.

The final recommendations for improving the structure of the LTAD are too focused on restricted, and somewhat contentious, physiological variables and concepts. The weakness of proposing absolute values (e.g., times, durations, frequencies) that violate the Principle of Individuality (Rushall & Pyke, 1991) leads to the reader being warned that those values are dubious and should not be adopted literally.

[It is heartening to read some refreshing advocacies by Dr. Treffene. However, the mix of some sound advice and very restricted interpretations of limited concepts and contentious factors (heart rate and lactate tests) provides an unfortunately muddled article.]

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## TECHNIQUE IS UNDER-EMPHASIZED OR IGNORED IN LONG-TERM DEVELOPMENT MODELS OF COMPETITIVE SWIMMING

Arellano, R. (2010). Interpreting and implementing the long term athlete development model: English swimming coaches' views on the (swimming) LTAD in practice – A commentary. *International Journal of Sports Science and Coaching*, 5(3), 413-419.

Professor Arellano compares a number of long-term development plans (USA male sprinters and distance swimmers; LTAD minimum and maximum values; Russian male model (1988)) as a way of evaluating what is proposed in British Swimming's LTAD. He shows a lack of consensus of volumes of training per age-group between the models. If the British LTAD was based on sound principles of growth and development (Gordon, 2006), then it is reasonable to assert the other models were not based on the same principles because of their differences. It is hard to believe that if universal principles were used by Great Britain that the other countries would misinterpret, distort, or ignore them to arrive at very different implications for work volumes. It is reasonable to assume that the decisions for the different models were based on different premises, probably of a dogmatic nature rather than on objective science.

A strong point is made that given the current condition of young age-group programs [at least in the USA], only a small proportion (~10%) of high-achievers carry through to be high-achievers at the senior level. The underlying implication of this is that it should be more than slow technique-work (as commonly advocated) that should be provided for the early age-groups of competitive swimming. Technique and psychological factors (e.g., motivation, mental skills, social-bonding) should be of greater emphasis than "engine-work" (conditioning). The difficulty of retaining high-achievers permeates all age-groups indicating that the overall swimming experience is usually one that does not retain young people with swimming talent.

Professor Arellano is one of the world's foremost authorities on aquatic biomechanics. While one might charge his advocacy as being "biased" that would be incorrect. His work and understanding of aquatics, including competitive swimming is largely beyond criticism. Given that status, he points out that in a number of nations, early technique emphases are lost or disregarded as participation covers several years. The later-years models fail to mention technique and focus on physical conditioning. Given the now understood impotency of conditioning as an avenue for swimming performance improvement in later age-groups and senior years, it is no wonder that improvements in performance are usually absent or minuscule in the senior ranks. Professor Arellano has produced a Spanish-language book that illustrates swimming experiences and activities that continually develop technique and familiarity aspects of competitive swimming. It is those activities that should be central to competitive swimming training, not a dubious set of "*physiological principles*".

A major difficulty with modern competitive swimming is explained:

*I have been concerned about the lack of consideration shown by the training plans (long-term and short-term) to technique development. Swimming drills ["loads"] are included, but not quantified or differentiated from the physiological water exercises. A similar situation is observed in LTAD models; that is, they describe the technique development in an imprecise manner and fail to illustrate different procedures to train and evaluate progress. The early performances obtained by young swimmers in most countries are based on overload rather than skill development programmes that induce low rates of participation of early, top-*

*ranked, age-group swimmers in long-term elite swimming. Experts must pay serious attention to correct this fundamental error in LTAD models (p. 418).*

**Reference**

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## PSYCHOLOGY IS NEGLECTED IN LTAD MODELS

Holt, N. L. (2010). Interpreting and implementing the long term athlete development model: English swimming coaches' views on the (swimming) LTAD in practice – A commentary. *International Journal of Sports Science and Coaching*, 5(3), 421-424.

Professor Holt rightfully considers LTAD models to have two diverse goals: to improve sport performance and sport participation (p. 421). Unfortunately, there are obvious weaknesses that underlie the inclusions in LTAD models, including that of British Swimming.

A principle weakness of the LTAD model is that it is based on both anecdotal and empirical evidence. Thus, it becomes a mix of dogma (or "swimming folklore") and scientific fact. That leads to a very dubious structure that will not achieve that for which it is intended. A glaring weakness is the absence of references to psychological factors in the swimming experience.

There is a considerable accumulation of sport-psychology research [much of which is descriptive or explanatory] but guidance for coaches as to how to implement psychological experiences or develop appropriate mental skills is lacking in the field. What is needed is "*evidence to guide practice in terms of which psychological skills should be taught to young athletes, how to teach them, and when to teach them*" (pp. 422-423). Clearly, psychological principles and their implementation when coaching swimming is lacking.

[Rushall (2003) offers a detailed set of mental skills exercises for inclusion in coaching programs. The exercises cover the general topics of a) establishing attitudinal and motivation behaviors, b) important skills, c) competition psychology, d) long-term orientation, and e) group orientation. No LTAD has adopted any structure of this form let alone this particular set of coach-implementable exercises as part of a sport-specific training program.]

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