

## Revising the Definition of Periodization: Merging Historical Principles with Modern Concern

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### The Power of Sport

Building and sustaining excellence is arguably a primary objective for any country competing in international elite sport. While Araujo and colleagues (Araujo, 2007) state the concept of sporting excellence is not clearly defined, it can be posited that excellence within high-performance sport is the ability of a nation to chronically produce an abundance of podium-ranking performances as the result of a multi-faceted, elite-athlete development program. This is significant as many nations consider athletic success a marker of their country's political, economic, and militaristic position on the global scale. Yessis reminds us that some nations have considered international sport a war without employing the tools of war (Yessis & Trubo, 1988). This particular attitude and belief is amplified during the Olympic Games, where nations vie for dominance of the medal count over a two-week period of competition across a variety of sporting disciplines.

Within the Olympic Movement, the primary goal of the United States Olympic Committee is to help American athletes achieve sustained, competitive, excellence and increase medal opportunities for Team USA. This objective is only achievable through competitive success in a vast array of sporting disciplines. As such, the athletes representing the U.S. must be sent into Olympic competition at peak physical readiness. For this reason, sport performance professionals and coaches alike must adopt training theories and practices that will optimize competitive preparedness.

Performance professionals in the field of high-level competitive sports, such as the Olympic setting, are faced with the challenge of enhancing the preparedness of athletes who are already considered the “best” in their respective sport. However, small improvements in an elite athlete's performance capabilities are vital for the continuation of competitive success. Even in the Olympic Games, these marginal improvements are considered valuable, as the difference between a podium finish or not can be less than one percent in sports such swimming, track & field, weightlifting, and bobsled (Mujika & Padilla, 2003).

### The Periodization Paradox

In order to ensure athlete preparedness in the high performance sport setting, strength and conditioning professionals employ many types of periodization. To date, periodization has evolved in practice, while the current pool of definitions has maintained traditional constructs. Even though an abundance of literature emphasizing the utilization of periodization training models in the development of athletic performance exists, some sport science professionals have called for extensive research to determine which methods are most appropriate for elite athletes given updated knowledge in regards to individualized, physiological responses to training (Bompa, 1999, Bompa & Haff, 2009, Fleck, 1999, Haff & Haff, 2012, Kraemer & Fleck, 2007,

Kraemer & Hakkinen, 2002, Plisk & Stone, 2003, Schiötz et al, 2002, Stone, O'Bryant & Garhammer, 1981, Stone et al., 1999, Stone et al., 1999, Stone & Stone, 2008, Wathen, Baechle & Earle, 2000, Zatsiorsky & Kraemer, 2006).

Specifically, John Kiely challenges our current thoughts on periodization in his article *Periodization Paradigms in the 21st Century: Evidence-led or Tradition-driven*. Within this thought-provoking piece, the author questions periodization philosophies' assimilation of advances in scientific insight – do practitioners understand the role of individual variation in response to training, or do they assume that biological adaptations to training are predictable and determinable without regard to scientific rigor (Kiely, 2012)? As Kiely states, the field is becoming “disconnected from contemporary scientific practice.” The article suggests it is essential for practitioners within this field to maintain knowledge of current scientific literature in order to continue the evolution of training theory as it relates to athletic development.

Second, there is a call for a clear and unbiased assessment of what biological adaptations occur throughout the training process, in addition to a description of the science behind choices made in the planning stages. Kiely advocates unbiased analysis of a program that considers both performance successes and failures. The author indicates the assessment of a periodized training program can only be done through the employment of critical thinking. This reflective process should be clear of feelings and assumptions and should be guided by “evidence contextualized against conceptual understanding.”

Finally, Kiely asks if we – as sport performance professionals – employ training systems based upon presumptions, or if we reinforce our planning choices with updated scientific understanding of biological processes? While the question posed to the field of sport science is timely and valid, the author points out most of the current research and literature continues to focus on the efficacy of one training plan over another (Apel, Lacey & Kell, 2011, Brown, 2001, Buford et al., 2007, Fleck, 1999, Fröhlich, Emrich & Schmidbleicher, 2010, Bowerman & Freeman, 1991, Hoffman et al., 2009, Issurin, 2008, Issurin, 2010, Jiménez, 2009, Johnson et al, 2011, Kerksick et al., 2007, Lewing et al., 2010, Mann, Thyfault, Ivey & Sayers, 2010, McNamara & Stearne, 2010, Miranda et. al., 2011, Monteiro et. al., 2009, Painter et. al., 2011, Painter et. al., 2012, Prestes et al., 2009, Prestes et al., 2009, Rhea et al., 2002, Rhea et al., 2003, Rhea et al., 2002, Simão et al., 2012). While evaluation of various training protocols is important, the purpose of this article is not to add to the ongoing discussion on various periodization strategies, but to propose an updated definition of periodization that fills in the gaps apparent made by Kiely.

Although a portion of the sport performance profession may disagree with Kiely on his assertion that many of the periodization studies to date are based on dogma or archaic beliefs regarding the implementation of periodization strategies, we can acknowledge that Kiely may be correct in his statement that a universally accepted definition of periodization does not exist. Furthermore, no currently accepted definition of periodization implicitly states the planning process should be guided by scientific rigor and based on individual responses made apparent through athlete monitoring. While some sport performance professionals can argue that this goes without saying, it should not be inferred or assumed that practitioners are up-to-date on – or base their decisions on – the ever-evolving scientific literature. For this reason, a revised definition of periodization should concretely state the need for consistent monitoring and reevaluation of the scientific literature to ensure optimal adaptation and progress in development of an athlete in the high-performance setting.

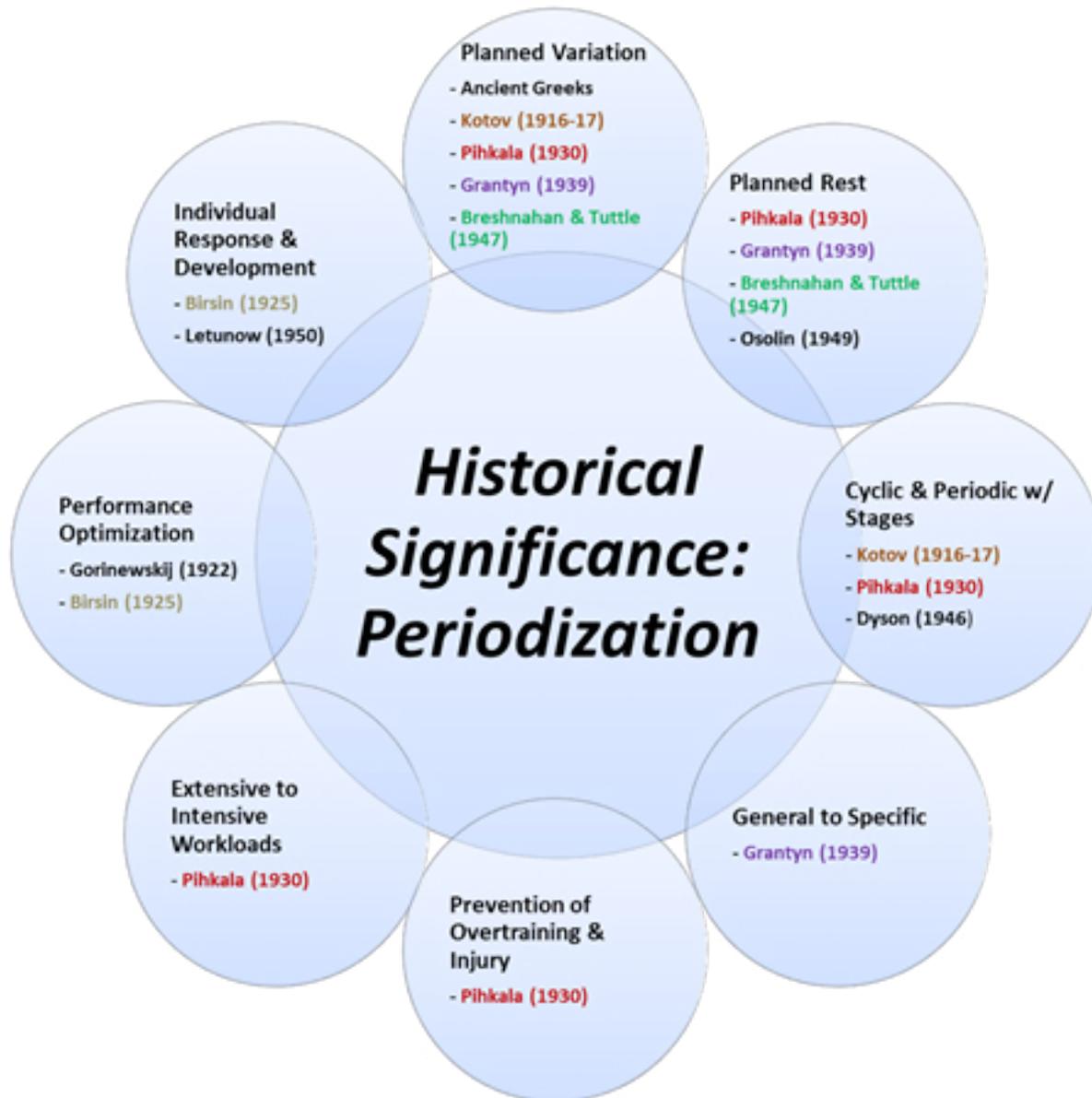
## Periodization: A Stagnant Definition

The founding constructs of periodization can be traced back to ancient Greece (Konig, 2005). As Pedemonte explains however, periodization of training plans did not become important until the early 20th century. This sudden shift in program design was the result of an increased number of athletes taking part in year-long training (Pedemonte, 1986a). Of note, one of the first documented texts regarding long-term, segmented training was Kotov's 1916-1917 publication, *Olympic Sport*. Specifically, Kotov introduced the strategy of dividing a training period into general, preparatory, and specific stages (Pedemonte, 1986a). This was a landmark deviation from the previously accepted opinion that athletes should limit training to eight to ten weeks prior to competition in order to prevent burnout or physical harm. For the next few decades, the underpinnings of modern periodization developed through the work of sport-focused authors such as Pihkala Mang, Dyson, and Osolin. While a detailed, historical account of periodization is beyond the scope of this article, Diagram 1 provides insight into the contributions made by the aforementioned authors. Specifically, Diagram 1 is a generalized overview of how the originating thoughts of periodization developed to become a single definition. Of interest, this diagram demonstrates how each author's individual examinations and "laws" of training manifested into what are now considered "modern-day tenets."



*Paige McPherson of Team USA celebrates Bronze medal Taekwondo win in London. Photographer: Hannah Johnston, Getty Images*

Diagram 1. Founding Constructs of Modern-Day Periodization



To date, many of the current thoughts on periodization strategies and practices are based on the work of Leo Pavlovic Matveyev, who is considered the father of modern-training periodization. Within his text, *Fundamentals of Sports Training*, Matveyev provides detailed insight into how periodization is the process of governing the training process through objective laws and principles (Pedemonte, 1986b). Specifically, Matveyev (1977) states:

*“The integrity of the training process is ensured on the basis of a definite structure which is a relatively stable order of uniting its components (parts, aspects, and links), their regular correlation with each other, and their general consequent character.*

*“If we concretise this definition with the help of the notions discussed earlier, we can say that the structure of the training session is characterised in particular by the following: a rational order of the interaction of various aspects of the content of an athlete’s training (components of the general and special physical training, physical and technical training, etc.); the necessary correlations of parameters of the training loads (quantitative characteristics of the volume and intensity of training work), as well as by the training and competitive loads; a definite sequence of different links of the training process (separate sessions and their parts, stages, periods, and cycles) which are the phases or stages of the given process, expressing regular changes in time” (p. 245).*

In addition, Matveyev noted that early adopters of periodization based their training decisions on both the competition calendar and the climatic conditions. He rejects this initial dogma, however, and asserts that the periodization of the training process must be attributed to the development of sporting form. Matveyev (1977) supports this shift in ideology by establishing a concrete definition of sporting form, that reads:

*“A state of optimum (best) readiness of the athlete for achieving sporting result which is acquired under definite conditions in each big training cycle (annual or semiannual). It is characterized by a complex of physiological, medical-control, and psychological indices. On the whole, sporting form is a harmonious unity of all the aspects (components) of the athlete’s optimum readiness: physical, psychic, technical, and tactical” (p. 260).*

While Matveyev provided great insight into the intricate details of the training process, most of the currently accepted definitions of periodization continue to follow the principles set forth in his text, regardless of recent infusion of science and technology in the development of the modern athlete. Moreover, many of these definitions are strikingly similar to those proposed by earlier adopters of periodization such as Pihkala (Pedemonte, 1986a). To date, one of the most comprehensive definitions of periodization is that of Plisk & Stone (2003), which is detailed in Table 1. While this detailed definition proposes that planning choices be based on an athlete’s biological responses to training stimuli, developmental status and the specific demands of his or her sport, it does not represent modern concerns made apparent by Kiely and others. Specifically, the definitions listed in Table 1 lack the explicit terminology that emphasizes periodization strategies be based on an individual’s physiological, biochemical, and psychological responses made apparent through the utilization of an athlete-monitoring program and ongoing study of scientific literature. This missing component to the definition of periodization is not a failure of modern-day sport scientists, but rather a demonstration of how quickly sport has evolved. In other words, we as practitioners are having to keep up-to-date with the sudden influx of valid and useful technology and evolving scientific evidence that has entered the sporting arena. As a result, the definition of periodization should be revised in order to align historical principles with modern advances. This fundamental shift in how we define periodization

**Table 1. Proposed definitions of periodization following the work of Matveyev.**

<b>Authors</b>	<b>Year</b>	<b>Definition</b>
Doherty, K.	1980	Within all time segments – periods, phases, and cycles and sub-cycles; high levels of stress should be balanced by active rest – physically recuperative, mentally enjoyable, emotionally relaxed and the monotony of year-round training avoided by use of variety in every form.
Stone, MH., O'Bryant, HS., & Garhammer, J.	1981	The basic tenet of periodization is a shift from high volume and low intensity of training during the early season (preparation phase) to an emphasis on high intensity, but low volume of training (competition phase) during the late season. Technique training also increases during this latter part of the season. The competition phase is followed by a period of “active rest” during which the volume and intensity are both low and the athlete trains at a recreational level.
Stone, MH., & O'Bryant, HS.	1987	The concept of periodization, originally proposed by Matveyev in 1961, embodies and manipulates these basic training principles (frequency, duration, intensity, variation, specificity) in a manner that reduces the potential for overtraining and brings performance to optimum or peak levels.
Bowerman, WJ. & Freeman, WH.	1991	Dividing the training process into periods of time with different training emphases, goals, and lengths. Each period prepares the athlete for the next, a more advanced training period, until the athlete peaks at the most important competition of the year.
Kibler, WB., & Chandler, TJ.	1994	A plan for conditioning based on manipulation of the volume (frequency times duration) and intensity of the work an athlete does during various periods of an athletic season.
Zatsiorsky, VM	1995	A division of the training season into smaller and more manageable intervals (periods of training, mesocycles and microcycles) with the ultimate goal of reaching the best performance results during the primary competition(s) of the season.
Martin, DE. & Coe, PN.	1997	The specific time scale and format for all the various parts of a training plan. The training life of an athlete is a constant cycle of hard work, recovery, improvement in performance and brief layoff to permit another cycle to repeat.
Siff, MC. & Verkoshansky, YV.	1998	The overall long-term cyclic structuring of training and practice to maximize performance to coincide with important competitions.
Schiotz, MK., Potteiger, JA., Huntsinger, PG., & Denmark, DC.	1998	Periodization utilizes the theories of General Adaptation Syndrome, organizing training into cycles of undulating volume and intensity to achieve training objectives, prevent overtraining, and optimize performance.

<b>Authors</b>	<b>Year</b>	<b>Definition</b>
Bompa, TO	1999	A process of structuring training into phases.
Stone, MH., O'Bryant, HS., Schilling, BK., Johnson, RL., Piece, KC., Haff, GG., & Stone, M.	1999	A logical phasic method of manipulating training variables in order to increase the potential for achieving specific performance goals.
Fleck, SJ.	1999	Periodized strength training refers to varying the training program at regular time intervals in an attempt to bring about optimal gains in strength, power, motor performance, and/ or muscle hypertrophy.
Wathen, D., Baechle, TR. & Earle, RW.	2000	The varying or cycling of training specificity, intensity, and volume to achieve peak levels of conditioning. Planned variations of the program design variables associated with exercise help athletes avoid staleness and overtraining while encouraging continuous adaptations to progressively more demanding training stimuli.
Graham, J.	2002	The cycling of specificity, intensity, and volume of training to achieve peak levels of performance for the most important competitions.
Kraemer, W., & Hakkinen, K.	2002	Programmed variation in the training stimuli with the use of planned rest periods to augment recovery and restoration of an athlete's potential.
Plisk, SS. & Stone, MH.	2003	Planned distribution or variation in training methods and means on a cyclic or periodic basis. The basic goals are to exploit complementary training effects at optimal times, manage fatigue, and prevent stagnation or overtraining. This involves long-term, intermediate and short-term planning. Accordingly, periodized training programs are typically structured into macro-, meso-, and micro-cycles that progress from extensive to intensive workloads as well as general to specific tasks. Corresponding decisions should be made with respect to several factors, including the biological responses to training stimuli, the athlete's developmental status, and the specific demands of his or her sport.
Zatsiorsky, VM. & Kraemer, WJ.	2006	A division of the training season into smaller and more manageable intervals (periods of training, mesocycles and microcycles) with the ultimate goal of reaching the best performance results during the primary competition(s) of the season.
Sharkey, BJ. & Gaskill, SE.	2006	The process of incorporating systematic variation into the training plan. This variation is programmed at several levels: daily, weekly, seasonal, and career.

Authors	Year	Definition
Buford, TW., Rossi, SJ., Smith, DB., & Warren, AJ.	2007	The planned manipulation of training variables in order to maximize training adaptations and to prevent the onset of overtraining syndrome.
Baechle, TR. & Earle, RW.	2008	The planned distribution or variation in training means and methods on a periodic or cyclic basis.
Issurin, V.	2008	A division of the entire seasonal program into smaller periods and training units.
Hartmann, H., Bob, A., Wirth, K., & Schmidbleicher, D.	2009	The primary underlying concept of periodization in general is to transfer a variety of performance variables (power, strength or local musculature endurance) to their highest rate of development with the aim of peaking at a precise time and avoiding any stagnation, injury, and overtraining.
Bompa, TO. & Haff, GG.	2009	A method by which training is divided into smaller, easy-to-manage segments that are typically referred to as phases of training.
Issurin, V.	2010	The purposeful sequencing of different training units (long duration, medium duration, and short-term training cycles and sessions) so that athletes could attain the desired state and planned results.
Turner, A.	2011	A training plan, whereby peak performance is brought about through the potentiation of bio-motors and the management of fatigue and accommodation. This is principally achieved through the logical yet creative variation of training methods and volume loads.
Haff, GG. & Haff, EE.	2012	The logical, integrative, sequential manipulation of training factors (i.e., volume, intensity, training density, training frequency, training focus, and exercise selection) in order to optimize training outcomes at predetermined set points.
USATF	Not listed	The process of planning training in order to produce high levels of performance at designated times.

highlights the need for coaches to stay abreast on the evolving scientific literature, as well as adopt athlete-monitoring strategies. Combined, this information can improve a coach's ability to "forecast" an individual athlete's future training needs and responses.

### Thinking Outside the "Black Box"

As previously mentioned, the argument is not whether periodization strategies are effective tools in the development of athletic preparedness, but whether the training agenda is built upon assumptions or evidence. While the question may be difficult to answer in the short term, a more effective method of determining how a practitioner assesses the development and effectiveness of their periodization strategy can be utilized. Specifically, a coach can critically reflect on their planning process by revisiting the "Black Box versus White Box" analogy.

Within sport, a coach's performance is typically assessed by their win-loss record or their ability to improve the competitive rank of the athletes under their supervision (Cote et al., 2007, Erickson et al., 2007). For instance, a coach may be deemed successful if their athlete improves from a sixth-place finish in last year's championship match to a third-place finish in the current championship season. In other words, the coach knows the "input" (sixth place) and "output" (third place), but the internal process which led to this improvement goes largely unknown or investigated. This "Black-Box" approach is commonly referred to as "Performance-Based" coaching where an improvement in the competitive arena largely determines the success of the program used along the way. The adoption of this method can provide practitioners false security in their periodization strategies, as the improvement in athletic performance resulting from the training plan cannot be distinguished from confounding factors such as the athlete's maturation or a decrease in external stressors. As a result, it is unclear whether the athlete realized their true competitive abilities, as the training program was not optimized to their individual needs.

In contrast, a coach can increase their insight into the training process by adopting the "White-Box" approach. Within this context, the coach understands the input (preseason rank) and output (postseason rank), but they also understand the individual athlete's physiological and psychological responses to training via scientific monitoring. This ongoing reflective process can be termed an "Evidence-Based" approach as the sport performance professional is equipped with objective, reliable feedback that can demonstrate a training plan's effectiveness and ultimately ensure preparedness. The overall goal of an evidence-based approach is to acquire a snapshot of an athlete's adaptations to training and, in turn, apply these findings to future program development. In short, this can be considered the act of optimizing periodization choices and the training plan in order to meet the needs of the individual athlete.

### **A Call for Monitoring**

The aforementioned monitoring process involves frequent measures of performance with consistency and reliability. Once this performance information (or data) is collected, a thorough and swift analysis of the results follows. The speed of this process should be emphasized as the returned information will allow the supervising coach to plan accordingly for future training blocks. When returned quickly, relevant feedback from the monitoring process can empower coaches and sport performance professionals to make more informed, evidence-based decisions regarding the structure and periodization of a training plan.

As discussed, periodization should involve the development of designing a training protocol that is based on sound evidence. This plan must successfully operate within a framework that is dictated by numerous external variables, including the competition schedule, the level of competition, training camps, hours available for training, the athlete's personal obligations and financial constraints. During the generation of the periodized plan, monitoring adds individual and situational-specific evidence to the process. Unlike research and formal scientific inquiry that provide the practitioner with knowledge of group responses to controlled stimuli, one cannot infer individual athletes – especially in the high-performance setting – will respond to training in the same manner.

How, then, do we determine an athlete's unique circumstance in relation to training choices and resultant adaptations? The answer to this question lies in the monitoring process. Practically speaking, each athlete is tracked individually as if they are participating in a case study. This allows the athlete to serve as their own criterion, as statistical significance is usually difficult or impossible to obtain in a clinical setting with a small sample population. Further, change (or lack of change) may be meaningful and significant

to the direction of future training choices in the sport setting. Therefore, as Stone, Stone, and Sands have advised, formalized athlete monitoring programs should be longitudinal in nature and employ several testing sessions. Through continued analysis, the investigator is guided to the most appropriate variables (Stone, O'Bryant & Garhammer, 1981).

### **Renewing the Definition of Periodization**

Considering the scientific and technological advancements in sport, the current pool of acceptable definitions regarding periodization have become stagnant. Specifically, this collection of definitions does not concretely state the need for periodization strategies to be based on individual responses made apparent through the utilization of an athlete-monitoring program. Regardless of the stance a coaching professional may have on a specific periodization strategy, one must not allow unfounded dogma or assumptions to underpin planning decisions. Therefore, a proposed definition for periodization is:

*“The strategic manipulation of an athlete’s preparedness through the employment of sequenced training phases defined by cycles and stages of workload. These workloads are varied in order to facilitate the integration of planned programming tactics that will harmonize the relationship between training-induced fatigue and accommodation. Further, the process of balancing stress stimuli and recovery periods should be based on advanced knowledge regarding the physiological, biochemical, and psychological principles related to human performance. Thus, an individual’s response to training can more effectively be measured and be made apparent through the execution of a comprehensive athlete-monitoring program and ongoing scientific study.”*

### **Moving Periodization into the 21st Century and Beyond**

Periodization has been, and will continue to be, an integral part of athlete development. Both empirical and anecdotal evidence suggests athletes adhering to a tactfully-planned program demonstrate consistent improvements in physical preparedness and are less likely to sustain over-training or overuse injuries (Monteiro, et al., 2009). As a result, coaches employ various periodization strategies with the overarching goal being a bolstering of an athlete’s competitive success.

While periodization may continue to be a recommended strategy in program design, recent advancements in the scientific understanding of human development cannot be dismissed. Specifically, the increased use of technology and monitoring systems in the sport setting will allow coaches and performance professionals to become more aware of how individual athletes respond to a given training stimulus. As coaches become more astute in the monitoring process and subsequent data interpretation, periodization strategies can be tailored to meet the needs of each individual athlete under their supervision. This evidence-based approach to the sequentially-staged planning process will continue to refine and optimize an athlete’s opportunity for success when they showcase their physical and mental capabilities against similarly-equipped competition.

The revised definition of periodization proposed in this article calls us all to take further steps in the process of determining program design strategies for the athletes under our supervision. In addition, this definition not only answers the question posed by Kiely, but more importantly supports Pedemonte (1986b), who decrees, “We can take full advantage of periodization only when we know the objective basic laws of this process and when we really know the man who is in front of us”(p. 27).

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*Elaxis Gillette and guide Wesley Williams in the Men's 200m T11. Photograph by Gareth Copley, Getty Images*