

Which Way to the Top?

The sport science literature dealing with the issue of developing athletes to achieve elite performance has been dominated by the classical dichotomy between an athlete's genetic endowment (ie, nature) and environmental influences (ie, nurture). In this context, research has clearly established that various physiological characteristics associated with success in specific sports and athletic events have a strong genetic influence. Moreover, it has also been shown that the response to a given training program is, to a large extent, genetically determined.

In view of such evidence, it is naïve to assume a *tabula rasa*, or blank slate, thesis in the context of developing athletic expertise. Nonetheless, it is well established that environmental factors play a major role in the development of the elite athlete. For instance, a recent grounded theory of psychosocial competencies and environmental conditions associated with success in adolescent football indicates that discipline, resilience, commitment, and social support are necessary to succeed in a highly competitive sport such as professional football. Some geneticists argue, of course, that these psychological characteristics also have a genetic basis. However, the most important of all environmental factors associated with athletic expertise is undoubtedly training and practice. In this respect, two considerably disparate approaches to talent development are favored by different groups of researchers: the *deliberate practice framework*, characterized by early specialization and repeated and extended exposure to the task domain to develop the skills necessary for successful performance, and the *developmental model of sport participation*, which supports the notion that early diversification in sport participation and large amounts of deliberate play (as opposed to deliberate practice) are good predictors of elite sport achievement.

Although late specialization associated with the developmental model of sport participation can lead to athletic excellence in some instances, there is little doubt that early specialization and deliberate practice in a given sport are in general the preferred path to elite performance. Indeed, the relationship between engagement in deliberate practice over extended periods of time and elite performance is now well established by sport scientists. A recent popular example is that of Britain's Tom Daley, who at 13 years of age became Britain's youngest diving gold medalist by winning the men's 10-m platform at the European Championships in Eindhoven in March 2008, in addition to qualifying to compete in the 2008 Beijing Olympics. Also well known is the case of F.C. Barcelona's 17-year-old football player Bojan Krkic, who has broken every possible goal-scoring record in the youth ranks and is already a rising star in the super-professional and super-competitive European Champions League.

Extensive exposure to practice induces adaptations to the specific physical, physiological, and psychological demands of sport. In addition, perceptual-cognitive skills that discriminate between elite and nonelite performers are also developed. These include advanced cue utilization, pattern recognition, visual search behaviors, assessment of situational probabilities, and strategic decision making. On the other

hand, some experts argue that early specialization may have costly consequences in terms of injuries, dropout rate, and lifelong participation in sport as a recreational and health-promoting activity. The interactions among deliberate practice, growth and maturation, physiological characteristics, and subsequent athletic achievements offer promising areas of investigation.

Both genetic and environmental determinism are reductionist answers to the complex issue of achieving elite sports performance. In his excellent 2003 book *Nature via Nurture*, Matt Ridley brilliantly argues that, far from being mutually exclusive alternatives, nature and nurture work one through the other, in a constant feedback loop that is responsible for the amazing complexities of life. This could well be the model through which elite athletic performance is attained.

Iñigo Mujika, Associate Editor