

Early Sport Specialization: Roots, Effectiveness, Risks

Robert M. Malina

Department of Kinesiology and Health Education, University of Texas at Austin, Austin, TX; Department of Kinesiology, Tarleton State University, Stephenville, TX

MALINA, R.M. Early sport specialization: roots, effectiveness, risks. *Curr. Sports Med. Rep.*, Vol. 9, No. 6, pp. 364–371, 2010. *Year-round training in a single sport beginning at a relatively young age is increasingly common among youth. Contributing factors include perceptions of Eastern European sport programs, a parent's desire to give his or her child an edge, labeling youth as talented at an early age, pursuit of scholarships and professional contracts, the sporting goods and services industry, and expertise research. The factors interact with the demands of sport systems. Limiting experiences to a single sport is not the best path to elite status. Risks of early specialization include social isolation, overdependence, burnout, and perhaps risk of overuse injury. Commitment to a single sport at an early age immerses a youngster in a complex world regulated by adults, which is a setting that facilitates manipulation — social, dietary, chemical, and commercial. Youth sport must be kept in perspective. Participants, including talented young athletes, are children and adolescents with the needs of children and adolescents.*

INTRODUCTION

Sport is a major context of physical activity for youth, but emphasis on those aspiring for elite status detracts from the potential values of sport participation for all children and adolescents (40). The talented few are a very visible minority, whereas the overwhelming majority of youth who participate pass under the radar. Unfortunately, most attention and resources, and commentaries in print and electronic media, focus on the exceptional minority. One consequence is specialized, systematic training in a single sport at a relatively young age with the goal of attaining elite status. Statistics documenting the trend to specialization are difficult to specify, but the following is an increasingly common observation: “A growing number of coaches, parents, and children believe that the best way to produce superior young athletes is to have them play only one sport from an early age, and to play it virtually year-round” (21). This article considers the roots, consequences, and limited data on the effectiveness of early specialization in sport.

ROOTS OF SPECIALIZATION

Several factors have contributed to early sport specialization. These factors interact with each other and the demands of sport systems.

Perceptions of the East

The relative success of sport systems in former communist countries of Eastern Europe has contributed to a perceived need for early specialization. It commonly has been perceived in the West that systematic training in Eastern Europe began at early ages and involved year-round participation. The relatively young ages of competitors in several sports were highlighted by the media and reinforced early specialization as a requisite for success. Eastern European talent identification and development programs varied to some extent by sport and emphasized exposure to a variety of activities and skills in early sport experiences (multilateral training). Specialization in most sports tended to occur after puberty; “early entry sports,” specifically gymnastics, diving, figure skating, and to some extent swimming were exceptions (8,9,15,29,52). The perception of early specialization was reinforced by coaches and sport scientists who migrated to Western countries and often became involved in elite programs. Eastern European programs have been modified over time and probably with cultural setting. A recent modification is long-term athlete development, which emerged in the 1990s (4). The scientific basis and effectiveness of the various programs has not been

Address for correspondence: Robert M. Malina, Ph.D., FACSM, 10735 FM 2668, Bay City, TX 77414 (E-mail: rmalina@skyconnect.net).

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evaluated systematically, and in some instances, recent applications seemingly have taken the form of a business.

Getting Ahead

Parents are major players in specialization in sport and other endeavors. In the classic study *Developing Talent in Young People* (7), talented individuals in sport (tennis, swimming), art (pianists, sculptors), and science (research neurologists, mathematicians) — fields in which success (elite status) was attained at relatively young ages — were studied. Home environments of the talented shared three characteristics: child-centered — parents channeled their own interests into and were very involved in the activities of the children; concentration on development in the specific endeavor; and emphasis and value on achievement (53).

Parents want what is best for their children and will do what they can to facilitate prospects in school, sport, and other activities. This is consistent with time trends among children in the United States aged 3–12 yr. From 1981 to 1997, discretionary time, television time, and time in unstructured activities (play) decreased, while time in school or day care, time reading and studying at home, and time in organized activities including hobbies, sports, and arts increased (58). Time in organized activities at early ages probably has increased since. Approximately one third of children 3–4 yr of age in the United States were enrolled in preschool in 1993 (3), whereas approximately 47% and 74% of 3- and 4-yr-old children, respectively, were enrolled in public and private preschool programs in 2007 (5). Among youth in the United States 18 yr and younger participating in organized sports, children 6 yr and younger comprised 9% in 1997, 14% in 2000, and 12% in 2008 (48).

Driven for success of their children, parents often perceive an early start as necessary to obtain an edge. The Tiger Woods story — early introduction to golf, deliberate practice at a very early age, a dominating parent, a highly regulated life through childhood and adolescence into adulthood, and eventual success is well documented (20). This story and probably others have functioned to influence parental perceptions of the need for an early start in sport.

Future education also is a concern of parents, and sport is a potential venue for scholarships (see later in this article). Seemingly in contrast to early specialization, holding youngsters in grade for a developmental advantage compared to peers, “redshirting,” has been noted in preschool, especially in affluent communities (25,61). Although older children within grade learn more, some evidence suggests greater frequency of behavior problems over the long term (57).

“Redshirting” also is well documented in football where size is perceived as important. Parents hold a boy back in grade for one year, often at the recommendation of a coach, for the purpose of gaining a size and strength advantage over grade peers. This often occurs in 6th through 8th grades when differences in size and strength among boys are considerable (41).

Some parents are influenced by potential economic benefits. Management groups sign talented youth at very young ages and parents form corporations to fund instruction and training under the tutelage of expert coaches. The young athlete is the commodity and investors share in future earn-

ings. It is not uncommon for larger clubs to find jobs for parents to lure talented athletes.

Parents and home environment clearly are important in specialization. The influence of coaches and other adults associated with a sport, probably interacting with parents, in specialization and the lives of young athletes needs systematic evaluation.

Labeling

Children often are labeled as gifted or talented at an early age in sport, arts, and academics. Such labeling probably encourages specialization. Two issues are of relevance: What is the impact of labeling on individual and parental expectations, and does the child have a voice in the decision to specialize?

Pursuit of Scholarships

Many youngsters with encouragement of parents begin specialized sport training in a single sport at young ages with the goal (hope) of obtaining a college scholarship, often with considerable expense for the family (60). There is, however, a degree of unreality in perceptions of scholarships for sport. Only 22/1000 girls (2.2%) and 20/1000 boys (2.0%) participating in high school sport in 1999 to 2000 received partial or full scholarships; estimates for full scholarships were lower, 1/81 girls (1.2%) and 1/93 boys (1.1%). The scholarship yield is very small, and financial aid rarely covers tuition, room, and board at most colleges and universities (50).

Although potential financial returns on time and money invested in athletic development and probability of scholarships are overestimated, the road for talented youth is linked to special programs. Select or travel teams recruit youth for the purpose of competing at a higher level; they emerge at approximately the 10- to 12-yr age range in basketball, baseball, softball, and soccer. The programs are independent of interscholastic programs and encourage participation in a single sport year-round. Select programs vary in cost, most of which is borne by parents. Funds for youth with limited family resources usually are available, although sources are not always clear.

Discussions of talented male youth basketball and football players dominate the media. The extent of the search for talent in basketball at young ages is evident in *The Hoop Scoop*, a commercial enterprise that nationally ranks players in 6th to 12th grades (20). Given the importance of visibility, lobbying by coaches and parents to have a child/player ranked is considerable. Select basketball teams for the elite usually are active after the scholastic season and are prime recruiting grounds for collegiate programs. In many ways, select team coaches have become brokers in the recruiting process. Shoe companies often are involved — seeking the best players and their parents for potential endorsements (14).

U.S. football has its own methods. National media and several independent services regularly rank high school football players locally and nationally. Rankings presumably bring talented players to the attention of college coaches and others involved in recruiting. Downward extension of player rankings is apparent in the Football University Youth All-American Bowl, a series of three games for talented 7th and 8th graders (18).

Pursuit of Professional Contracts

Some youth and/or parents are driven by the opportunity for a professional contract. A very small but visible percentage of high school athletes move directly to professional contracts, although rules vary by sport. Club-based sports often have developmental programs, academies, including soccer in most countries, baseball in the Caribbean, and increasingly basketball in Europe and Africa. Corporate money also permeates developmental programs for young tennis players (40). Youth athletes are developed for the international market (including college scholarships) and jobs may be offered to families to bypass official regulations. Given potential economic benefits, it is no wonder that parents facilitate and encourage early specialization.

Sporting Goods Industry

The sporting goods retailing industry is a key player in specialization. According to the Mercanti Group, "A regimen of organized games, training and practice is now the norm among youngsters, while casual participants have dropped out of team sports. ... This reflects a trend among individuals to sport specialization, in which youngsters play a single sport year-round. ... Sport specialization has upped demand for sport training and conditioning programs, facilities, and products" (46).

A major part of any business venture is advertising aimed at parents and youngsters.

Expertise Research

Understanding expert performance is a popular topic in sport psychology. The theoretical framework of expert performance in any endeavor is, however, more complicated. Expert performances are "... Acquired characteristics resulting from extended deliberate practice" (17). Primary emphasis is on quality of instruction and practice, and ability of the individual to organize the specific knowledge. It involves explicit teaching of specific skills, supervised practice, and corrections as needed; this is formal learning. Frequent repetition under the watchful eye of an expert coach is a feature of deliberate practice. The accumulation of experience ultimately is represented in the motor and cognitive neural substrates. Biological variables and biobehavioral interactions were not considered explicitly in early discussions, although the potential role of biological factors, specifically genetic, is recognized (16).

Observations and anecdotes have suggested, in general, that at least 10 yr of experience and 10,000 h of deliberate practice are necessary for international success in music, chess, and other disciplines. This view has been extended to sport (56), although not all evidence is consistent with the proposed time scales (1,23). Nevertheless, the 10-yr or 10,000-h rule has made its way into the popular press (4,12,24,33) and probably has contributed to early specialization. Parents thus may see an early start in a single sport as essential, often to the exclusion of other childhood activities and sports.

Many discussions of expertise overlook the reality of life for many children involved in sport. Many sports and sport-related activities are carried out in informal settings, that is,

"street games." These involve major time commitments and frequent repetitions, but not under the eye of a coach. Street games represent what is now labeled deliberate play (13). They involve trial and error, experimentation, and repetition; exposure to different conditions, skills, and rules; and variable settings associated with numbers available and seasonal changes. Skills acquired under such circumstances represent informal or implicit learning (11). Sport and sport-related skills apparently are learned without awareness or explicit knowledge of the skills. It is postulated that skills learned under informal conditions are influenced less by fatigue and stress (51). Research on implicit learning in sport is in its infancy but is expanding (44,45).

DOES SPECIALIZATION WORK?

Sport is exclusive! Few athletes make it to elite levels. This is illustrated in the estimated numbers of participants in four organized team sports in the United States in 2000 summarized in Table 1. The base is broad among youth and is reduced

TABLE 1. Estimated numbers of participants in five organized teams sports in the United States from youth to elite levels in 2000.^a

Sport	Age/Level	Males	Females
Basketball	Youth 6–17 yr	6,231,000	3,790,000
	High school varsity teams	541,130	451,600
	College teams	15,874	14,445
	NBA/WNBA 29/16 teams	440	208
Soccer	Youth 6–17 yr	5,400,000	4,190,000
	High school varsity teams	330,044	270,273
	College teams	18,221	18,188
	MLS 12 teams	268	
Baseball	Youth 6–17 yr	6,836,000	
	High school varsity teams	453,055	
	College teams	25,938	
	MLB 30 teams	1200	
Softball, fast pitch	Youth 6–17 yr		1,339,000
	High school varsity teams		344,414
	College teams		15,157
Football	Youth 6–17 yr	2,867,000	
	High school varsity teams	1,029,435	
	College teams	57,593	
	NFL 31 teams	1643	

^aNumbers of youth, high school, and college participants are adapted from Sporting Goods Manufacturer's Association (55) while numbers of professional athletes are derived from team rosters: National Basketball Association/Women's National Basketball Association (NBA/WNBA), from rosters for the 1999–2000 season for men and 2000 season for women; (b) Major League Soccer (MLS) rosters for the 2000–2001 season; (c) Major League Baseball (MLB) rules permit 25 players on the roster during most of the season, but the roster expands to 40 players after September 1; a 40-man roster was used for the estimate; (d) National Football League (NFL) rules permit 53 players on each team's roster.

markedly as sport becomes more selective. It thus is no surprise that talent identification and development programs and, by inference, early specialization have limited success.

Although the apparent success of the early “scientific selection” protocols of Eastern Europe often was lauded (9), the process apparently facilitated hormonal manipulation of young athletes (22,31), and achievements were tainted. Other observations suggest a relatively small yield. Only 0.14% of 35,000 highly qualified Russian athletes training at sport schools, including 2700 candidates for select schools, succeeded from entry-level selection to high-level sports mastery (34).

A 7-yr follow-up of German athletes in seven Olympic sports indicated that only 15 of 4972 (0.3%) selected at the youngest level in each sport eventually ranked among 10 best international senior athletes, while a 3-yr follow-up noted that 192 of 11,287 athletes in elite sport schools (1.7%) attained a medal in an international championship (28).

Corresponding data for the United States are not available, but the likelihood of competing in sport beyond high school provides similar results (Table 2). The probability of moving from high school to major professional sport is small. The highest likelihood of moving from high school to collegiate sport is in ice hockey, which has the smallest number of participants. Probability of moving from college to professional is highest for baseball, which reflects its extensive minor league system. Relatively few make it from the minor to major leagues. Corresponding probabilities for other sports are considerably lower.

Sport background and career trajectories of talented athletes provide additional insights into the relative merits of early specialization. For example, “quick” (≤ 4 yr) and “slow” (≥ 10 yr) tracks from novice to elite status were identified among senior national Australian athletes. Compared with athletes on the “slow” trajectory, those on the “quick” path began their main sport at a later age (17.1 ± 4.5 vs $7.9 \pm$

2.5 yr) and participated in more sports before starting the main sport (3.3 ± 1.6 vs 0.9 ± 1.3 yr). Athletes on the “quick” path rarely participated in another sport after beginning their main sport, while those on the “slow” path participated in an average of two sports after beginning their main sport (49).

Three observations for German national athletes in all Olympic sports ($N = 1558$) have implications for specialization. Successful athletes participated in more than one sport either before or parallel to their current sport (juniors 2.2 ± 1.4 ; top-level athletes 2.4 ± 1.6). Approximately 64% of international finalists and 53% of less-successful top athletes participated in other sports. And internationally successful athletes continued training in other sports to a later age (27). By inference, specialized training in the primary sport began later.

Among U.S. university female athletes, the majority in diving, tennis, golf, track and field, basketball, and volleyball had their first organized sport experiences in a sport other than their current sport; swimmers were an exception (Table 3). Sixty-three of 376 athletes (17%) participated only in their current sport: 25 swimmers, 25 track and field athletes; 9 in diving, tennis, and golf, and 4 in basketball and volleyball. The contrast between individual and team sports was clear. Consistent with collegiate divers, only 25 of 189 U.S. Junior Olympic divers had their first organized sport experience in diving (42).

POTENTIAL RISKS OF SPECIALIZATION

Early specialization is not without risk. Several subsequently are noted.

Social Isolation

Focus on a single sport and the associated time commitment may foster isolation from age and sex peers, especially

TABLE 2. Estimated percentages of athletes moving from high school to college, high school to professional, and college to professional in several sports in the United States.^a

	Men's Sports					Women's Basketball
	Basketball	Football	Baseball	Ice Hockey	Soccer	
High school athletes						
Total	549,500	983,600	455,300	29,900	321,400	456,900
Seniors	157,000	281,000	130,100	8500	91,800	130,500
College freshman athletes	4500	16,200	7300	1100	5200	4100
High school to college, %	2.9	5.8	5.6	12.9	5.7	3.1
College athletes						
Total	15,700	56,500	25,700	3700	18,200	14,400
Seniors	3500	12,600	5700	800	4100	3200
Athletes drafted	44	250	600	33	76	32
College to professional, %	1.3	2.0	10.5	4.1	1.9	1.0
High school to professional, %	0.03	0.09	0.46	0.39	0.08	0.02

^aAdapted from the National Collegiate Athletic Association (47), percentages are based on estimated data and thus are approximations. Estimates for the professional level are based on athletes drafted; there is no guarantee that they qualified for the playing roster.

TABLE 3. Sports participation background and age at specialization in university female athletes in seven sports.^a

	N	Age (yr)		Age (yr) at First Participation in Organized Sport		Same Sport (%)	Participants in Other Sports (%)	Total Number of Other Organized Sports		Age (yr) at Specialization in Current Sport	
		Mean	SD	Median	Range			Median	Range	Median	Range
Swimming	83	18.7	0.8	6	4–12	71	70	2	1–7	10	5–16
Diving	22	19.4	1.6	7	4–18	32	96	3	1–7	11	4–16
Tennis	29	18.9	1.1	8	5–13	45	86	3	1–6	11	8–15
Golf	35	19.1	1.1	9	6–16	34	89	3	1–5	13	10–18
Basketball	56	19.2	1.2	9	5–15	48	95	3	1–5	14	9–18
Volleyball	44	19.0	0.9	9	5–13	21	98	4	1–6	14	11–18
Track & field	107	19.4	1.4	10	4–16	46	77	3	1–10	14	7–19
Total sample	376	19.1	1.2	8	4–18	47	83	3	1–10	13	4–19

^aMalina (unpublished data), female intercollegiate athletes in a Division I program. SD = standard deviation.

during adolescence, and may alter relationships with peers, parents, and family. It also limits experiences in other sports and activities. An increasing number of talented young athletes in the United States are homeschooled and may miss opportunities for important nonsport developmental experiences — peer interactions, social activities, and independence.

Overdependence

The lives of young elite athletes tend to be highly regulated. This may foster overdependence on others and in many cases loss of control of what is happening in life. Elite young athletes may be trapped by fame, which in turn may influence perceptions of their qualities as a human being — an athlete and not a person, a commodity to be marketed. Arrested behavioral development is a potential consequence, as are socially maladaptive behaviors during youth and extending into adulthood. These may be overlooked until something dramatic happens. The following comment in a brief article, “Michael Jackson, Death by Show Business,” merits attention: “There is a theory that applies to any child star, that the age at which you become famous is the age at which some part of you becomes forever, and irreparably, arrested” (10). This indeed would be an interesting topic for study among elite athletes.

Burnout

Burnout, sometimes described as burning desire (35), often is attributed to early specialization. Burnout is not sudden but develops over time. It is associated with perceptions by the athlete that he or she cannot meet the physical or psychological demands placed upon him or her. Reduction in sport accomplishments and associated rewards are additional factors. Signs of chronic stress include agitation, sleep disturbances, loss of interest in practice, depression, lack of energy, skin rashes, nausea, and frequent illness (26,62). Many factors are involved in burnout, but three are primary: negative performance evaluations — critical rather than supportive, inconsistent feedback from coaches and officials — mixed messages, and overtraining. Contributing factors include injury (often a trigger); overprotection by coaches, trainers, parents, and sport officials; and perceptions of not being able to meet self-imposed expectations or those of others (26).

Injury limits activity, while overprotection limits exposure to new situations and opportunities through which the young athlete can learn coping mechanisms and social relationships. These can foster feelings of lack of control, dependency, and a sense of powerlessness. Sport environments conducive to burnout in youth are, of course, superimposed on and interact with normal demands of “growing up” — physical growth, biological maturation, and behavioral development (41).

Manipulation

Commitment to a single sport at a relatively early age immerses a youngster in a complex world regulated by adults. The youngster and perhaps parents often place blind faith in the system. This is a setting that facilitates manipulation.

Social manipulation perhaps is most evident in preferential treatment by sport systems, schools, management groups, and media. It also is evident in differential access to resources for the elite — travel, tutors, and access to scholarships, among others. Preferential treatment may lead to overdependence on and/or control by coaches and sport organizations, and altered social relationships with peers, parents, and family. Abuse — emotional, physical, and sexual — is a potential byproduct of dependence. Stresses associated with year-round training and competitions also are byproducts of an environment of overdependency and accumulate over time. Among young women, 3 of 27 highly trained gymnasts and 4 of 16 moderately trained swimmers were considered at risk for “a manifest mental disorder over time” (59).

Age modification is a form of manipulation. Age group competition is a feature of virtually all youth sports. The integrity of competitions is based upon the assumption that ages are accurate and records of chronological age (birth certificate, passport) are valid. Problems with accurate age reporting appear on a regular basis in youth sports and with elite athletes (36). Who is the source of inaccurate reporting or age falsification? Look to those who regulate youth in sport — coaches, administrators, trainers, parents, agents and perhaps others.

Dietary manipulation, direct and indirect, is a concern in some sports. Some adolescents may institute self-imposed dietary restrictions, especially in aesthetic sports such as

artistic gymnastics, figure skating, and ballet. Pressures, at times subtle, to maintain or lose weight by young athletes, when the natural course of growth is to gain weight, can lead to disordered eating and clinical eating disorders. Comments on body weight from trainers, coaches, and judges can trigger disordered eating. Dietary restrictions on elite young athletes also may come directly from the sport system. Gymnasts in the former German Democratic Republic were on a dietary regime "...intended to maintain the optimal body weight, i.e., a slightly negative energy balance, and thus a limited energy depot over a long period" (30). Such intentional energy deficit is abuse. On the other hand, the culture of U.S. football with emphasis on size and mass may pressure some boys to gain weight and increase the risk of overweight/obesity (43).

Chemical manipulation seemingly is rampant in sport — dietary and other supplements, diuretics, stimulants, and of course performance-enhancing drugs. Small percentages of youth, athletes and nonathletes, apparently have tried or have been enticed to try performance-enhancing substances (19,32). Surprisingly, parents, friends, and even family physicians were indicated by the adolescents as the source of performance enhancers (32).

Merchandising is commonplace in sport at all levels. What is overlooked is the fact that young athletes are often the merchandise. Development of young athletes in many sports is a long-term investment. A talented 5-yr-old soccer prodigy in the Ajax system was described as "...well worth this investment of time and attention, because one day he might be sold to Chelsea or Real Madrid or Juventus for millions" (54).

Talented young athletes are regularly sought-after commodities, and they often are exploited. Corporate money permeates youth tennis. Soccer, baseball, basketball, and football players are widely scouted and actively pursued at young ages. High school sport programs are publicly subsidized feeder systems for collegiate and professional basketball and football, and to a lesser extent baseball. Many athletes are from lower socioeconomic backgrounds, so the potential for exploitation of the youngster and family is heightened. Sport often is placed ahead of education and also is the lure for education (scholarships). Youth basketball coaches for select teams have become brokers controlling access of players to college coaches. Many clubs develop young players for the international market (soccer in Africa and South America, baseball in the Caribbean), and jobs may be offered to families to bypass official regulations. The problem is of sufficient magnitude that international legislation to regulate clubs and agents, especially those pursuing underage players, is under discussion (6).

Injury

Overuse injuries are a consequence of repeated micro-trauma in a tendon, muscle, or bone associated with chronic repetition of specific sport activities — tennis serving, baseball pitching, gymnastic routines, running, and shoulder action in swimming, for example (2). Although specialization may place a youngster at risk for overuse injuries, other factors intrinsic to the young athlete and sport environment, and their interactions (39), probably are more important.

Compromised Growth and Maturation

Complications in growth and maturation occasionally are attributed to early intensive sport training, but data are not convincing. The short stature and later maturation of elite artistic gymnasts and later maturation of ballet dancers are examples most often attributed to intensive training at young ages (37,38). It is difficult, however, to establish early specialization and training as causative factors underlying the growth and maturity status of young gymnasts and dancers, and perhaps female athletes in other sports. Allowing for variation in sampling and methodology, constitutional factors in the selection and retention processes of gymnastics, ballet, and other early entry sports need careful consideration. If early specialization and training can compromise growth and maturation, it is essential to partition their effects from the extremely selective physical and aesthetic criteria of gymnastics and ballet, requisite skills, differential dropout, and the complexities of the tightly controlled elite sport/dance environments before causality can be established (37,38,41).

CONCLUSION

Few individuals who specialize in sport at young ages make it to elite levels and reap the social, economic, and other benefits associated with success. The overwhelming majority drop out along the way. Nevertheless, specialization in sport at relatively young ages is a fact of life for many children. Factors underlying specialization interact with each other and demands of sport systems, which essentially are businesses operated by adults. Adults also are implicated, directly and indirectly, in consequences of specialization.

Information on the effectiveness of early specialization and the long-term success of young athletes is limited. Only the successful are highlighted, but early success is no guarantee of later success in elite sport. Limiting experiences to a single sport year-round may not be the best path to elite status.

It is essential to keep sport in perspective. Young sport participants, including talented athletes, are children and adolescents with the needs of children and adolescents. Their goal is to "grow up" — biologically grow and mature and behaviorally develop. These processes place many demands on youth, and the demands of sport are superimposed upon them. Unfortunately, talented young athletes are often pawns in a complex matrix — the sport, adults who run the sport, parents, schools, sporting goods and services industries, media, and in some cases international politics. Sport scientists can be in a tenuous position studying the development of young athletes while avoiding manipulation by or entrapment in the matrix.

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