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The Downfall of Sports Science in the United States

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summary

Although sports are considered an important part of American life, sports science has lost its identity and has largely been replaced by exercise science. Although exercise science may use sport for examples or as handy models for understanding exercise responses, exercise science is seldom concerned with enhancing the sport performance of the athletes it studies. The authors hope that sport science may be resurrected so that modern American athletes can benefit from scientifically derived and tested training methods and thus compete more effectively both at home and abroad.

In this short opinion article we hope to bring attention to what we believe is one of the failings of the educational system in the United States and a potential threat to national and international athletic performance by U.S. athletes. This failure concerns the decreased emphasis on sports and sports-science activities within the university educational system and elsewhere.

We would argue that sports are at least 1 of the 3 most important aspects in daily life, e.g., "News, weather, and sports at six o'clock." Newspapers contain separate sports sections, and some magazines are dedicated to sports. On weekends, large portions of the population regularly attend sporting events or view sports on television. We would also argue that sports science has a large potential to affect (improve, we hope) sports performance. Considering this potential affect, sports science could have a major impact on people's lives through enjoyment of improved sport performance by improved international rankings in competitions, reduction of injury, enhanced fitness, fairer competitions, and a better understanding of where sports fit in peoples' lives. Although high-level competitive sports comprise a major factor in most people's lives, true sports science is practically nonexistent in the United States. By true sports science, we are referring to the tight interaction of sports scientists with the ongoing training and development of athletes at all levels, with the aim of improving all aspects of sports participation. In contrast, typical sports/exercise science involves quasi-isolated studies of exercise behavior, largely in a public-health domain.

Although the term *sports science* is used in the titles of several academic departments, no university in the United States actually offers a course of study in sports science. Many universities use sports behavior as a vehicle to clarify and study physiological, biomechanical, and psychological aspects of exercise. We would like to contrast studies aimed at exercise behavior, underlying physiology, biomechanics, and psychology with those that are designed to study and improve athletic performance, safety, and fairness.

One important aspect of this discussion is a clear understanding of what sports science is and what sport scientists do. To begin to understand sports science, we need to consider some basic terminology:

- Biology is, in simple terms, the interdisciplinary study of life.

- Exercise science is the study of biological responses and adaptations to exercise and training. Exercise science depends on various disciplines, including biomechanics, physiology, and psychology/sociology. Exercise science includes various specialties such as geriatrics, adult fitness/wellness, ergonomics, and pediatric exercise. Today, exercise science is largely concerned with health, health-related performance, and the underlying mechanisms. Although there can be carry-over to sports, the carry-over is largely indirect.
- Sports science is concerned with the enhancement of sports performance through the application of scientific methods and principles. Several basic sports-science functions can be identified. As with exercise science, sports science has an educational role. However, unlike exercise science, sports science involves tightly integrated and regular sports testing and feedback as well as practical/applied research. Although health and mechanistic factors are addressed indirectly, the major concern of sports science is physical performance.

Thus, we would argue that, conceptually, (a) exercise scientists use exercise and training to understand human biology, and (b) sports scientists use human biology to understand exercise and training. Therefore, a major purpose of sports science is to "bridge the gap between science and sports."

Disincentives and Sports Science

In a combined 60+ years of work in academics, the authors have often noted that students are drawn to exercise science as a result of their interest in sports. During their schooling and particularly after graduation, it quickly becomes apparent to these young people that pursuit of a career in sports science is difficult, at best.

In the United States, sports-science jobs are scarce. Whereas spectatorship and the entertainment aspects of sports may be growing in some quarters, the desire for a career in sports science diminishes when young professionals have little hope of meaningful employment. Young potential sports scientists are socialized away from sports research because of the "dumb jock" image, a lack of job opportunities, and relatively few funding sources.

Higher education is perhaps the single largest employer of potential sports scientists, who serve as teachers and researchers. Success in many, if not most, higher education institutions are largely predicated on 2 factors: grants and publications. Grants are needed to pay the direct costs of research and are often crucial to a long-term program of research. A career in research often requires funding to support an infrastructure of graduate students and laboratory equipment and can lead to publications in top-tier journals. Sources of grants for sports research have dwindled to almost nothing in recent years. This has forced potential academic sports scientists to pursue other areas of research if they wish to obtain the money needed to maintain a research program that leads to tenure and promotion.

Is higher education the only source of jobs for potential sports scientists? An Internet search on Monster.com with the keywords *sports science* resulted in 2 jobs, neither of which involved sports science but were actually sales positions. A second Monster.com search with the keywords *exercise physiology* resulted in 18 jobs. The actual job descriptions, however, ranged from "exercise physiologist" involved in cardiac rehabilitation to "drug quality coordinator" and "territory sales manager." A third search with the keyword *biomechanics* resulted in 14 jobs, none of which had anything to do with sports. A fourth search with the keyword *sport* resulted in 185 jobs; only 4 of these jobs appeared to be unrelated to sales. These were "physical therapist" and "coach counselor." As merely a sample of the available jobs for sports scientists outside of academe, the results were discouraging.

Similar on-line searches in the *Chronicle of Higher Education* and HigherEdJobs.com produced about 100 job listings for areas concerned with sports and exercise science, mostly in academic institutions, but none really dealt with sports science.

Research Difficulties

Young sports scientists enter a world in higher education that is not entirely conducive to sports-science research. Sports research projects are often problematic when research on near-elite and elite athletes tries to fit the criteria of modern ethics committees (3, 4). The different covenants of the sports-research world and the world of typical academic research becomes increasingly apparent when children are both the athletes and the subjects for research (3). It is not uncommon to find bold studies in the international literature that would be nearly impossible to perform in the United States because of ethics-committee guidelines and regulations. For example, monitoring athlete development and performance has become commonplace among elite athletes (4). Monitoring may involve everything from simple height and weight to blood samples, injury information, and psychological profiles. Often these data are collected with no intent to publish but rather to be a service to the sport, coach, and athlete. However, these longitudinal studies of elite athletes are also among the most valuable for the development and management of training and, therefore, merit publication because of their inherent rarity and analysis of such specific populations (4). Finally, it is difficult to disentangle the issues surrounding informed consent when athletes are involved as subjects. Is it possible for athletes to freely give consent to serve as a research subject when the data may be used by a coach to make training and selection decisions? In the world of professional sports, where sports scientists provide support services, is it feasible for athletes to provide informed consent freely when participation in the data collection may be a prerequisite for their employment?

Nearly all peer-reviewed journals require a statement or other evidence that the study was conducted only after approval from a relevant research ethics committee. Obtaining such permission from typical academically based ethics committees can be difficult when the "study" may last the length of an athlete's career, include subjects that may not be able to freely provide informed consent, and may be entirely exploratory. This is because no existing studies cover the population of interest, use single-subject designs, or require the investigators to "wait and see" if the data collected are indicative of anything meaningful regarding training and performance.

These problems rise to practical significance when the sports-science researcher wants to publish in typical peer-reviewed journals. The study must first be reviewed and approved by an ethics committee. First of all, most Institutional Review Boards (IRBs) do not have members who are conceptually familiar with sports science. Usually, the members of the IRB are more attuned to the academic approach for carrying out exercise-science studies, which deal with health issues or focus primarily on mechanisms rather than performance. For example, the most common approach to academically based research is the pre-/posttest control-group design. This design is almost impossible in sports science involving elite athletes because, by definition, these athletes are unique; therefore, a comparable control group is nearly impossible to obtain. Moreover, many sports-science studies are longitudinal, involving multiple testing sessions and relatively few subjects. Statistical power is always an issue, along with what appears to be little academic training on the part of IRBs in longitudinal designs, single-subject designs, and time-series analysis. Much of what happens in sports-science research would be classified as hypothesis-generating studies rather than hypothesis-testing studies. For example, in monitoring studies, often no coherent a priori hypothesis can be made, and the investigator will simply be led by the data to the most appropriate analysis of the most appropriate variables. Then, once a relationship between training and performance is established, the "study" is not really over. The coaches and athletes will then manipulate training according to these new results and thus contaminate further analyses by their new interventions. This approach, though common in statistical process control in industry, is not common in academically oriented research (7).

Studies of exercise (not sports) may provide a simpler and cleaner way to study exercise-related phenomena and are thus seductive to the young, potential sports scientist who has limited time, few funding resources, and a serious need for appearing in publications. Furthermore, these exercise-based studies may be more "politically correct" in that (from the academic's view) they may be more fundable and fit in with the current emphasis on health and disease mechanisms. In this respect, a review by the authors (using very liberal criteria) of the abstracts presented at the American College of Sports Medicine meeting in 2003 revealed that only about 10–12% of the abstracts presented were concerned with sports science.

Collapse of Nonrevenue Sports

Sports scientists have come from all sports. Often, they develop an interest in their particular sport as a competitive athlete. Many current sports scientists can trace their interest in sports science to a lifelong dedication to sports, first as an athlete and later as one trying to uncover the underlying principles of high performance. However, the landscape of intercollegiate and high school sports has been changing dramatically in the past decade. A recent article in *The Chronicle of Higher Education* paints a bleak picture for nonrevenue sports, also sometimes called "Olympic Sports" (10). Although opportunities for women and football have continued to grow

> …colleges have dropped scores of swimming, track, and wrestling teams, among other sports. Cynics joke that every men's gymnastics team in the country can boast of being in the top 20 (10, p. A38).

Title IX has been at least partially responsible for declining numbers of collegiate athletic teams, along with tightening budgets (2, 10). Since 2000, 31 universities have dropped 61 sports (10). Because universities are the homes, potentially, for both sports-science–training programs and athletic-training programs, the natural interaction between coaches and athletes interested in sports science and sports-science programs is likely to decline.

Poor Coach Education

Coaches are often not schooled in science and may even have developed a cynical bias against sports science because of the mistaken application of health-oriented studies to high-performance athletes. There are quantitative and qualitative differences in the training responses between elite athletes and typical recreational athletes, especially those between the ages of 18 and 22 who enroll in college fitness classes (9). Numerous promises or quasi-promises, in the form of "cutting edge research," have been made over the years but have not resulted in furthering sports performance (8). Unfortunately, the coach or athlete is not always knowledgeable enough to distinguish between reasonable scientific information and fads, gimmicks, and just plain misleading information. We are bombarded by many dietary supplements, few of which actually work. Numerous gadgets are touted as miraculous in improving performance and almost never live up to their billing. This problem can be compounded at times by the relative slowness of science, scientific methodology, and sports scientists. Sports scientists seldom speak in a language that lay people can completely understand. Lactate testing was once considered the answer to all training problems, only to be abandoned later and then resurrected. For years, athletes were told that

steroids did not work, but they knew otherwise. Historically, people thought that drinking water during training and performance was a sign of weakness. Years later, athletes were told to drink plenty of water. Now we find that there is a condition termed *hyponatremia,* caused by drinking too much water (5, 6). All this combined with the recent apparent increase in sports "guruism" leaves the coach or athlete wondering which way to turn.

Existing sports scientists are often their own worst enemy. Increased specialization has resulted in sports scientists having a general inability to talk with each other. Biomechanists, physiologists, and psychologists take different classes, attend different conferences, and publish in different journals. However, coaches and athletes almost never take these classes, attend these conferences, or read these journals. If sports science is done only for the consumption of other sports scientists, one has to wonder what it is all for. Sports scientists have seldom realized that no matter how sophisticated the science, the results must be funneled through a coach to reach an athlete. Therefore, if the scientific information is not quickly available, understandable, and able to be implemented by a coach, the science is of little or no use. Sports scientists, and perhaps scientists in general, are seldom trained in the translation of their work to the coach or athlete.

These observations are borne by the reluctance of coaches to read scientific journals, including journals dedicated to specialty areas such as strength and conditioning. As Durell et al. (1) point out, not taking advantage of potential advances in training methods, monitoring of athletes, and so forth that are a result of scientific research will likely reduce the effectiveness of the coach. Failure to take advantage of advancements in sports science is a responsibility shared by coaches, sports scientists, and especially the educational systems.

A Final Observation

Currently, sports-science internships are available at all 3 Olympic Training Centers (Colorado Springs, Lake Placid, and San Diego). Typically, the interns who are chosen are Masters students or graduates with an interest in physiology or biomechanics (strength and conditioning internships are also available). Although these interns are carefully chosen and tend to be well versed in the typical exercise physiology laboratory procedures (e.g., $\dot{V}O_2$max, lactate threshold, etc.), they are usually not familiar with typical strength-power or high-intensity endurance exercise testing procedures, and they are almost never familiar with testing athletes or working with coaches. All this takes considerable training and re-evaluation on the part of the interns as to the physical and mental capabilities of elite athletes versus relatively sedentary subjects. One interesting aspect is that even though sports-science training is practically nonexistent in the university system, several hundred students apply for internships each year. Indeed, we (the authors) regularly receive inquiries from potential graduate students as to which university has a sports-science program. Although there are a few individual sports scientists in the university setting in the United States, we regrettably and consistently point such inquiring students toward Europe, Australia, or New Zealand, where a course of study in sports science is available.

Conclusion

As sports continue to evolve, sports science should also evolve to ensure that athletes are trained in the most intelligent, safe, and progressive ways. This will require competent and experienced sports scientists. These sports scientists must be trained somewhere—presently, sports-science training does not occur on a systematic basis in the United States. Although we do not believe for a second that the work involving exercise and disease is valueless—in fact, it is quite the opposite—we do believe that neglecting sports science will ultimately result in increased rates of injury, unpredictable and unstable sports performances, and poorer competitive standings for U.S. athletes in the world. ♦

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