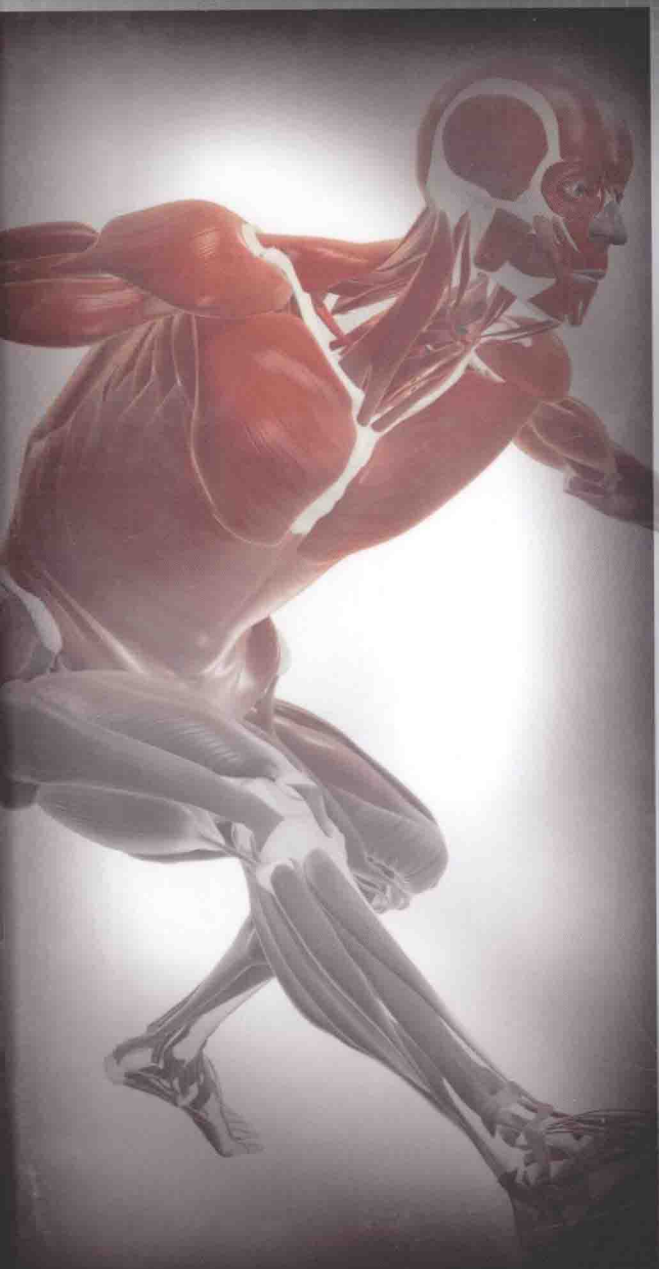

Praeger Handbook of

SPORTS MEDICINE AND ATHLETE HEALTH

Volume One

SPORTS MEDICINE CAREERS

Claude T. Moorman III, MD, Editor-in-Chief and Donald T. Kirkendall, PhD, Volume Editor

Praeger Handbook of Sports Medicine and Athlete Health

Volume 1
Sports Medicine Careers

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Preface

Claude T. Moorman III
and Donald T. Kirkendall

How many times has the question "What do you want to do when you grow up?" been answered with, "I want to work with athletes"? The problem is that there are any number of options that fulfill that response. While there are many options, from event and facility management to being an agent or other aspects of sports management, one way to satisfy that goal is to pursue a career in the ever-expanding field of sports medicine.

This quote was found while browsing through a magazine: "I knew I wanted to be an architect when I was 12." We were not that focused at such a young age, but we ended up in the highly visible field of sports medicine. When it comes to sports medicine, it is probably safe to say that few, if any, could state that sports medicine was on their radar as a youth.

One of the problems is the definition of the term sports medicine. In reality, " sports medicine" is an umbrella term that encompasses professions like medicine, physical therapy, nutrition, biomechanics, psychology, physiology, training, and a host of others. And each one of those is an umbrella term for their own subspecialties.

Because the public's first (and sometimes only) view of sports medicine is an injured athlete, we thought it was important to offer a wider, and more personal, statement on what the term "sports medicine" encompasses. To do this, we asked representatives from most

of the major specialties in sports medicine to give a personal account of what they do and how they got to where they are. In most cases, the path to their career was a roundabout journey. Each started in one direction and then had some experience, for example, a class, an internship, a volunteer opportunity, or an individual that led them into a different path toward the corner of sports medicine that attracted them. Maybe you will identify with a story that may help narrow your direction when it comes to "working with athletes." We did little in editing these chapters because it was important for the writer's voice, personality, and experience to be very visible to the reader so he or she just might touch some hidden recess within you. As each career choice has unique traits, we have inserted an italicized opening paragraph to each chapter in vol. 1 as an introduction to the larger world of each discipline.

A common denominator with most anyone in sports medicine is a history and interest in a specific sport or athletic endeavor; we all have a favorite sport. What we think you will find, however, is that some personal connection was the inciting event; a specific teacher or mentor or experience that caused a change in vision that resulted in not just an interesting diversion, but a lifelong career and passion. You will see that the term "sports medicine" does not reflect a single career or individual. This makes the singular term a misnomer. Sports medicine is really a team effort whose goal is physical performance at whatever level the person desires to achieve. We hope that these personal stories will offer a light at the end of the many tunnels you may face, and will shed light on the fascinating field of sports medicine.

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Chapter 1

Kinesiology and Exercise Physiology

Edward F. Coyle

For many students in physical education or exercise science programs, anatomy and physiology are courses to be survived. The subsequent course that usually captures their imagination is exercise physiology: how the body responds to exercise and adapts to training. Thus, this course is, for many, the real eye-opening experience into the wider world of sports science, when students begin thinking that what the professors do just might be their career of choice. Exercise physiology's central position as the fundamental exposure to sports medicine and exercise science allows us to see—with a little latitude here—a path in becoming a university professor of exercise science. The path is long, but it can lead to a very satisfying career.

When I tell high school or college students that I am a professor at a university, some of them remark that sounds like a really cool job. And it is cool, but maybe not for the reasons they might think. We can all usually agree it is cool to work with young adults and witness their intellectual and professional growth. The freedom to teach and conduct research in an area that is your passion is definitely cool, especially if you earn tenure and thus have security and freedom to continue to make discoveries. Compared to other professions, professors have more latitude in scheduling their work hours, at least when it comes to when they can be found in their office, and, at times, what they can

wear to work. Having summers and holidays off sounds nice, but that is a fantasy, along with the notion of free tickets to home football games.

In reality, professors at top universities usually work far more than a typical 40 to 50 hours per week. The competition for jobs is fierce, and being approved for tenure can challenge even the most patient and dedicated people. Being awarded a PhD is the first important step, but this is but one of several equally demanding steps of professional development necessary to establish a productive long-term career. To succeed as a university professor and, maybe, to find professional happiness in the process, I believe one needs to find fulfillment in the arduous process of reading, researching, writing, and lecturing.

One student told me that my life seemed like one big, continuous term paper, and I think this is an accurate description. The task of writing, be it a review paper or a research article or a grant, can be grueling. It is hard work for me because at points I feel confused and frustrated, not unlike preparing a college term paper. In college, I complained and wondered just "what does the prof want or expect." Now that I am that professor, I still ask the same question and what is required is a product that meets the needs of the reader, which usually means developing new and important insights. These products take days, weeks, or months to finish. It's just like running a marathon when one must put aside any thoughts of quitting and follow the process you have learned. This requires self-motivation. It also helps to have deadlines and people who count on you to succeed, just like in any hard job.

I find fulfillment in this demanding job of professor because of my students' enthusiasm for learning, especially about topics that excite me. I enjoy the process of developing ideas and making discoveries about how the body functions during exercise. Luckily, I found the right fit for me, because above all else, professors at major public universities are required to teach and mentor students. I also enjoy conducting physiological research on healthy people who are capable of and even enjoy exercising intensely. This stems from my background as an endurance athlete. Finally, we get to develop laboratory techniques and use high-tech equipment that satisfies my need to spend some time working with my hands. Managing the equipment and developing techniques is what I enjoyed most about graduate studies, which is good because these are time-consuming tasks. They also test dedication and aptitude for our particular line of research. I have found that when I team with my best graduate students and many colleagues, we all enjoy the scientific process and learning so much that when we have a day for selfish leisure, we find ourselves reading the scientific literature

or analyzing data. This nurtures our curiosity and gives us a thrill when we find one more piece that fits into the physiological puzzle that is human exercise performance.

In the spirit of this book, I'll begin my story of how I was attracted to academics and describe the rather indirect path I followed to my current position as a professor at the University of Texas at Austin. Of course, my experiences are those of only one professor of kinesiology in the field of exercise physiology at a given major university. However, I am sure that my experiences are common to most professors who thrive in the university community. First and foremost, they need to have passion for their field and a desire for lifelong learning, as all knowledge is temporary and a university is where much of that new knowledge is developed. They also need to be realistic regarding what jobs might be available and how one needs to be prepared in order to be competitive for those positions. This does not mean that a high school senior, or college senior for that matter, needs to understand each step of how to progress through graduate school, job searching, and university promotion. That might be counterproductive as the steps might change, and more importantly, too much information can be overwhelming. As you will see, I often approached each step somewhat naïve to reality.

My numerous mentors provided the reality check that got me through and onto the next challenge. Good, like-minded mentors with academic passion in your chosen field are most essential. For me, "good" turned out to be mentors who were professionally active, but also realistic and blunt when necessary. In return, I was asked to be true to myself and work hard. I had to be open to moving anywhere in the United States for that next step that offered the best opportunity. For me, time flew by and I never experienced boredom because of the constant flow of enthusiastic students, hard-earned research discoveries, and ever more sophisticated laboratory equipment. We just need to take it as it comes and have the confidence that we have been prepared to succeed at the next step. It is with faith and desire in ourselves, as well as the guidance of our mentors, that we might find our potential.

A TYPICAL WEEK IN THE LIFE OF A UNIVERSITY PROFESSOR

No single week is exactly like another. My years climbing through the university rankings from assistant professor to associate professor to full professor were similar in some ways. For five days per week during the fall and spring semester (16 weeks each), I usually spend 6 to 9 hours teaching formal classes. I often choose to hold class from

3:00 P.M. to 6:00 P.M. on Monday, Wednesday, and Thursday because our research experiments usually begin by 8:00 A.M. and wind down in the early afternoon before going into the classroom. I often leave class happily tired and brain-dead. On the two afternoons a week when I am not lecturing, I usually hold office hours with students or attend meetings related to university administration or public service. During office hours, I advise graduate students on how to approach their theses or projects, and advise undergraduates according to their needs. My Friday afternoons are usually reserved for seminars during which graduate students and I present scientific ideas and new findings. Although the teaching and meetings are routine, each research study to be conducted and each scientific paper to write or review is a new and exciting challenge. I find that the project I'm currently immersed in often strikes me as the most interesting project I've ever worked on, because I enjoy trying to understand each new puzzle.

As a research professor, I enjoy quite a bit of freedom. My superiors at the university don't tell me how I must teach or what research projects to conduct. They did, however judge my accomplishments in both, typically after 6 years, in order to decide if I should be promoted from assistant professor to associate professor and be allowed to stay at the university. The same review process is performed for advancement to the rank of full professor. The phrase "publish or perish" is accurate, but would be more complete if "and teach well" were added. This pertains to my institution, the University of Texas at Austin.

You might ask what do I do during the remaining 20 weeks of the year, such as during the month long winter holiday break and three months of summer when most undergraduate students are off to other things. To a professor, these weeks bring valuable blocks of uninterrupted time to write research grants (most research professors have to solicit funds to support their research program) and manuscripts, each of which take several weeks of concentrated effort, and often on a strict, non-negotiable deadline. These periods also provide the time to conduct studies that require uninterrupted days of data collection. In addition to this, much time is devoted to developing and refining new lab techniques.

A TYPICAL EXERCISE PHYSIOLOGY/HUMAN PERFORMANCE RESEARCH PROJECT

One doctoral student sought to determine if dehydration in endurance-trained cyclists reduced the amount of blood that is pumped throughout the body (i.e., the cardiac output) and how the body coped

with this severe stress (Gonzalez-Alonso, 1995). A subject would report to the lab at 8:00 A.M., and we would prepare him by placing temperature sensors on the skin and inserting a probe in the esophagus (via the nasal passage) for a core body temperature reading. Other devices, all of which had to be calibrated before the subject arrived, were placed to measure blood pressure, skin blood flow, cardiac output, heart rate, oxygen consumption, and blood chemistry. These measures were made while the subject cycled for two hours in an environmental chamber where the temperature set at 100 degrees F. As the subject cycled, we recorded how much his core body temperature increased and how much cardiac output declined as a result of exercise-induced sweat loss equivalent to about three quarts. Although he was very hot, the amount of blood flowing through the skin declined, impairing his ability to move heat out of his body. This explained why dehydrated subjects experience dangerously elevated core body temperatures. He greatly increased the "fight or flight" hormones (e.g., epinephrine and norepinephrine) in his body that contributed to reducing loss of heat because those hormones constrict skin blood flow and restrict heat loss. Essentially, we described how the cardiovascular system tries to allow dehydrated people to continue exercising until they reach a point of near collapse. The feeling of fatigue or weakness or being very hot is one way the body tells itself to stop exercise before collapse or doing serious damage. This bout of exercise performed in a safe lab environment allowed us to apply this knowledge to athletes running a marathon in the heat or firefighters battling a blaze.

Our goal continues to be to have a better understanding of the signs and limits of human performance. This project required more than 14 experimental trials on subjects and took months to complete. The few hours in the morning spent with the subject collecting the data represented less than 10% of the time devoted to this experiment. Most of our time was spent developing all the techniques needed to measure cardiac output or skin blood flow; you don't want to make any mistakes and have to start all over when the subject is sitting on there on the cycle. Subjects have to be recruited, methods have to be perfected, equipment must be calibrated, and then each piece of data needs to be analyzed and calculated. Much of research is in the planning and preparation of the project.

Analysis of the blood samples required 1 to 2 months of full-time work for that doctoral student. Before all of this could be done, grants were written to find the money. The project had to be approved by

ethics and regulatory committees of the university and other agencies. All these piles of preliminary paperwork are an important part of the process to ensure the safety of the subject and to help increase the likelihood that all this work will produce new and important results. And this research project was one of several performed that year.

After class, around 6:00 P.M. when I am tired, I would recover mentally by exercising for about one hour. During most of my years as an assistant and associate professor, my drive home was pleasantly detoured to pick up one or both of my children from their after-school activities. My son's gymnastic tumbling class progressed into joining the age-group team that trained most weekdays and competed one or two weekends per month. Eventually, my son replaced gymnastics with springboard diving, performing in our campus natatorium with monthly out-of-town trips for competition. Similarly, my daughter's casual horse riding lessons developed into her passion for "hunter-jumper" training, with horse shows that became more frequent after we purchased an old horse. So, the drive home now had two pleasant stops and a brief daily opportunity to socialize with other parents and children. This may be a familiar routine to some parents.

ONE STEP AT A TIME

Later in this chapter, I will come back to the nature and details of what it takes to teach classes and to direct a university laboratory. Personally, I had little idea of what that entailed when I was an undergraduate student. Every day showed me something new. It is with some reservation that I attempt to detail some of the realities of a university professor. For that matter, I believe this is true for any meaningful or hard-earned life endeavor, from parenting to running a marathon. We just need to take it as it comes and have the confidence that we have been prepared to succeed, prepared for the next step. It is with faith and desire in ourselves as well as the guidance of our mentors that we might find our potential—in this case, academically.

All the authors in this book were asked to describe how we found our academic path. I surely didn't do it alone. Each of my mentors guided me to the next step. Often I was naïve as to what was over that next threshold. This is not necessarily bad. I am confident that many people, particularly parents or counselors reading this chapter, understand this about life.

UNDERGRADUATE SCHOOL

My decision to attend college was fueled by my desire to continue running track and cross-country after high school and by the fact that my high school viewed itself as a preparation for college. Attending college was expected, and I was the first in my immediate and extended family to attend college. At the time I was graduating from high school, the Selective Service was still in effect. Thus, in 1970, if I didn't attend college, the draft lottery almost guaranteed that I would be drafted and likely headed for Vietnam. I don't recall that bothering me until a couple of years later, when I considered leaving college and understood the reality of what that decision would bring. I was fortunate to attend Queens College, one of the top institutions of the New York City university system (i.e., CUNY). My running times for the 1-mile and 3-mile runs and cross-country improved over the first three years, yet I had not declared a major area of study. My courses were a smorgasbord of contemporary civilization and physics and biology.

About this time, I was recruited by a group of exercise physiology professors at Queens College to be a subject in study that compared values for maximal oxygen uptake when running and cycling. I would pass their lab door on the way to track practice and saw they had a treadmill and interesting equipment, so I was happy to volunteer and see firsthand why I often heard a combination of cheering and moaning coming from behind those doors marked *Work Physiology Laboratory.* So I performed the maximal oxygen uptake test while running on a treadmill that increased in grade every minute. Besides having to wear a mouthpiece, this run to exhaustion was like most hard workouts or races. I managed to run longer and achieve higher values then they had ever personally witnessed. They made me feel pretty special because of the results, as they excitedly recalibrated their equipment to make sure the values were real. Their excitement grew further when I told them I could recruit the team's best runner at that time to run their test. Thus began my interest in exercise physiology, which blossomed into my main passion, at least after I stopped racing in track running.

I soon realized that having four exercise physiology professors at Queens College was as much as any university across the country. More impressively, I now realize, although not at the time, that they were relatively young and quite eager to make their marks. Furthermore, they were cool (or hip, to use the vernacular of that time), open-minded, and passionate. In the lab with their students, they constantly debated

the factors that determined maximal oxygen uptake and how it responded to endurance training of runners and swimmers. Having trained to compete in track (i.e., athletics) for years, and because a teammate was a math major who shared his passion of analyzing and comparing track running performances, I felt I could follow parts of their discussions going on in the background as they instrumented me for their additional experiments. Although I knew track, I didn't have a sufficient background in biology and physiology to understand their discussions. It was like trying to engage in a fascinating and passionate conversation being conducted in a foreign language. I understood the essence of their arguments, but I lacked the ability to communicate or think systematically in their field. I suppose it was not unlike a child wanting to move from checkers to chess.

Two of these "cool men of science" challenged me to read Professor P. O. Astrand's classic textbook of the time and take the prerequisite science classes needed to eventually take their classes in Exercise Physiology and Measurement and Evaluation. It became painfully clear that the handful of undergraduate students in their lab were far ahead of me in academic maturity and critical scientific thinking. And why not—the time and energy I spent training in the field lab of track and cross-country was time they spent learning exercise physiology in the academic lab. One tribute to the powerful influence of the faculty on their students was the number who decided to pursue graduate school and earn a PhD in exercise physiology or kinesiology. Of the approximately 30 undergraduate students in my single exercise physiology class that semester, I know of five or six who went on to earn a PhD in exercise physiology.

I will forever be indebted to Dr. Frank Katch and Dr. Bill McArdle. These generous and engaging men were my first academic mentors. They continue to be engaging scholars and professors of exercise physiology. These two master teachers joined with Dr. Victor Katch of the University of Michigan to write a textbook on exercise physiology that has been, for the past two decades, the most widely used book in the field. I was so lucky they found me.

Needless to say, I declared my major as physical education and took their classes. My days and nights were filled taking classes, training and racing with the track team while working several part-time jobs to support myself. I didn't get to spend much time in the lab as an undergraduate. My fellow students tried to keep me posted, and I did only minimal damage when trying how to learn the Scholander techniques for chemical analysis of oxygen and carbon dioxide.

At Queens, Dr. McArdle continued to challenge me with questions, and Dr. Katch gave me a stack of research journal articles to read. Dr. Katch urged me to write a 50-page paper on the physiology of marathon running. This paper was hard work, but I was proud of the product. When I gave the paper to him, he flipped through it and in the course of five minutes noted just how many of the articles I used were written by Dr. David L. Costill of the Human Performance Laboratory at Ball State University. After 10 more minutes, Dr. Katch concluded I should go to graduate school and that studying with Dr. Costill should be my next step. I didn't really have a plan of what to do after graduation. I had the vague notion of coaching high-school track and teaching physical education, although I was behind in the classes needed to become a certified public school teacher. I held my breath when Dr. Katch told Dr. Costill he had an undergraduate student named Coyle who needs to come and get a masters degree with him. The phone was passed to me and Dr. Costill invited me to visit in two weeks. After buying a very used car for $100, I made the drive to Indiana. Dr. Costill offered me a graduate assistantship for the next academic year that I immediately accepted.

Before driving to Indiana, I told my track coach I had regrets about giving up my dream of moving to Gainesville, Florida, to concentrate on my training to lower my time for the 1-mile and 3-mile runs. My coach, a giant of a man in physical size, heart, dedication, and a former Olympian, sat me down to compare the two paths. He gently explained that personal bests in running were an admirable goal as it helped get me where I was, but in reality, it was not a path that would greatly add to my professional opportunities. Besides, I could continue to compete in middle-distance running as a hobby while in graduate school. Maybe I might apply all that science to myself in order to train efficiently. Besides, he explained, if I wanted to coach, a master's degree might help get me that high-school teaching certification.

MASTER'S DEGREE

Ball State University's Human Performance Lab was little more than a Quonset hut structure next to the field house. When I arrived a few weeks before classes, I immediately found a list of techniques to learn and chores to perform, although I don't remember if I got that information from Dr. Costill or the more senior graduate students. I don't remember much about the course work that first semester. It was the challenging lab work that excited me and would determine