ARCHIVES of Exercise in Health and Disease

DOI: 10.5628/aehd.v1i1.74

*Editorial*

# Research in exercise science: a road map for the future

**Scott Kline Powers**

Department of Applied Physiology and Kinesiology, University of Florida, Gainesville, Florida, USA

*Arch Exerc Health Dis 1 (1):1-2, 2010*

During the past 50 years, research investigating the effects of physical exercise on the function of cells and organs (hereafter referred to as "exercise science research") has changed markedly. In this commentary, I provide a viewpoint about several issues that I predict will influence the future of research in exercise science. This editorial is not meant to be a dogmatic road map for exercise scientists to follow but rather represents my personal views on several important issues that I believe will influence the progress of research in this important field. I begin with a brief overview of how exercise science research has changed during the past 50 years

## *Exercise Science: an evolving discipline*

Research in exercise science has changed markedly during the past several decades. For example, exercise science investigations during the 1960's were primarily conducted at the whole body and organ system level. Much of this work was performed on human subjects and most studies were "descriptive" investigations that depicted how exercise training influenced body composition, maximal oxygen uptake, and muscle power output in humans. Research in the exercise field began to change in the early 1970's when scientists began to biopsy human muscles and to include laboratory animals into their research programs. During this period, the research focus in exercise science began to shift from the organ level to the cellular and sub-cellular level. This era, which lasted from ~1970 until the mid 1980's has been called the "biochemistry of exercise" era. From the mid-1980's to the present time, research in exercise science has been transformed into the "molecular and cell signaling era". This transition has been driven by need to address mechanistic questions and the development of powerful new tools to study gene expression and cell signaling. Judging from the vast number of published papers in the scientific literature during 2008-09, exercise science research has clearly benefited from the molecular/cellular research advancements that have occurred during the past two decades. Undoubtedly, new advances in scientific technology will continue to influence this rapidly changing field in future years.

## *Pipeline of new scientists: essential for research advancement*

A requirement for success in any area of scientific research is the continuous production of well-trained new scientists that enter the discipline. This training begins with a solid undergraduate and graduate background in the basic sciences (i.e., mathematics, chemistry/biochemistry/molecular biology, physiology, and cell biology). Moreover, graduate training must include advanced studies in experimental design/statistics, interpretation of results, and of course, critical thinking skills. Importantly, several years of post-doctoral training in a state-of-the-art laboratory is also essential to insure that young scientists achieve the required knowledge to become independent and productive investigators.

## *Application of new research tools*

Similar to all other areas of biological research, exercise science has greatly benefited from the continuing evolution of new scientific tools. For example, the development of new techniques in molecular and cell biology has afforded exercise scientists the opportunity to probe the mechanisms responsible for exercise-induced adaptations to cardiac and skeletal muscles, blood vessels, and other tissues. For instance, the use of gene silencing tools (e.g., antisense oligonucleotides, siRNA, etc.) affords the scientist with the ability to block gene expression in



**Corresponding author:**
S. K. Powers: Department of Applied Physiology and Kinesiology, University of Florida, Room 25 Florida Gym, Gainesville, FL 32611, USA • Email: spowers@hhp.ufl.edu

cardiac or skeletal muscle during and following an exercise bout. The power of this experimental tool is obvious and provides one example of how state-of-the-art techniques can be applied to studies in exercise science. If exercise science is going to compete effectively with other areas of basic science research, it is imperative that exercise scientists take advantage of the growing arsenal of state-of-the-art research tools.

## *Future directions for exercise science research*

Much of the early research (e.g. 1960-70's) in exercise science focused upon human athletic performance. Although numerous outstanding exercise scientists continue to investigate human performance-related questions, many scientists have turned their attention to the use of exercise as a tool to understand how regular physical activity modifies tissues of the body and positively impacts human health. In my view, studies designed to investigate the mechanisms of how regular exercise encourages good health are extremely important and should constitute a large portion of future research in exercise science. Indeed, many countries around the world are facing an increasing incidence of obesity, hypertension, and type II diabetes within the population. Moreover, cardiovascular disease and cancer remain as two primary causes of death around the world. Given that regular exercise has been shown to reduce the risk for all of these health problems, research that provides new information about the mechanistic link between physical exercise and good health is extremely important. Indeed, research into the mechanisms responsible for the health benefits of muscular exercise could ultimately result in ways to prevent disease rather than the current approach that focuses upon developing treatments for an already existing health problem. Clearly, we are entering an exciting period of research in exercise science with the realization that physical exercise is "good medicine".