PM R 7 (2015) 345-353

www.pmrjournal.org

Special Feature: AAPM&R Annual Assembly

46th Walter J. Zeiter Lecture, Exercise *Is* Rehabilitation Medicine: Our History and Future

Bruce E. Becker, MD, MS

Exercise Is Medicine: The Ancient Roots

In Greek and Roman mythology, Apollo was the physician deity and the father of Asclepius, the Greek god of medicine. Asclepius and his wife Epione had 5 daughters. Hygieia was the eldest daughter of Asclepius and the goddess/personification of good health. Whereas Asclepius was more directly associated with healing, Hygieia was associated with the prevention of sickness and the continuation of good health. Hygieia's symbol is the snake, which was combined with the rod of Asclepius to form the symbol of medicine. The other daughters of Asclepius were Panacea, the goddess of universal remedy; Iaso, the goddess of recuperation; Aceso, the goddess of the healing process; and Aglea, the goddess of beauty [1].

Today the symbol commonly used for medicine combines the snake and staff of Asclepius with the winged staff of Hermes, the Roman god of commerce and the marketplace, as was pointed out by Dr Thomas Strax in his 2007 Zeiter lecture [2]. The combination is surely ironic given the current state of American health care.

A physician named Susruta practiced in the Indus Valley of India in about 600 BC. Susruta was a strong believer in exercise, and his writings are the earliest record of an understanding of the health benefits of exercise. These writings are remarkably contemporary with respect to the current science of exercise. Susruta wrote that exercise should be practiced daily and that exercise should be taken to half one's capacity [3]. Current American College of Sports Medicine (ACSM) guidelines state that we should exercise 5 or more days/week or more when exercising moderately or in combination with vigorous exercise, and it is known that for aerobic conditioning to occur, sustained exercise levels ideally occur at 50%-70% of maximum heart rate, $\geq$60% of maximal oxygen consumption, or a Borg Scale level of about 13-15, which is about half of an individual's capacity [4,5]. Susruta advocated moderate exercise because "it gives the desirable mental qualities of alertness, retentive memory, and keen intelligence" [3]. Susruta wrote that exercise should always be prescribed for corpulence and especially recommended it for the treatment of "prameha," the word that then described type II diabetes. He wrote that exercise was absolutely conducive to the preservation of good health and that "Diseases fly from the presence of a person habituated to regular physical exercise" [1,3].

Hippocrates (460-380 BC) believed that exercise training would increase stature, bone mass, muscle mass, tone and endurance, digestion, temperature regulation, and tolerance against fatigue [1]. Hippocrates wrote that "eating alone will not keep a man healthy, he must take exercise, for food and exercise work together to produce health" and "If we could give every individual the right amount of nourishment and exercise, not too little nor too much, we would have found the safest way to health." He further wrote that "Walking after dinner will dry the abdomen and the body and it does not allow the abdomen to become fat." His statements are remarkably contemporary, especially given the current global epidemic of obesity [1].

The Roman physician Claudius Galenus or Galen (129-210 CE) was a great believer in exercise as 1 of the 4 major factors in health. He taught that exercise needed to be moderate in intensity in order to be prescribed for health reasons. He prescribed such exercises for patients weakened through disease, and for diseases such as arthritis, epilepsy, gout, tuberculosis, and vertigo. Galen's teachings persisted far beyond his life, greatly influencing the practice of medicine throughout Arabic and European countries during the subsequent 1400 years, until the end of the Middle Ages [1]. As the Middle Ages came to a close, the role of exercise remained an important element. The Spanish physician Christobal Mendez wrote in his 1553 textbook *The Book of Bodily Exercise* that "...if we use exercise under the conditions that we will describe, it deserves lofty praise as a blessed medicine that must be kept in high esteem" [6].

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http://dx.doi.org/10.1016/j.pmrj.2015.02.013

Exercise Remains Medicine: Europe 1700-1850

European culture during the 1700s saw a continuation of the beliefs that exercise was important in health maintenance and recovery. In the early part of that century, the English physician Francis Fuller published *Medical Gymnastics: A Treatise Concerning the Power of Exercise*. In it he wrote that "…the use of exercise does conduce very much of the Preservation of Health" [6]. Later in that century, Scottish physician William Buchan wrote in his *Domestic Medicine* that "…of all the causes which conspire to render the life of man short and miserable, none have greater influence than the want of exercise" [6]. Thomas Sydenham (1624-1689) was known as the "English Hippocrates" for his influence on the field of medicine through his 1769 textbook *Observationes Medicae*, which remained the dominant medical resource throughout the subsequent 200 years. Sydenham was a great believer in exercise, particularly stressing the value of hippotherapy—that is, horseback riding—for exercise [7]. The French physician Nicolas Andry (1658-1742) has been called the father of modern orthopedics, in part for his 1741 publication of *Orthopaedia,* in which he stated that muscles were the chief instruments in shaping a child's body and that properly ordered exercises could be used to resolve many deformities [7]. The Scottish surgeon and medical scientist John Hunter (1728-1793) believed that the understanding of muscles and their function was a critical skill; he developed the concepts of agonists and antagonists and the use of exercise to prevent contractures. He is truly the pioneer of contemporary muscle re-education [7].

During the 1800s, while exercise was a recommended treatment for a variety of ailments including gout, dyspepsia, and consumption, among others, the primary use of exercise was for prophylaxis. A major part of a physician's duties focused on the preservation and promotion of health and the prevention of disease [6]. In this context, physicians emphasized the importance of exercise and diet, especially during the mid 1800s. In America, physicians such as John Warren, faculty of Harvard, published *Physical Education and Preservation of Health* in 1845, and American physicians birthed the physical education movement, serving on many university faculties and developing the American Association for the Advancement of Physical Education, with its membership dominated by renowned physicians [6]. University gymnasiums for exercise were usually separated by gender and often focused on "medical gymnastics" rather than sport. The directors of these physical education programs were usually academic physicians, and they developed university curricula, taught exercise, and influenced the construction of collegiate gymnasiums across the nation, leading the Superintendent of Public Instruction in Massachusetts to call them "Palaces of Health" [6]. All states by 1900 required instruction in the "Laws of Health," embodied in the physical education curriculum [6]. J. William White, a faculty member at the University of Pennsylvania, wrote in Lippincott's magazine in 1887, ''Let it be understood that the main object and idea of exercise is the acquirement or preservation of health; that it is by far the most important therapeutic and hygienic agency at the command of the physician of today; that it can be prescribed on as rational a basis with as distinct reference to the correction of existing troubles or the prevention of threatened ones as any of the drugs of the pharmacopeia'' [6].

Medicine Changes Focus From Exercise: The 1900s

In the early part of the 1900s, the field of medicine underwent a radical change following the understanding of the germ theory of disease, antisepsis with safer surgical techniques, disease management through inoculations, and the expansion of the medical pharmacopeia. The focus shifted greatly from disease prevention to disease cure and management. Medical education underwent radical changes following the Carnegie Foundation Report written by Abraham Flexner in 1910 [8]. This report resulted in dramatic alterations in the educational curriculum with an expansion of pharmacology, surgical technology, and medical disease management techniques, rather than in areas focused upon disease prevention through natural methods. Poor-quality medical schools closed, the curriculum became more scientific, the course of study lengthened, fewer physicians were trained, and medical specialization began to come into play [8]. Both general hospitals and teaching hospitals were constructed, but the emphasis on scientific medicine made careers in directing physical education programs less attractive and less remunerative to the new crop of physicians. The scientific practice of medicine became primarily focused on disease cure through pharmacology and surgical techniques rather than disease prevention. The focus on exercise waned dramatically. At the same time, the promotion of organized athletics within universities took over more and more of the curriculum, leading to the departure of medical leadership of such programs, and specific sports skills training for activities such as basketball, football, and baseball crowded out programs for health-related programs such as medical gymnastics [6]. It was this cultural shift against which the founders of our field had to create a place for the understanding of the role of exercise and physical therapy in disease management. We continue this challenge to the present day.

Wellness and Health Promotion in the 1900s

Theodore Roosevelt, the 26th president of the United States from 1901 to 1909, was a tremendously active individual, emphasizing the importance of both an

active lifestyle and the value of exercise. He was a popular president who had significant influence over our national culture, raising awareness of exercise and its health benefits.

Simon Baruch was a physician who served in the Confederate Army during the Civil War shortly after his graduation from medical school and went on to become an extremely successful and respected physician in South Carolina. His success led to a move to New York City in 1880, where he quickly gained renown for his work in public health, which included improving the public water supply, and he was named New York City Commissioner of Public Hygiene. Dr Baruch taught hydrotherapy at the Columbia College of Physicians and Surgeons and held a chair there in that field from 1907 until 1913, actively engaging in research. He published *Principles and Practice of Hydrotherapy* in 1908, and it met with sufficient success to warrant the publication of 3 subsequent editions. Dr. Baruch was appointed physician-in-chief at the Montefiore Home for Chronic Invalids in 1884, where he practiced hydrotherapy in the management of these patients [9]. Dr Baruch raised 4 sons, training them in the importance of moral values, to be humanists, and to work for the good of the community. His second son Herman went on to become a physician, following in his father's footsteps. Bernard Baruch, his first son, was a brilliant student who graduated from City College of New York at age 19 years and went on to become a tremendously successful financier, purchasing his own seat on the New York Stock Exchange in 1897. By 1903, he was elected to the Board of the New York Stock Exchange. He became a very influential advisor to many presidents, beginning with Theodore Roosevelt, but he was especially influential with Franklin Delano Roosevelt. Bernard remained tremendously supportive of his father and financially supported his retirement from clinical practice to pursue research and writing in hydrotherapy and medical hygiene. Bernard also continued his father's focus on community service, hydrotherapy, and public health [9]. Bernard went on to become one of the leading proponents of our field, thanks to his background and political connections.

The Role of Exercise in the Beginnings of Our Field: 1920 and Beyond

One of our field's pioneers, Dr Frank Krusen, had a father who also was a leader in public health, having served as director of public health for the city of Philadelphia. Dr Krusen's initial career choice of surgery was interrupted during his residency when he contracted tuberculosis in the mid 1920s [9]. While hospitalized in a sanitarium, he observed the effects that exercise and physical agents had upon the deconditioned population of the sanitarium and became convinced that exercise and physical agents needed to become part of standard medical practice. His focus turned from surgery to physical medicine. In 1926, he moved to Philadelphia to assume the associate deanship at Temple University at the young age of 26, where 3 years later he established the Department of Physical Medicine, a term he coined, and was subsequently installed as Chair. An active proponent of physical therapy, he was appointed to the American Medical Association (AMA) Council on Physical Therapy [9].

It was in that role that he began collaboration with Dr John S. Coulter, who was president of the American College of Physical Therapy. Dr Coulter had focused on the importance of physical therapy since his experience as an Army physician after World War I. Dr Coulter understood the importance of physical measures including heat, water, massage, and exercise in the treatment of disease and believed that physicians needed to understand and oversee the use of these physical measures in clinical medicine, educate medical students and other physicians, and develop technicians proficient in their use. Toward that end, in 1926 he moved to Chicago, where he directed the first physical medicine academic program at Northwestern University. Dr Coulter was charged by the American College of Surgeons to assist it in developing standards for hospital physiotherapy departments nationwide [9]. His textbook, the first on the history of physical therapy, was published in 1932 [7].

Like several of our pioneers, Dr Henry Kessler began his career in medicine intent on surgical practice after graduation from medical school in 1919. He came under the mentorship of a prominent orthopedist, Dr Frederick Albee, who was creating a program of rehabilitation for the New Jersey Worker's Compensation System because of his professional interest in workers with industrial injuries. Dr Kessler quickly developed a keen interest in vocational rehabilitation and became a leading member and advocate for the National Rehabilitation Association, which was formed in 1925 as an organization open to all persons interested in rehabilitation, not only physicians. This organization was very important in the development of our field through subsequent decades [9].

Franklin Delano Roosevelt was diagnosed with polio in 1921 and was cared for by Dr Robert Lovett, an orthopedist at Massachusetts General who had a deep interest in the disease. Dr Lovett was a staunch advocate of hydrotherapy, movement, and exercise, all of which were very controversial at that time because most physicians insisted that paralytic limbs should be placed in casts to prevent contractures [10]. In the summer of 1924, Roosevelt received a letter from his friend and former Harvard classmate, George Peabody, who told him about a young man with polio who had regained the ability to walk through exercising in the mineral springs of Warm Springs, Georgia [10]. Roosevelt, already an aquatic enthusiast, visited the struggling facility in October 1924 and remained there for 6 weeks. He became a staunch supporter of the facility and an even

deeper believer in the value of aquatic exercise. In April 1926 he purchased the resort at Warm Springs from Peabody against the strong opposition of his wife and Basil O'Connor, his advisor and law partner. Roosevelt expanded the pools and constructed lodging facilities, which began attracting people with polio from across the nation [10]. Roosevelt turned it into a nonprofit organization, the Georgia Warm Springs Foundation. He built a home on the grounds, recruited physicians to serve there, and developed exercise, vocational training, social, and recreational programs. Warm Springs became one of the first true rehabilitation centers in the United States [11] (Figure 1). The facility received the stamp of approval from the American Orthopedic Association after they reviewed the first 23 patients treated there and found that all showed improvements in function [9].

World War II and Its Impact

In 1938, before the United States entered World War II, Drs Krusen, Coulter, and 8 other physicians formed the Society of Physical Therapy Physicians [9]. At that time Dr Krusen had moved from Temple to the Mayo Clinic, where he had established a school of physical therapy, similar to what he had done at Temple. The school trained both persons entering the field and established physiotherapists using Dr Krusen's scientific approach. He also added a physician training program to teach the principles of physical therapy and physical medicine, which attracted physicians from across the nation. Dr Coulter reported to the AMA War Preparedness Committee that the country would need at least 6000 physical therapists if it were to enter the war, far beyond the existing supply [9].

Shortly after the entry of the United States into World War II in December 1941, Dr Krusen began training a greatly expanded corps of therapists at Mayo Clinic and added physician training programs, 11-12 per session in 3-month rotations, eventually training 171 physicians over the program's 5 years of existence [9]. Many of these physicians went on to become important leaders in our specialty.

Figure 1. Franklin Delano Roosevelt at Warm Springs.

Dr Howard Rusk, an internist, became chief of the Army Air Force Reconditioning and Recreation Program in Washington, DC. He contacted Dr George Deaver, who since the late 1930s had been the medical director of the Institute for Crippled and Disabled Adults in New York City [9]. In that role Dr Deaver had worked with severely disabled adults, including those with spinal cord injuries, and was perhaps the first physician to establish methods of evaluating abilities in activities of daily living. Dr Deaver would later join Dr Rusk in his program at New York University [9].

In 1943, Bernard Baruch recruited Dr Frank Krusen from the Mayo Clinic to join in the establishment of a national Commission on Physical Medicine. The group was charged to create a Blue Ribbon Panel to make a comprehensive study of the field of physical medicine and rehabilitative services across the nation. Bernard Baruch provided $1 million of his own money to implement the panel's recommendations [9]. The group's membership was large and illustrious, comprising all of the rising stars in our field, as well as AMA leaders, academic medicine leaders from many of the major national universities, and engineering staff as well. Its goal was to serve as a guide for creation of a medical field to provide rehabilitative services to both civilians and veterans with disabilities and support the training of professionals in that field, as well as funding research to underpin its value. The report was completed in early January 1944, and its major recommendations were as follows:

1. Establish teaching and research centers in physical medicine and rehabilitation at academic medical centers and research in physical medicine and rehabilitation in medical schools.
2. Establish residencies and fellowships in PM&R in medical schools.
3. Establish training programs for rehabilitation professionals.
4. Build wartime and civilian medical rehabilitation service programs.
5. Develop integrated centers of both medical and vocational rehabilitation services to deliver services in all sectors.
6. Create a Board of Physical Medicine to examine and certify members of the specialty, under the auspices of the AMA [9].

This report created the infrastructure of our present field, and essentially all of the programs then developed have survived to this day.

Exercise as the Unifying Element Between Physical Medicine and Rehabilitation

Our field was the first specialty to include an understanding of the role of physical agents in disease management at a time when the value of physical therapy was seriously questioned. Exercise was certainly included within our understanding of these agents and a central focus. However, in the early days of our field there was a rift between physical medicine practitioners and those concerned with rehabilitation, somewhat similar to the recent strains within our field that led to the formation of the Physiatric Association of Spine, Sports, and Occupational Rehabilitation. It was Dr Krusen who clearly saw the essential interlinkage of these fields. He wrote, "There are phases of physical medicine (as in the definitive treatment of acute diseases by physical agents and exercise) which cannot be called rehabilitation. Similarly, there are phases of rehabilitation (as in the psychosocial adjustment of disabled persons) which cannot be called physical medicine. Yet for the most part, they are closely interdigitated…." [9].

Our specialty has always had its feet firmly planted on the gymnasium floor, with a solid understanding of the role of anatomy and physiology in function and the role of our hands and listening skills in physical diagnosis rather than sole reliance upon scalpels, medications, and complex technology. Exercise has formed the foundation of our treatment regimens for our patient populations, both in acute physical medicine and in traditional rehabilitation practice. Often the primary focus was to strengthen weakened musculature, reduce neuromuscular imbalance, or increase limited ranges of motion, and we have always worked to become expert in these areas. Foremost among medical specialties, we have grasped the critical role of understanding existing medical and physical constraints and limitations and creatively structuring our therapeutic goals to meet the functional requirements of patients, in accordance with their wishes and needs.

The Resurgence of Exercise Is Medicine

Medicine was reluctant to abandon the tradition of rest in recuperation, but the winds were changing. Symposium findings published in *Journal of the American Medical Association* in 1944 focused on the abuse of rest in cardiovascular disease, obstetrics, orthopedics, and psychiatry [12]. In 1947 Dr Krusen published a remarkable, prescient article in *Postgraduate Medicine* entitled "The Abuse of Rest as a Therapeutic Agent" [13]. It really is only in the past 40 years that the holistic value of exercise in health maintenance has once again been generally recognized. Jeremiah N. Morris, a remarkable Scottish epidemiologist, first studied the significant differences in cardiovascular disease and survival between London double-decker bus drivers and conductors [14]. Morris found that the drivers, whose shifts were spent essentially in full-time seated position, had nearly double the rate of myocardial infarcts and half the rate of infarct survival compared with the bus conductors, whose workday was spent punching tickets on the upper and lower bus sections, climbing up and descending the steep stairs again and again through their entire shift (Figure 2). His pioneering study was really the very first in modern times to demonstrate the very direct relationship between exercise and cardiovascular disease development and survival [14]. Since then, much research has demonstrated the relationship between cardiorespiratory fitness and heart disease, diabetes, cancer, and even cognitive function [15-18] (Figure 3).

The ACSM launched the "Exercise Is Medicine" movement in 2007 in association with the AMA, and it has since attracted the support of many professional medical organizations, including, I am proud to say, our own. The program has a global outreach and seeks to create understanding and impact across the entire life span, from elementary education through nursing homes.

Mechanisms Through Which Exercise Promotes Health

Since the 1950s remarkable research has shown that aerobic exercise produces an entire repertoire of biologic responses in mammals. Nearly every issue of *Medicine and Science in Sports and Exercise* (the official journal of the ACSM) details a newly discovered exercise produced biotrophin and its presumptive function. At this point, we know in some detail about brain-derived neurotrophic factor [19-21], peroxisome proliferator gamma coactivator-1α [22-26], insulin-like growth factor 1 [20,27,28], neurotrophin 3, neurotrophin 4 [29-33], and heat shock proteins and chaperones [34-37], among others. The mechanisms through which these bioprotective factors operate are beginning to be understood.

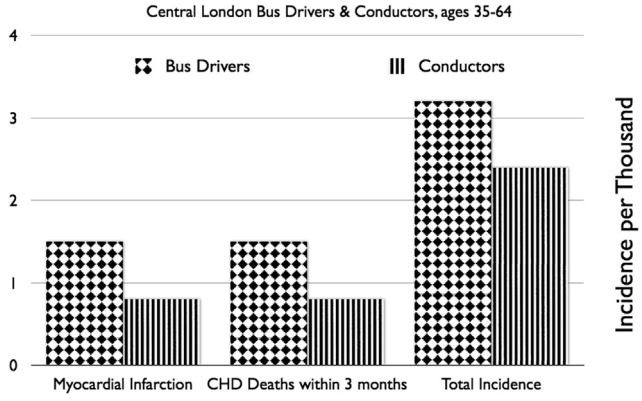

Figure 2. Coronary heart disease development and survival and the physical activity of work [14].

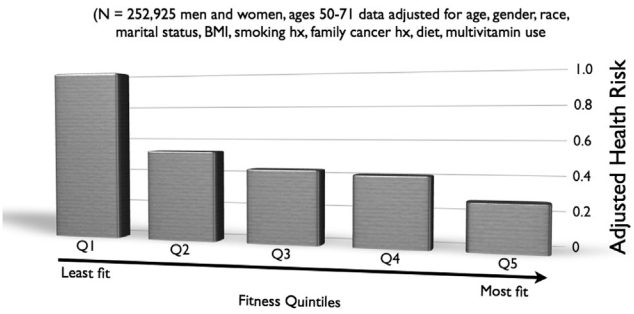

Figure 3. Cardiorespiratory fitness and all-cause mortality. BMI = body mass index; hx = history. From Blair SN, Morris JN. Healthy hearts and the universal benefits of being physically active: Physical activity and health. Ann Epidemiol 2009;19:253-256.

Reduction of Inflammatory Processes

Exercise has been found to decrease pro-inflammatory cytokines, including interleukin 1-β, C-reactive protein, nuclear factor-κB, transforming growth factor β-1, and tumor necrosis factor-α [26,38,39]. While decreasing these pro-inflammatory cytokines, exercise increases anti-inflammatory cytokines such as interleukins 6 and 10 and insulin-like growth factor 1 [40,41] (Figure 4).

Promotion of Arterial Compliance

The decrease in arterial compliance over the mammalian age span has long been noted, with reduction in intima media elastin and increases in adventitial collagen [42-44]. The consequence of this decreased compliance is an increase in pulse pressure, a reduction in coronary perfusion, hypertension, and an increase in cardiovascular risk [42,45]. Regular aerobic exercise has been shown to have a significant beneficial effect upon vascular compliance, whereas strenuous resistance exercise tends to decrease large arterial compliance [46,47] (Figure 5). Low-intensity resistance exercise and combined aerobic and resistance training seems to preserve arterial compliance [48]. Swimming exercise

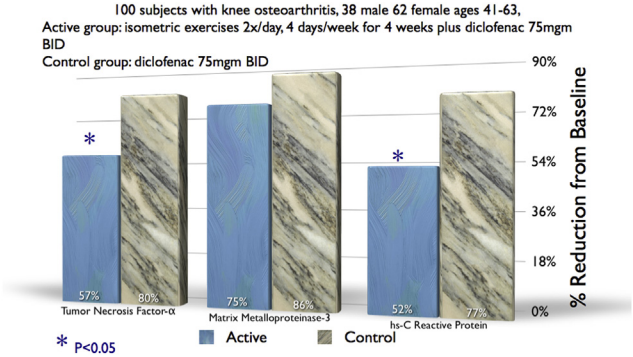

Figure 4. Synovial cytokine level reduction after exercise. BID = twice a day. From Zhang SL, Liu HQ, Xu XZ, Zhi J, Geng JJ, Chen J. Effects of exercise therapy on knee joint function and synovial fluid cytokine levels in patients with knee osteoarthritis. Mol Med Rep 2013;7:183-186.

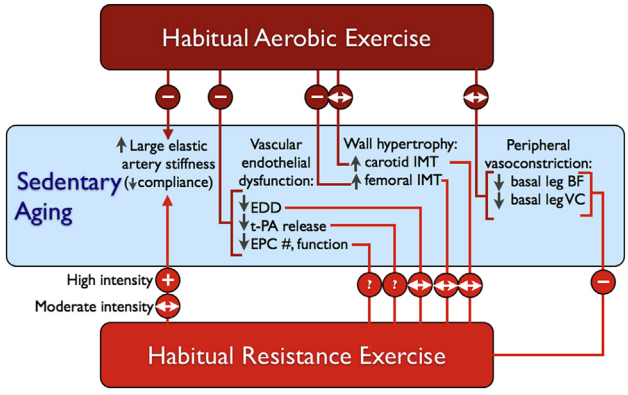

Figure 5. Aging and vascular responses to exercise. BF = blood flow; EDD = endothelium-dependent dilation; EPC = endothelial progenitor cells; IMT = intima-media wall thickness; t-PA = tissue plasminogen activator; VC = vascular conductance. From Seals DR, Desouza CA, Donato AJ, Tanaka H. Habitual exercise and arterial aging. J Appl Physiol 2008;105;1323-1332. Reprinted with permission.

has been shown to produce increases in arterial compliance and reductions in blood pressure in hypertensive adults [49] (Figure 6).

Neural Cytoprotection and Regeneration

Animal studies have shown remarkable effects of exercise training on neuroprotection and neuroregeneration after experimental ischemia or trauma [30,31,50,51]. These effects have been seen in peripheral nerves and hippocampal neurons, along with a reduction in cerebral apoptosis [52,53]. The relationship between cognitive function and cardiorespiratory fitness has long been established and appears to be due to a combination of cerebral blood flow, cerebral vasomotor reactivity, and genomic induction of cellular protective and regenerative neurotrophins [54-61]. The benefits of aerobic exercise seem to hold even in the face of dementia, parkinsonism, and multiple sclerosis [55,57,60,62-69] (Figure 7).

Myoplasticity

Aging has long been associated with a decline in muscle mass and deterioration of mitochondrial content and

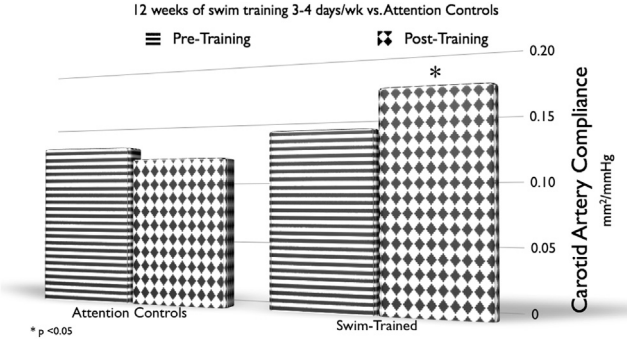

Figure 6. Effects of swim training on carotid artery compliance [49].

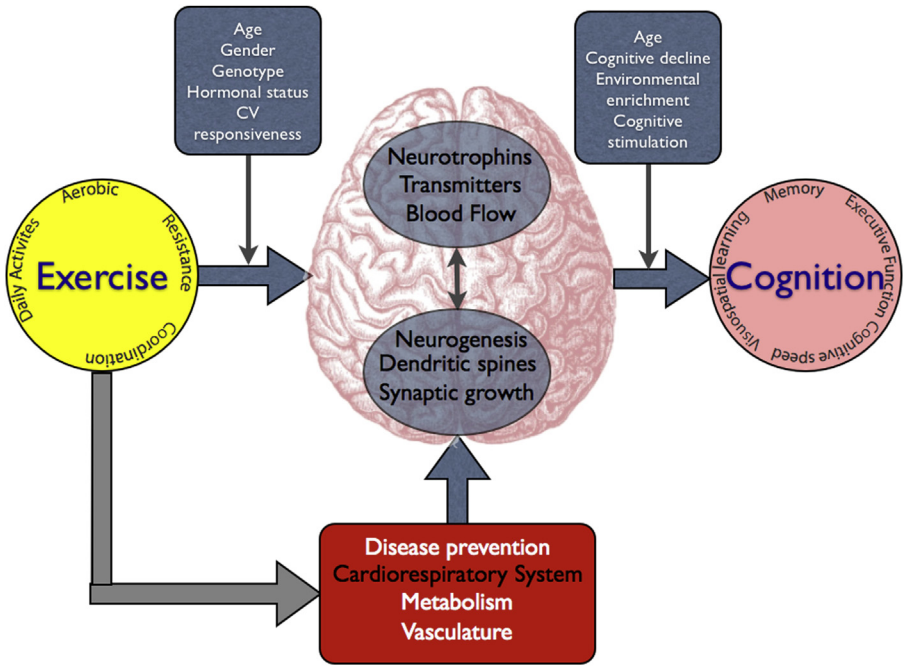

Figure 7. Exercise effects on cognition. CV = cardiovascular [55].

function, together termed *sarcopenia* [22,70,71]. It has become increasingly clear that these effects are far more tied to inactivity than to the aging process itself [25]. Comparative studies of sedentary versus regularly exercising older adults have shown that the latter group maintain mitochondrial volume and number, and cross-sectional studies have shown a similar relationship between fitness levels and mitochondrial volume and number [72,73]. Relatively short periods of training have shown an ameliorating effect on mitochondrial loss [72]. The pool of muscle stem cells, termed *myoblasts* or *satellite cells*, is reduced by oxidative stress, which is a common correlate of aging muscle [74]. However, brief periods of exercise produce an increase in muscle fiber size and satellite cell content [75]. Satellite cells are essential in overseeing the repair process of myofibrils, and exercise induces an increase in their number, facilitating myofibrillar hypertrophy and function [74,76]. Regular aerobic exercise increases the proliferation of capillaries and microvascular blood flow across the age span, facilitating a regenerative cascade [77]. Furthermore, exercise decreases inflammatory cytokines and free radical formation that contribute to myofibrillar breakdown [74,76,78].

These are incredibly potent bioremediators of the processes of injury, trauma, and aging and are designed to keep our homeostatic mechanisms functioning over whatever life span Mother Nature grants us. However, there is a bargain—in return for producing these bioprotective and truly rejuvenative processes, Mother Nature expects us to continue our exercise regimens. Once we stop physical activity, the flow of these preservative and restorative processes also stops. Muscle cells begin the process of senescence, axonal structures dwindle and diminish synaptic connectivity, and even neurons die away, never to be replaced. Inflammatory processes begin to carry off the debris of dead tissues, apoptosis begins to reign supreme as a cellular process, and we begin the gradual exit stage left from the stage of life. "Use it or lose it" is *not* a myth. In all, the benefits of exercise benefits on cardiorespiratory fitness produce a remarkable cascade of physiologic processes to maintain function across the age span.

The Leading Role of Physiatry in Exercise *Is* Medicine

In summary, the history of our field reveals that exercise has always been central to our profession, that it is the most potent tool in our rehabilitative toolbox, and that it is central to future of our field, to our society, and to the health of the people of the world. Our profession should take the lead in promoting this understanding. Physiatrists have unique training to coach incorporation of exercise into the lifestyles of our patients, because we have built our professions on maximizing function despite age and disability. We owe it to our patients to understand the potent mechanisms through which exercise exerts these beneficial effects. We also owe it to our patients to teach them how best to benefit from these potent life and function-preserving effects across their life spans, regardless of health status or age. However, we must also practice what we preach by incorporating exercise into our own lifestyles and those of our own families. We must be community spokespeople for creating active living environments, for by doing so, we will not only be increasing the health

of our own communities, we will be contributing to the betterment of our whole society. The science is solid, society is awakening to its importance, and our profession is the best positioned to lead in this effort. Exercise is, always has been, and always must be rehabilitation medicine.

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Disclosure

B.E.B. University of Washington School of Medicine, 13125 S Fairway Ridge Ln, Spokane, WA 99224. Address correspondence to: B.E.B.; e-mail: aquaticdoc@msn.com

Disclosure: nothing to disclose

Submitted for publication February 20, 2015; accepted February 20, 2015.