Health & Fitness Journal
of Canada

Volume 6 **September 30, 2013** **Number 3**

HISTORICAL PERSPECTIVE
The developing understanding of Human Health and Fitness: 8. The Modern Era

Roy J. Shephard[1]

Abstract

During the Modern Era, a growing range of effective treatments for acute disease and improved conditions at work and at home led to a substantial reduction of mortality, particularly in childhood and early adult life. The discovery of insulin also enhanced the prognosis for individuals with type I diabetes mellitus. Developed societies thus saw a substantial increase of average life expectancy, and an overall aging of their populations. But at the same time, a progressive reduction in habitual physical activity and a resulting loss of physical fitness was associated with an increased premature mortality from chronic conditions, particularly atherosclerotic heart disease. The main elements of cardiac, respiratory and muscle physiology had by now been clearly established, and investigators were focussing their research on how these various body systems were affected by vigorous physical activity, both in comfortable and in challenging environments. New methods of counting and identifying leukocytes prompted an exploration of immune function and the impact of exercise upon resistance to infection. There was also a growing understanding of the negative effects of physical inactivity upon cardiac health, and a progressive acceptance of the value of exercise in cardiac rehabilitation. Physical educators continued to rely on simple field tests of an individual's physical fitness, but exercise physiologists began to develop precise, objective and standardized measures of physical function. Politicians showed a wide range of attitudes towards health and fitness, but authors with a strong social conscience prompted improvements in housing, working conditions, nutrition, and social support for the poorer members of society. In most countries with the exception of the U.S., there was a move towards the introduction of universal state-sponsored health care. The Western democracies generally continued to deliver the types of physical education programme that had been initiated during the previous century, although some instructors became increasingly interested in combining physical activity with music. In contrast, new totalitarian regimes saw fitness programming as one more tool to gain control of the population, and their physical education programmes were modified to maximize military preparedness. During the 1950s, field tests suggested that American children were much less fit than their European counterparts, and this spurred development of the President's Council on Fitness. National and international competitions were marked by a progressive improvement in athletic records, a gradual acceptance of female participation, and the development of events for those with various forms of disability. However, there was also a growing politicization of the Olympic Games, and for a short time a rival Workers' Olympiad served as an alternative venue for a substantial segment of the working-class population. The blatant doping of many athletes marred International competition, sometimes with fatal consequences. Beginning in Germany, both comprehensive textbooks and professional associations began to develop a systematic and comprehensive understanding of Sports Medicine and Sports Science. Activity patterns of the general population were modified by the introduction of paid holidays. New sources of vigorous physical activity included various ball games, roller-skating, ballroom dancing, indoor swimming, visits to National and Provincial Parks, mountaineering, orienteering, and Youth Hostelling. However, stadia of ever-growing size, new forms of gambling, movie theatres, radio and television all encouraged the adoption of a more sedentary lifestyle by most of the population. **Health & Fitness Journal of Canada 2013;6(3):3-113.**

Keywords: Acute infections; Chronic Disease; Doping; Female participation; Fitness testing; Health Care; Insulin; Nutrition; Olympic competition; Paralympics; Physical Education; Rehabilitation; Sports Medicine; Worker Olympiads

From the [1]Faculty of Kinesiology & Physical Education, University of Toronto, Ontario, Canada. Email: royj@shaw.ca

Introduction

Previous articles in this series have explored the development of our understanding of health and fitness from the earliest days of pre-history, through to Victorian times (Shephard, 2011; Shephard, 2012a, 2012b, 2012c; Shephard, 2012d; Shephard, 2013a, 2013b). The present segment of this narrative covers a period that we may characterize as the "Modern Era." Some historians have suggested that the Modern Era extends all the way from the 1500s to the late 1870s, when impressionism introduced a "Post-Modern" form of art. Others have linked Modernism with the prevalence of specific philosophical views such as Materialism, Positivism, and Reductionism, or with the emergence of Enlightenment philosophers such as Hegel and Nietzsche (Shephard, 2013a) who wrote about the *Übermensch,* the final, "know-it-all" form of human development. However, for the purpose of the present review, we will focus our discussion on the period from the beginning of World War I to the early 1960s. This is sometimes categorized as the "High Modern Era." Features of High Modern Life included the mass production of goods, a widespread ownership of private cars and labour-saving devices (particularly in North America), the introduction of mass-communication by cinema, radio and television, the growing emancipation and political role of women, the social chaos that followed the financial crash of 1929, and the flourishing of both Fascism and Communism during the 1930s. The main features of resting physiology had now been clarified, and exercise scientists were examining how body function was modified by demanding bouts of physical activity performed under both favourable and challenging environmental conditions. Physical educators still had relatively little scientific equipment at their disposal, and most of them were still relying upon simple field performance tests to assess an individual's physical fitness. However, exercise physiologists began to develop new, sophisticated and standardized measures of physical condition, an essential preliminary to monitoring secular trends in National fitness. In Western democracies, politicians continued to show a rather uninspired interest in the promotion of health and fitness, but stimulated by writers with a strong social conscience, most countries enacted legislation to improve housing, working conditions, and nutrition, and to provide social support for the poorest and most vulnerable members of the community. These efforts led to the introduction of various systems of universal pre-paid medical care following World War II.

During and following World War II, new forms of medication progressively controlled and eradicated what had previously been fatal acute diseases. This was coupled with a decrease of fertility rates in developed countries. The overall life expectancy increased, and a growing proportion of many populations were now becoming old or very old. Gains in the health of younger individuals were quickly threatened by epidemics of heart disease and obesity, apparently linked to inadequate habitual physical activity, and there was a growing recognition that an adequate daily dose of exercise could both prevent and treat coronary artery disease. Totalitarian systems in Germany, Italy and Russia saw fitness programmes as an important instrument of social control, essential to their military might.

Western governments generally continued unimaginative physical education policies inherited from the 19th century, although for a brief period some instructors showed an interest in merging physical activity instruction with the teaching of musical and dance rhythms. Towards the end of the Modern Era, comparisons of field performance test scores between children in the U.S. and Europe suggested that the latter were much fitter, and this prompted the U.S. government to establish the President's Council on Fitness.

The Modern Olympic Games that had begun relatively modestly in 1896 (Shephard, 2013c) blossomed into a major quadrennial festival. Contests were marked by ever-growing athletic achievements, a progressive acceptance of female participation, and the development of parallel events for those with various types of disability. Unfortunately, the Games were soon marred by politicization and doping scandals, and during the inter-war years many from the working-class community gave their allegiance to the Socialist alternative of a Workers' Olympiad. The discipline of Sports Medicine saw its birth in Germany, with the formation of a National Association and publication of several German language texts, and parallel initiatives were soon underway in other countries. The active leisure of the general population was encouraged by some new opportunities for exercise (paid holidays, various new ball games, roller skating, ballroom dancing, indoor swimming, visits to newly developed National and Provincial Parks, Youth Hostelling, mountaineering and orienteering), but other features of the 20th century favoured the acceptance of an ever more passive lifestyle (the growing size of cities, widespread ownership of cars, the inroduction of labour-saving equipment at work and at home, construction of ever-larger stadia, the appearance of new forms of sport-linked gambling, the construction of enormous movie theatres, and opportunities to follow sport through radio and television broadcasts.

Scientific Progress

Since the main features of physiology and anatomy had already been clearly identified by previous generations of investigators (Shephard, 2013b), the exercise physiologists of the Modern Era turned to specific fitness-related studies of respiration, the heart and circulation, looking at the manner in which the various body systems responded to exercise. Enquiry was stimulated by a variety of factors. A need was seen to reduce physical fatigue in industry, well-exemplified by the research programme conducted at the Harvard Fatigue Laboratory during the Inter-War years (Horvath and Horvath, 1973). There was a desire to quantitate the restrictions that various chronic diseases imposed upon physical performance (as seen in studies emerging from the clinical physiology laboratories of Stockholm and other Scandinavian research centres (Sjõstrand, 1960)). Defence Departments wished to enhance the performance of their troops, particularly when they were required to operate in adverse physical environments, and this stimulated the construction of well-equipped applied physiology laboratories in Germany, the U.K., the U.S. and Canada (Haldane and Priestley, 1935; Müller, 1950). Attempts were made to categorize the several components of overall fitness, to enhance conditioning regimens, and to develop

better health in both athletes and the general population (Cureton, 1947). Unfortunately, investigators who were interested in health and fitness were often obliged to conduct their research from the side-rooms of gymnasia and sports stadia, with limited access to modern scientific equipment.

Respiratory system. During the Modern Era, physiologists who were concerned with the assessment of fitness and health devoted much effort to evaluating population data on vital capacity, breath-holding time, the ability to maintain a fixed expiratory pressure against a resistance and the maximal voluntary ventilation. All of these variables could be measured easily enough, but their relationships to fitness proved sufficiently slim that they are no longer included in routine assessments of physical fitness.

Vital capacity. The spirometer had become a commonplace piece of equipment by the onset of World War I, and measurements of vital capacity were used extensively in efforts to grade the fitness for service of potential soldiers and aircrew. Dreyer (1920) recognized that undernutrition was still a significant problem among recruits during World Wart I, and he drew up extensive tables showing the expected relationships between height and body mass in healthy individuals. He also argued that a clinically useful three-level grading of physical fitness could be obtained from the individual's vital capacity, expressed as a function of body mass, trunk height and chest circumference. He certainly demonstrated substantial differences of vital capacity between athletes and the general population, but it now seems probable that this reflected the strength of the chest muscles rather than the cardio-respiratory fitness of athletic individuals. A large vital capacity also helps the flotation of swimmers, but in the absence of chronic chest disease, lung volumes bear no close relationship to cardio-respiratory function.

Breath-holding time. The measurement of breath-holding time was a routine component of fitness assessment in the British Royal Air Force until 1939, and as recently as 1962 a German Aviation Medicine Laboratory was still discussing interpretation of "*Die apnoeische Pause*" (Kallfelz, 1962). It is now realized that breath-holding times reflect largely the motivation of the test subject; times can sometimes be doubled if subjects are shown a clock where the movement of the second hand has been deliberately retarded. Such data have greater relevance to the individual's ability to don an oxygen or gas mask in a hostile environment than to cardio-respiratory fitness.

Maintenance of expiratory pressure. Another popular test adopted by Air Force physicians during the Modern Era was the subject's ability to hold a column of mercury at a height of 40 mm for at least 45 seconds (Flack, 1920). As with simpler breath-holding procedures, scores were found to depend greatly upon the subject's motivation and tolerance of the unpleasant sensations associated with maintenance of a high intra-thoracic pressure.

Maximum voluntary ventilation (MVV). The idea of measuring the maximum respiratory minute volume over a 30 second period was introduced

by Hermanssen (Hermanssen, 1933). This test remained a popular tool of respiratory function laboratories for many years, although it has been eclipsed more recently by determinations of forced expiratory volume (the maximum volume that can be expelled from the chest in one second ($FEV_{1.0}$), the total volume expired over several seconds (FEV), and the ratio of the two measurements (FEV%).

An inactive person complains of dyspnea if breathing exploits more than 50% of their maximal voluntary ventilation, and to the extent that endurance exercise is limited by shortness of breath (Shephard, 1974), the MVV does provide some estimate of a person's cardio-respiratory fitness. However, like other ventilatory measurements, performance depends substantially upon motivation, and it is likely that athletes can push themselves to use a larger fraction of their maximal voluntary ventilation than would a sedentary individual.

The FEV% still finds application in the detection of bronchospasm, and a 10-15% deterioration in FEV1.0 or FEV% following a bout of exercise offers a useful diagnostic test for the presence of exercise-induced bronchospasm.

Cardiovascular system. During the Modern Era, cardiovascular physiologists explored the influence of exercise and postural change upon systemic blood pressures. Investigators also attempted to interpret physical condition from inter-individual differences in the form of the pulse wave and the rate of recovery of heart rates following a standard bout of exercise. With improvements in electrocardiographic recording systems, cardiologists began the search for possible changes in the resting ECG associated with involvement in sport and with myocardial ischaemia. The development of chest radiography and cardiac catheterization allowed more direct investigation of the dimensions and functiuonal performance of the heart.

Blood pressure regulation. With perfection of the sphygmomanometer, physiologists began to study the changes of systemic blood pressure induced by various circulatory stressors. Barringer (Barringer, 1917) noted the rise of blood pressure that followed a minute of exercise, specifically the repeated lifting of 1.5-10 kg dumb-bells. Normally, the highest systolic reading was seen in his first measurement, taken 20-30 seconds after completion of the exercise, but as the loading was increased the rise of blood pressure was delayed, until the highest reading was seen 50-90 seconds following exercise. Barringer thought that the corresponding loading had exceeded the reserve power of the heart. A present-day exercise physiologist might interpret his findings as indicating that the load had reached a level where the heart was unable to sustain perfusion of the vigorously contracting muscles, and that an accumulating concentration of lactate stimulated a reflex hypertension. Bock et al., (1928) also attached importance to the rise of systolic pressure seen during vigorous exercise on a cycle ergometer. At any given power output, a much greater rise of blood pressure was seen in a sedentary person than in a subject who was fit.

A second type of blood pressure test examined the individual's capacity to adjust to a sudden change of body posture. Leonard Hill (1895) had previously noted that the visceral vessels

had sufficient dimensions to accommodate a person's entire blood volume. He suggested that as fatigue developed, the autonomic nerves failed to induce constriction of the visceral vessels sufficiently rapidly on moving from a lying to a standing position, thus predisposing to episodes of fainting following prolonged exercise. The Crampton (1905) and Schneider (1920) tests of physical fitness were each based on these observations. Both tests presupposed that if a fit person moved rapidly from a supine to an upright position, the visceral vessels would constrict adequately, allowing systolic blood pressure to be maintained or rise rather than fall, without any large increase of the individual's heart rate.. Crampton rated subjects from 100 (ideal) downwards, based on the observed changes in both blood pressure and heart rate. Schneider's assessment considered four variables (resting heart rate, the change in blood pressure from the supine to the upright position, the change in heart rate immediately after a simple stepping exercise, and the rate of heart rate recovery following a standard bout of exercise). Adequate adjustments of blood pressure to postural change certainly show some relationship to the gains of cardio-respiratory fitness induced by daily exercise (Scott, 1924), probably mainly through the development of an increased tonus in the leg veins (Holmgren, 1967). Nevertheless, both heart rate and blood pressure are modified by many extraneous factors, making postural tests relatively poor indicators of a person's physical fitness. Indeed, an evaluation by McCloy concluded that the Crampton, Foster and McCurdy tests gave little more information about a person's fitness than could be obtained by a random guess (McCloy, 1931). Schneider himself admitted that postural changes in blood pressure were poorly related to resting blood pressure. Some use of this type of test continued into the early 1960s, for example, Olafson (1962), but such approaches have since been superceded by more direct measurements of cardio-respiratory fitness.

Pulse pressures. Attempts to assess a person's cardio-respiratory condition from formal rather than subjective analyses of pulse pressures began with Wyman, who suggested that strenuous training induced a reduction in the resting systolic pressure (Wyman, 1913). The Barach Index was calculated as the sum of systolic and diastolic pressures, multiplied by the resting heart rate and divided by 100 (Barach, 1914). A low score implied a good cardio-respiratory fitness. The Barach Index continued to be used by physical education departments until the 1960s (Hicks, 1960; Willgoose, 1961). However, already in 1926 one study of girls who were attending a camp in the Rocky Mountains had noted that the pulse pressure was greater in athletic than in non-athletic individuals (Damez et al., 1926). German studies based on the classical "Windkessel theory" of Otto Frank (1865-1944 CE) (Frank, 1899; Shephard, 2013b) confirmed that (other factors being equal) the size of the pulse pressure was dependent upon the left ventricular stroke volume and thus a person's cardio-respiratory fitness (Wezler and Böger, 1937). However, clinical application of this measure was compromised, since the pulse pressure also increased with arteriosclerosis of the central arteries.

A device for recording the pulse wave (dignified by the name of "Heartometer") was long used by Tom Cureton (1901-2002 CE) in his studies at the University of Illinois (Cureton, 1947). One factor encouraging use of this apparatus was the reluctance of clinicians to permit physical educators to use and interpret data from other types of scientific equipment such as electrocardiograms, at least until the 1960s. Despite the need to transmit the pulse wave to the recording cuff through varying amounts of overlying muscle and skin, Cureton and his colleagues not only measured the amplitude and duration of primary and secondary pulse waves, but they also valiantly calculated first and second derivatives of the pressure curves (velocities and accelerations) (Franks, 1969). They further suggested that these derivatives bore some relationship to the vigour of the subject's cardiac contraction and thus myocardial contractility, although their theoretical interpretation was somewhat suspect, since all aspects of the pulse wave are also strongly influenced by arterial distensibility (and thus both autonomic tone and atherosclerosis).

Interest in pulse recording gained a new lease on life with the appearance of light-weight electronic tambours that could be positioned over the carotid artery. Such devices enabled observers to estimate such cardiac variables as electro-mechanical lag time, isovolumic contraction period and ejection period (Cundiff and Corbun, 1969). More recently, the determination of pulse wave velocities has also provided an index of arterial stiffness, and thus the likely extent of arteriosclerosis in different segments of the arterial tree (Aoyagi et al., 2010).

Pulse rate recovery curves. Because of difficulties in counting the pulse rate accurately during exercise, many early fitness tests were based on the ratio of recovery pulse rates to resting values. Counts were made, usually by wrist palpation, after running on the spot (15 seconds at a pace of 180 steps/min, (Foster, 1914)) or following a period of bench stepping (Brouha, 1943; Hunt and Pembrey, 1921; Schroeder and Tuttle, 1931; Tuttle, 1931). Bench heights varied quite widely, from 0.33 m (Tuttle, 1931) to 0.51 m (Brouha, 1943) in men, and dimensions were sometimes 16% smaller in women (Sloan, 1966).

The Foster test was used in school health examinations for quite a long period, although one trial noted a correlation as low as -0.14 between a cardiac efficiency score derived from this test and the classroom teacher's rating of the pupil's physical efficiency (Bliss, 1926). The pulse ratio was still being used to assess performance on the parallel bars as late as 1931 (Schroeder and Tuttle, 1931).

Rapid recovery of the pulse rate following a bout of exercise is certainly one criterion of cardio-respiratory fitness, and on the basis of the observations of Hunt and Pembrey, the British Medical Research Council concluded that the recovery curve gave the best simple index of a person's general physical condition (Medical Research Council, 1922). Comparison of the values obtained during and 10-15 seconds following exercise showed good agreement (Cotton and Dill, 1935), thus laying the basis for design of the Canadian Home Fitness Test (Bailey et al., 1976). However, if pulse counting was delayed until 30-60 seconds after the completion of exercise, a third of the information content concerning the

exercise response was lost (McArdle et al., 1969; Millahn and Helke, 1968; Ryhming, 1954; Shephard, 1967b).

Electrocardiogram (ECG). The form of the resting electrocardiogram was studied extensively, both in normal individuals and those with cardiac disease, soon after Einthoven had introduced the concept of electrocardiography (Shephard, 2013b). A study of 260 competitors who were attending the Amsterdam Olympic Games of 1928 suggested that two features of the resting ECG distinguished the fit athlete: a long P-Q interval and a large T wave (Hoogerhof, 1929). The long P-Q interval is sometimes associated with coronary thrombosis, but in the Olympic athletes it reflected mainly a slow pulse rate (the average heart rate of the competitors studied was 50 beats/min, and the rate for one individual was as low as 30 beats/min). The large T waves of the athlete today no longer attract great attention; a high voltage ECG probably reflects a lack of superficial fat rather than any cardiac abnormality. Nevertheless, debate continues on the merits of using a resting ECG in order to screen-out athletes who may be at risk of sudden death when exercising (Shephard, 2011a).

For many years, poor skin contacts and problems with the recording apparatus precluded ECG recording during exercise. However, an important discovery, made by Master in 1928, was that depression of the ST segment of the ECG immediately following a bout of vigorous stepping was a consistent harbinger of subsequent myocardial infarction (Master, 1969).

Cardiac radiography. During the Victorian era, many cardiologists such as Peacock had argued that "injudicious" forms of exercise, including lifting, pulling, pushing, straining and stair or mountain climbing could cause heart strain and weaken the heart (Peacock, 1865). Sir Thomas Lewis was one of the strongest opponents of this view; he argued that the fibrous nature of the pericardium prevented excessive dilatation of the heart during exercise, and he stated (Lewis, 1933):

"if strain of the heart exists, it is no more than a curiosity."

Resolution of this contentious issue depended in part on accurate determinations of heart size. The classical clinical approach had been percussion of the chest. Occasionally, a skilled clinician could detect the gross ventricular enlargement of terminal cardiac failure, but observations were necessarily at best qualitative approximations. Nevertheless, post-mortem observations had already demonstrated large hearts not only in those with chronic cardiac disease, but also in muscular, athletic men (Hirsch, 1899). Animal physiologists further pointed out that the heart weight of various species depended substantially upon the volume of habitual exercise that they undertook (Külbs, 1912). Moreover, puppies that were exercised regularly developed larger hearts than their littermates who had few opportunities for exercise (Steinhaus et al., 1932).

The introduction of chest radiography allowed clinicians to make semi-quantitative estimates of the size of the human heart during life. They observed that the hearts of previously sedentary individuals became larger during a period of military service, and this hypertrophy was particularly marked in bicycle dispatch riders (Schieffer, 1907). Distance

runners and cyclists were also shown to have larger hearts than weight-lifters and short distance runners (Herxheimer, 1929). Unidimensional radiographic estimates of heart size were refined by combining information from postero-anterior and lateral radiographs (Blumchen et al., 1966); this new approach provided a rough estimate of the total cardiac volume. As data accumulated, the idea emerged that the large heart of the endurance athlete was a favourable adaptation to regular physical activity rather than a manifestation of pathological change.

Cardiac catheterization. The accurate measurement of cardiac output was greatly facilitated by the development of cardiac catheterization. Now, well-mixed venous blood could be sampled from a small catheter that had been introduced into the right ventricle, or even the pulmonary artery, thus allowing Fick principle estimates of cardiac output in human subjects. Claude Bernard (1813-1878) had already used this technique in experimental animals, but during the 1930s, Werner Forssmann succeeded in introducing a long and narrow catheter into his own right atrium, monitoring movement of the tube on a fluoroscope that he had positioned over his chest. He shared a Nobel Prize in physiology with André Cournand and Dickinson Richards for this achievement, but the Hospital Administrators were less impressed. They concluded that the investigation had been foolhardy and they dismissed him from his position in the cardiac laboratory.

By the 1950s, catheterization of the pulmonary artery had become a routine procedure, and as a Resident Cardiologist, I was performing several such operations on young children every week at Guy's Hospital, in Central London. The Cardiac Department at Guy's was one of the pioneers in the surgical treatment of cyanotic heart disease, and an evaluation of intra-cardiac shunts (based upon the catheter reports) was a necessary preliminary to cardiac surgery. However, it was not until a few years later that the collection of arterial and mixed venous blood samples during exercise became commonplace (Lorell and Grossman, 1986).

Body build

During the Modern Era, the characterization of body build progressed from simple semantic descriptions to collection of objective and quantitative data on the amounts of muscle, fat and bone in the body.

Semantic descriptions of body build. Semantic descriptions of body build can be traced back as far as Hippocrates (Shephard, 2012b). Hippocrates had distinguished the *habitus apoplecticus* (the red-faced, jovial, thick set and forceful type of individual, who was liable to die of apoplexy) from the *habitus phthysicus*, (the lean and introspective type of person who was liable to die of phthisis). In 1797, Halle went further, distinguishing four types of body build: the fat *("Abdominal")* person, the strong *("Muscular")* individual, the long, slender-chested *"Thoracic"* type, and the large-headed "*Cephalic"* person (Sheldon, 1963).

Such descriptions initially held much greater interest for psychiatrists than for exercise scientists. Indeed, Ernst Kretschmer (1888-1964 CE) published a book discussing the relationships between an individual's physical make-up and his or her psyche (Kretschmer, 1921).

He distinguished three main types of physique: the round and compact "*Pyknic*" body form, the long and thin "*Leptosome*" and the muscular, "*Athletic"* individual, although he also recognized that the build of most people was an amalgam of the three extreme body types. He associated the Athletic body type with a cold, aggressive and ruthless personality, and an increased propensity to epilepsy (Kretschmer and Enke, 1936).

Some physical educators long persisted in making classifications of this sort. Thus, William Herbert Sheldon (1898-1977 CE) used nude body photographs to make a seven-point rating of his population of in terms of three supposedly orthogonal physical characteristics: fatness ("*Endomorphy*"), muscularity ("*Mesomorphy*" and linearity ("*Ectomorphy*"), He estimated that in a well-nourished sample of adults, 7% would be classed as Endomorphs, 12% as Mesomorphs, and 9% as Ectomorphs, although the remaining 72% of people would share two if not three of the proposed body types (Sheldon, 1963). Like Kretschmer, Sheldon believed that these traits were inborn, and played an important role in controlling the individual's personality: physique equated with destiny. After World War II, Sheldon fell into general disfavour. This was in part because of the discovery of files containing nude photographs of young Co-Eds, publicized by the popular press as the "*Great Ivy League Nude Posture Photo Scandal*," and in part because his former assistant, a Barbara Honeyman Heath, denounced Sheldon's methods as inaccurate and even fraudulent (Vertinsky, 2007). Nevertheless, a scientific article that was contributed to the International Olympic Committee *Encyclopedia of Sports Medicine* as recently as 2000 still rated various categories of athlete in terms of their Endomorphy, Mesomorphy and Ectomorphy (Eisenmann and Malina, 2000).

More recently, there have been attempts to combine the subjective impressions of somatotyping with objective measurements of body dimensions (Carter and Heath, 1980). However, most investigators have concluded that it is preferable to examine the relationship between physique and physical fitness in terms of lean body mass, body fat content, and bone dimensions rather than to look at a subjective and arbitrary "Gestalt" of body form that was in any event developed for Psychiatrists rather than for Physiologists.

Quantitative assessments of body build. Quantitative methods of assessing human physique that were developed during the Modern Era included hydrostatic weighing, soft tissue radiography and the use of skinfold calipers. Interest in determining the body density was initially stimulated by attempts to improve formulae for the estimation of body surface area (Bohnenkamp and Ernst, 1931), a need to relate body fat content to the storage of nitrogen during the decompression of divers (Behnke, 1942), and a nutritional interest in body fat content relative to the development of obesity and tolerance of starvation (Brozek, 1965).

In order to determine body density, subjects were weighed while submersed in water (Behnke et al., 1942; Brozek et al., 1963), or were exposed to varying air pressures while enclosed in a rigid chamber (Jongbloed and Noyons, 1938). For a few years, soft tissue radiography

was used to display fat and muscle (Brozek et al., 1958), but it was soon appreciated that the resultant radiation exposure was undesirable. Skinfold calipers were first introduced during the 1930s, but they only became widely accepted with the development of a precision instrument that exerted a constant pressure over all likely jaw-widths (Edwards et al., 1955; Tanner, 1959).

Prominent investigators who were involved in the quantitative study of body composition included Albert Richard Behnke (1903-1992 CE) and Ancel Benjamin Keys (1904-2004 CE) in the U.S., and James Mourilyan Tanner (1920-2010) and John Valentine George Andrew Durnin (1923-) in Great Britain.

Behnke was an American physician who had played a major role in development of the U.S. Navy's *Naval Medical Research Institute* (Bornmann, 1992). He is now recognized particularly for his work in distinguishing arterial embolism from decompression sickness, in developing standard decompression tables, and in applying the principle of hydrodensitometry to the determination of body composition.

Keys was identified as an "intellectually gifted" Berkeley student while serving as a subject during development of the classical Stanford-Binet tests of intelligence. After a period studying the physiology of fish under the direction of August Krogh (Shephard, 2013b) and conducting studies of Chilean miners who were engaged in hard physical work at altitudes of 4500-6000 m, Keys settled at the University of Minnesota in Minneapolis. There, he founded the *Laboratory of Physiological Hygiene*. During World War II, he developed *K rations* for the U.S. Military, and carried out experiments on prolonged starvation, using as his subjects 36 men who had expressed a conscientious objection to military service (Kalm and Semba, 2005). His source of "volunteers" might well raise the eyebrows of modern ethics committees! In the Post-War Era, he compared the prevalence of cardiac risk factors and the incidence of heart disease across 7 nations, leading to his espousal of the "*Mediterranean Diet*" (Keys, 1980).

Tanner was an Olympic-level hurdler, but he was unable to compete internationally because World War II led to cancellation of the 1944 Olympic Games. Tanner subsequently became a Pediatric Endocrinologist at the *Institute of Child Health* in Central London. His primary research interest was in documenting the growth and development of healthy children. He travelled each month to an orphanage in Harpenden, on the northern outskirts of London. There, he made detailed serial measurements on the resident children, with the skilled help of his devoted technician, Reginald Whitehouse. The end-results of this project were the *Tanner Scale of Sexual Maturation* and some widely accepted clinical norms of height and body mass for the growing child (Tanner and Preece, 1989). Reginald Whitehouse was a man whom Tanner had described as "*innocent of any academic training*" (Hall, 2006), but who undoubtedly played a major role in the meticulous measurements on which the reputation of the duo was built.

Durnin was for many years Professor of Physiology at the University of Glasgow, Scotland. He is remembered especially for establishing equations that linked various potential skinfold readings with the body density of subjects at all

ages and in both sexes (Durnin and Womersley, 1974). With Dr. Passmore of Edinburgh University, Durnin also created a detailed Compendium, listing the energy costs of many common physical activities, including 31 types of sport (Durnin and Passmore, 1967).The *Compendium* was used by Exercise Physiologists for many years, but unfortunately Durnin's painstaking efforts have now been largely out-dated by changes in equipment and technology that have reduced the energy cost of a host of activities.

Integrative physiology

The demands of the Armed Services during World War II stimulated the development of large and well-equipped environmental physiology laboratories in many countries. Such facilities allowed an examination of human responses when exercising at simulated high altitudes, high ambient pressures, extremes of heat and cold, and high gravitational accelerations. When hostilities began, the *Royal Canadian Air Force* quickly improvised a secret laboratory on the grounds of the former *Eglington Hunt Club*, in North Toronto. The building soon housed an environmental chamber for testing human responses to extreme cold and a small human centrifuge that simulated the sudden accelerations encountered by the pilots of fighter aircraft. One of the most important products of this laboratory was the anti-g suit, devised by Wilbur Franks, in 1941. As early as 1917, there had been reports of pilots "fainting" while in the air (Burton 1988; Head 1920). In the 1940s, German fighter pilots attempted to overcome this problem by raising their legs during tight turns, but Franks invented a suit that inflated automatically, compressing the veins in the legs and abdomen, when an aviator was exposed to high g values.

A decompression chamber for Canadian high altitude studies was also constructed during World War II. The original facility was located at the rear of the *Banting & Best Research Institute* of the University of Toronto. In 1952, it was decided to concentrate these various resources in a much larger laboratory that was constructed at the Downsview Base of the *Royal Canadian Air Force*. The new facility was originally known as the *RCAF Institute of Aviation Medicine*, but it went through many name changes in a manner typical of government laboratories, and it is currently identified as *Defence Research and Development Canada, Toronto* (DRDC, 2012).

In Britain, much of the early environmental research was conducted in the field. For instance, Air Commodore Stewart conducted many studies of anti-g forces while piloting a fighter aircraft. However, by the time that I was enlisted for military service, a large *RAF Institute of Aviation Medicine* had been constructed on the Farnborough Air Force Base, adjacent to the *Royal Aircraft Establishment*. As a young Flight Lieutenant and Medical Officer I quickly became a guinea pig for such issues as human responses on sudden exposure to an altitude of 70,000 ft., and evaluating the time required for the valves of an oxygen face-mask to freeze when sitting in a wind tunnel, exposed to a temperature of -40ºC and a gale-force wind. There was also an army laboratory on the Farnborough base; their main interest was to study optimal methods of carrying a heavy back-pack. On Porton Down, near Salisbury, the *Chemical Defence Research Establishment* examined human responses to toxic gases, as well as

the applied physiology and ergonomics of wearing protective clothing and respirators, under the supervision of a veteran physiologist, Sir Charles Lovatt Evans. And at Alverstoke (near Gosport, on the South Coast), the Royal Navy established an *Institute of Naval Medicine,* where Physiologists such as Haldane conducted much of their research on diving.

The United States also developed large and well-equipped laboratories for their armed services, including Wright Field, near Dayton, Ohio, (where Randolph Lovelace, Hermann Rahn , and Wallace Fenn carried out important experiments on hypoxia and the design of oxygen masks), Randolph Field, Texas, where early space research was conducted, the U.S. Army Research Laboratory at Natick, Mass (which explored many issues of heat and cold exposure), the Edgewood Chemical Defence Laboratory in Maryland, and the U.S. Navy's *Submarine Research Laboratory* in New London, Conn.

Many of the investigations undertaken by these various military laboratories initially had a security classification, but they were eventually released to other scientists, and this new knowledge proved helpful to those promoting physical activity. In parttcular, it clarified permissible environmental limits for those members of the general public who wished to engage in vigorous physical activity under challenging conditions.

High altitudes. In 1953, the New Zealand mountaineer Sir Edmund Percival Hillary (1919-2008 CE) and the Sherpa Tensing Norgay (1915-1986 CE) achieved the ultimate feat of high altitude exercise, the conquest of Mount Everest while carrying 14 kg back-packs. Hillary later devoted much of his energy to the *Sir Edmund Hillary Outdoor Pursuits Centre,* a charity that was intended to increase outdoor physical activity among a broad cross-section of New Zealand youth. It was in this capacity that I met him during a trip to New Zealand in the 1970s.

Hillary himself was undoubtedly superbly fit. Other members of the first Everest expedition, such as Lewis Griffith Cresswell Evans Pugh (1909-1994 CE), a human physiologist at the *British Medical Research Council's* Hampstead laboratories, were of more average physique. Nevertheless, all of the climbers had spent much time in preliminary acclimatization and training in the Himalayan foothills. In his subsequent writing about the Everest expedition, Pugh underlined the importance of oxygen tanks and adequate hydration to its ultimate success (Pugh, 1962). As tragic tourist treks in the Himalayas have underlined more recently (Krakauer, 1997), meticulous planning and careful acclimatization are vital to participant safety.

High altitude sickness is a problem that has affected many middle-aged tourists during visits to ski resorts at more moderate elevations (2500-4000 m). Mountain sickness may first have been described by the Jesuit missionary Antonio de Andrade (1580-1634 CE), as he crossed the Himalayas into Tibet in 1624. Several of his party were taken ill as they crossed the highest passes, and de Andrade noted (Firstbrook, 1999):

"*People in good health are suddenly taken ill and die…*"

Barcroft recognized that the condition of mountain sickness sometimes even

affected people who were travelling by train across the Andes (Barcroft, 1914). In its more chronic form, the condition was also prevalent among Andean miners, although it was not always clearly distinguished from industrial pneumoconioses (Monge and Monge, 1966). It is now known that mountain sickness is usually provoked by beginning vigorous exercise too soon after an ascent to high altitude, and most people can minimize adverse effects by taking prophylactic acetazolamide and allowing 24-48 hours for adaptation to low oxygen pressures.

Pugh, in company with many exercise scientists, became very interested in the challenges that would face athletes in 1968, when the Olympic Games were held in Mexico City, at an altitude of about 2240 m. The *Canadian Olympic Committee* dispatched me on a similar mission. It was an epic 4-day journey from Toronto across the lonely mountains of central Mexico, driving a heavily-laden station wagon at high speeds. On arriving at the Federal University in Mexico City, I began empirical tests on myself, my technician and a Canadian swimming champion, assessing the minimum period of acclimatization needed to optimize physical performance (Shephard, 1967a). Pugh predicted, correctly, that despite allowing an optimal period of acclimatization, the speed of long-distance athletes would be significantly slowed. On the other hand, he calculated that the reduced density of the air at this altitude would offer a small advantage to those participating in sprint, cycling and throwing events (Pugh, 1969). The results of the Mexico City Games brought into focus possible longer-term adaptations to high altitude, as the Ethiopian and Kenyan contingents began to excel in long distance events (Saltin et al., 1995; Scott et al., 2003).

Heat Stress. Heat stress has long been a concern among Marathon runners, and it has become an important issue for the health of the exercising public, given the high rate of participation in some summer events. The London Olympic Marathon of 1908 was held on a day that was hot by British standards, and Dorando Pietri (1885-1942 CE) entered the stadium to complete the final lap in a dazed condition. He turned in the wrong direction, and when track officials redirected him, he fell. They helped him up from five successive falls before he crossed the finish line. In the words of Sir Arthur Conan Doyle (Lovesey, 2001):

...again he collapsed, kind hands saving him from a heavy fall...Amid stooping figures and grasping hands, I caught a glimpse of the haggard, yellow face. the glazed, expressionless eyes, the lank black hair streaked across the brow."

Although Pietri ended in first place, with a time of 2 hours, 54 minutes 46 seconds, he took 10 minutes to complete the final 350 m of his race, and was subsequently disqualified because of the assistance that he had received. However, Irving Berlin recognized his efforts in the popular ballad "*Dorando*."

In Stockholm (1912), the day selected for the Marathon event was again warm and humid, and a Portuguese contestant (Francisco Lazarro, 1891-1912 CE) collapsed at the 30 km mark, to die in hospital on the following day. The primary cause of death was thought to be dehydration, although Lazarro had apparently exacerbated his problems of

thermoregulation by coating his body with a layer of wax to prevent sunburn.

Few lessons seem to have been learnt from these two events. During the Empire Games of 1954, Jim Peters, a seasoned British Marathoner, entered the Vancouver stadium in bright sunshine and 28°C heat, and he collapsed several times during the final 285 m of his race. He had maintained a very fast pace and was 17 minutes ahead of any other competitors. He staggered and fell several times as he moved half-way around the stadium, taking 11 minutes to cover a final distance of some 200 m. His masseur finally called for a stretcher when the runner was less than 200 m from the finish line. *"I was lucky not to have died that day*," Peters later told the masseur. He had chosen not to drink during the event, and was unconscious when he was admitted to hospital. At this stage, his rectal temperature was 39.4°C. He recovered fully, even though he was managed conservatively (Noakes et al., 2008). Dehydration and postural hypotension seem to have been the main causes of his collapse.

The setting of clear standards both for fluid replacement and the cancellation of distance running under unfavourable conditions has since reduced the number of cases of heat stress seen in Marathon events (American College of Sports Medicine, 1975). However, the incidence of heat-related collapse and deaths in American football seems largely unabated. The heat loss of the football player is typically restricted by padding and nylon clothing and in the Southern U.S. 3-4 players are still dying every year (Grundstein et al., 2012).

Cold conditions. The *Canadian Association of Sports Sciences* was founded in Winnipeg in 1967, during the Sports Medicine Meeting that was associated with the Pan-American Games. During this Conference, Griffith Pugh discussed a series of deaths that had occurred during hill walking races in the North of England. Here, the altitudes were modest (around 1000 m), but a combination of relatively low temperatures and clothing that offered inadequate protection against rain had led to hypothermia in a number of participants, particularly unfit climbers who had not maintained a sufficient intensity of effort to keep themselves warm (Pugh, 1972).

During this same era, Pugh explored issues of hypothermia in long distance swimmers. He demonstrated that when a person was exercising vigorously, a 10 mm layer of grease spread over the skin surface provided quite an effective means of sustaining body temperature during very prolonged events such as a Cross-Channel swim (Pugh et al., 1960).

Physical performance

Measurements of field performance remained popular among laboratories with limited equipment, but the increased availability of cycle ergometers and treadmills during the Modern Era led to the gradual replacement of such assessments by more precise methods of quantifying an individual's physical fitness.

Hans Kraus (1805-1995 CE) was a Physician, Physiotherapist, rock-climber, mountaineer and international skier of Austrian birth, who escaped from Nazi Vienna in 1938. He earned some notoriety with his Orthopedic colleagues by advocating the immediate mobilization of injured limbs, particularly in athletes. Following World War II, he introduced a six-item performance test battery to

assess the physical fitness of U.S. school students (Schwartz, 2005). Five of the tests tested muscular strength and endurance, and the sixth measured the individual's ability to touch the floor for 3 seconds while standing erect. This *Kraus-Weber test battery* was widely applied to U.S. and European school children. The results caused a great furor: 58% of U.S. students failed to meet the minimum criterion proposed for at least one of the tests, usually the floor-touching item (Kraus and Hirschland, 1954), although most European students had no problems completing the entire test battery.

Some U.S. Physical Educators seized upon these findings as a proof-text in their quest for greater governmental funding, but Max Howell (then at the University of Alberta) demonstrated the important impact of test learning upon the scores that were achieved. Over the course of 4 days of instruction and practice, Howell was able to bring the performance of Canadian children to a level that matched that of their European counterparts.

The American and Canadian *Associations for Physical Education and Recreation* continued the mass performance testing of school-children, but in response to criticisms of the *Kraus-Weber* findings, they each developed more broadly-based test batteries, taking care not to specify required minima of performance (American Association for Physical Education and Recreation, 1958; Canadian Association for Physical Education and Recreation, 1966). The new U.S. and Canadian test instruments differed somewhat from each other, but both had the attraction of apparently examining a broad range of fitness components, including muscular strength and endurance, flexibility and aerobic and anaerobic power. Findings for any given individual were expressed as percentiles of the mean for a corresponding age and sex-matched sample of the national population. However, it was soon appreciated that the scores obtained with the revised test procedures were still not very helpful in deciding on an individual's fitness level. Most of the scores depended heavily upon the individual's height, body mass and body fat content (Cumming and Keynes, 1967; Drake et al., 1968). Technique and personal motivation also contributed substantially to the observed performance, and most children could improve their score substantially simply by practicing the required skills. Relative opportunities for practice were shown to explain at least some of the observed differences of scores between European and North American students (Campbell and Pohndorf, 1961; Knuttgen, 1961; Sloan, 1963).

Jumping and throwing, muscular endurance tests, sprint and distance runs, and sit-and reach tests have all remained popular components of field performance test batteries.

Jump Tests. Dudley Sargent (1849-1924 CE), 4-time president of the *American Physical Education Association* (Shephard, 2013b), proposed an index of explosive muscle force based on the product of the individual's body mass and the height jumped when standing erect (Sargent, 1921). Initially, observers assessed the height jumped by having the subject touch a wall marker, but subsequently more accurate information was sought by filming the test participant, or using a force platform to record the corresponding mechanical impulse.

Variants of the original vertical jump (often associated with the name of

Carmelo Bosco (1843-2003 CE)(Bosco et al., 1983)) have allowed a preliminary flexion of the knees before jumping (a *counter-movement jump*), a *squat jump* with or without additional weighting of the subject, a *drop-jump*, and *standing long jumps*. In some but not all laboratories, allowance has been made for body mass when calculating test scores. Evaluations of children have also, on occasion, included a softball throw. This particular skill is familiar to North American but not to European students (Campbell and Pohndorf, 1961), and this is one test item where North American students have usually outshone their European peers.

Muscular endurance tests. Physical Educators have assessed muscular endurance by such tests as *pull-ups*, *chin-ups*, endurance of a *flexed arm hang*, *push-ups* and *sit-ups*. International comparisons of data have been compromised by small but significant differences of test protocol (compare, for example, details of the instructions found in the *AAHPER* and the *CAHPER* test manuals (American Association for Physical Education and Recreation, 1958; Canadian Association for Physical Education and Recreation, 1966)).

Flexibility. Niels Stensen introduced the goniometer to measure the angles of quartz crystals as early as 1696. Clinical use of the goniometer began during World War I, when Camus and Amar used a simple protractor goniometer to measure increases in the range of motion of battle-injured limbs during the course of rehabilitation (Fox, 1917). Some observers used the even simpler alternative of holding the limb against a protractor chart.

Variants of the basic apparatus have included a pendulum goniometer (Hand, 1938) and a hydrogoniometer (Anderson and Sweetman, 1975). By the middle of the 20th century, plastic and plexi-glass versions of the protractor goniometer became widely available, and physical educators and physiotherapists were using the Leighton flexometer in their assessments of physical fitness (Leighton, 1959). Incorporation of a potentiometer into this type of apparatus allowed a continuous electrical read-out of data during body movement (Karpovich and Karpovich, 1959).

In 1952, a desire to standardize the measurement of flexibility led to replacement of goniometers and toe-touching by the widely used sit and reach test of spinal flexibility (Wells and Dillon, 1952).

Sprint and endurance performance. North American Physical Educators adopted a 50 yard (45.7 m) sprint as a simple field indicator of anaerobic fitness (American Association for Physical Education and Recreation, 1958; Canadian Association for Physical Education and Recreation, 1966). They commonly tested students outdoors, and performance was then influenced by the ambient temperature, wind-speed and ground conditions, in addition to other variables such as body size, motivation and practice that affect all field performance test scores.

Aerobic performance was assessed from the distance run in a set time, but concerns were expressed about the need for medical supervision during prolonged, all-out aerobic effort. Many physicians and physical educators considered such activity too stressful for a schoolchild, so *AAHPER* adopted a 600 yard (549 m)

walk-run test (American Association for Physical Education and Recreation, 1958), and *CAHPER* opted for an even shorter 300 yard (274 m) all-out run (Canadian Association for Physical Education and Recreation, 1966). The typical duration of the 274 m test was sufficiently short that both aerobic and anaerobic processes contributed substantially to the student's performance.

As confidence in the safety of field testing increased, a Canadian kinesiologist (Luc Léger of the University of Montreal) developed a shuttle-run procedure that brought children to peak, if not absolute maximal aerobic effort (Léger and Boucher, 1980). Intended for use by both athletes and ordinary schoolchildren, the original shuttle run required subjects to complete a series of 20 m laps at increasing speeds, but 15 and 10 m variants of the test (Mikawa et al., 2012; Singh et al., 1992) have since been described for students with a low fitness level. Kenneth Cooper (1931-) devised another approach for adults while he was serving as a colonel in the U.S. Air Force. He determined the maximum distance recruits could run in 12 minutes (Cooper, 1968b). In part because body mass influenced the individual's running speed, scores on this "Cooper Test" showed a relatively close correlation (0.90) with treadmill determinations of maximal oxygen intake (if the latter was expressed in ml/[kg.min]).

Gas Analysis and Exercise Physiology. The earliest studies of respiration during exercise began in the mid-19th century, when a British physician named Edward Smith (1819-1874 CE) had subjects breathe out through a gas-meter. He removed water by passing the expirate over a pumice stone soaked in concentrated sulphuric acid, and then directed the gas flow into a canister of potassium hydroxide. The output of carbon dioxide was thus deduced from an increase in mass of the potassium hydroxide solution. Smith concluded that carbon dioxide production was increased greatly by physical exertion (Smith, 1859) and indeed the estimates that he made when subjects were walking at 3.2 and 4.8 km/h closely matched the figures obtained by C.G. Douglas some 50 years later (Douglas, 1956).

Beginning with the Danish chemistry professor E.A. Scharling (Scharling, 1843) and continuing with the early cycle ergometer studies of August Krogh (1874-1949 CE) (Krogh and Lindhard, 1920), some investigators opted to enclose their subjects in a small chamber; this enabled them to determine the metabolic exchange from changes in the oxygen and carbon dioxide content of a stream of air that was pumped continuously through the chamber.

An alternative approach was to collect the expired gas in a water-filled spirometer. The large and carefully counter-balanced spirometer developed by the French physiologist Jules Tissot (1870-1950 CE) proved particularly suited to exercise, as it offered quite a low resistance to expiration (Tissot, 1904). Other investigators directed the expirate to a wet gas meter, with proportional sampling of gas for later analysis (Magnus-Levy, 1893). Nathan Zuntz (1847-1920 CE) and his colleagues developed a portable dry gas meter for use on an expedition to Monte Rosa (Zuntz et al., 1906) and Ernst Simonson suggested fitting a side aperture to the expiratory tube that would direct small fractions of the expirate to a series of rubber sampling bladders (Simonson,

1928). Refinement of Simonson's device yielded the Kofranyi-Michaelis respirometer.

But for many years, perhaps the most popular approach for the exercise scientist was to collect the subject's expired gas in a large canvas bag. The English physician, chemist and natural theologian William Prout (1785-1850 CE) had first introduced the idea in 1813 (Hollmann and Prinz, 1997; Prout, 1813). Prout showed that when walking, the concentration of carbon dioxide in the expirate dropped from 4.1% to 3.3%. Prout's concept was popularized by Claude Gordon Douglas (1882-1963 CE); the latter investigator used large rubberized canvas bags that were either carried on the subject's back, or supported on the laboratory bench during performance of more sedentary tasks (Douglas, 1911). The main constraint faced by most investigators was the need to undertake a tedious chemical analysis of the expirate. This was generally accomplished using the apparatus devised by John Scott Haldane (1860-1936 CE) (Haldane, 1918). Considerable technical skill was needed to clean the glassware and mercury and to prepare the absorbent solutions for this apparatus, and even when it was ready for use, individual gas analyses took 15 minutes or longer to complete.

Ergometry. For the accurate assessment of physical condition, it is helpful to relate the subject's exercise responses (heart rate, ventilation and oxygen consumption) to an ergometric assessment of the work that has been performed. The earliest machines operated by human effort were stepping wheels. These had been introduced into British prisons as a form of punishment during the early 1800s. Edward Smith (above) used one of these devices in some of his early respiratory experiments. Gustave-Adolphe Hirn (1815-1890 CE), a French engineer at a fabric spinning factory in Colmar, Alsace, adopted a similar approach, setting a stepping wheel inside a closed chamber as he attempted to determine the mechanical equivalent of heat and examine the composition of expired gas during exercise (Hirn, 1858; Papanelopoulou, 2006).

Bruce Dill suggested in one of his historical papers that a motor driven treadmill was first used at the Carnegie Nutrition Laboratory in Boston (1913) (Dill, 1963). However, Nathan Zuntz (1847-1920) had in fact constructed a motor-driven treadmill for testing both horses and humans more than 20 years earlier (Zuntz, 1889), and George Katzenstein, working in Zuntz's laboratory, certainly applied the treadmill technique to studies of human subjects in that same era (Katzenstein, 1891). The external work performed on the motorized treadmill was calculated very simply from the belt speed, the slope and the body mass of the subject.

Francis Lowndes patented a device that he called the *Gymnasticon* in 1797. This machine was fitted with both pedals and arm cranks. It was intended to exercise the joints in all parts of the body, either simultaneously or independently, although the intensity of effort was not controlled (Good et al., 1819). Max von Pettenkoffer (1818-1901 CE) and Carl von Voit (1831-1909 CE) were the first to quantitate arm work. During their research at the Pettenkofer Physiological Institute in Munich (Shephard, 2013b) they enclosed subjects in a metabolic chamber while they were turning a

flywheel against a chain that carried a 25 kg load (von Pettenkofer and Voit). The German physician Carl Speck also developed a crank ergometer in 1885 (Speck, 1892). In France the following year, Hanriot and his better-known colleague the Nobel prize winner Charles Richet (1850-1935 CE) described a braked wheel that could be used in metabolic experiments (Hanriot and Richet, 1887).

The first mechanically-braked cycle "ergostat" was introduced as a slimming device for wealthy and obese patients (Gärtner, 1890). Although usually used in an uncontrolled manner, the apparatus did indicate the approximate braking effort in kg-m, and its inventor, the Viennese physician Gustav Gärtner (1855- 1937 CE) apparently recognized the potential application of his apparatus in exercise science (Gärtner, 1887). In 1896, a French medical student named Elisée Bouny introduced the first cycle ergometer, applying a braking force directly to the wheel of a jacked-up bicycle (Hollmann and Prinz, 1997). By the beginning of the 20th century, Nathan Zuntz had developed a typical friction belt ergometer, loaded by a box of weights (Zuntz, 1899), the Tunisian physiologist Jules Amar (1879-1935 CE) had used a mechanical ergometer to establish that the efficiency of cycling was in the range 20-25% (Amar, 1909), and August Krogh had adopted a mechanical cycle ergometer for his studies of respiratory gas exchange in Copenhagen (Krogh, 1913).

U.S. metabolic laboratories developed an alternative type of ergometer, where subjects.exercised against the resistance provided by a dynamo (Benedict and Cady, 1912). I also tried this approach when constructing a simple ergometer at the Ministry of Defence Laboratories in England, but I quickly found that the quantitation of effort was hampered because the impedance of the system altered as the temperature of the resistors increased. Nevertheless, I was able to suggest the use of a cycle connected to a television camera as a motivational tool in a fitness display at the Ontario Science Centre during the early 1960s. In Germany, Hugo Wilhelm Knipping (1895-1984 CE) developed a much more sophisticated electrically-braked ergometer that was capable of setting accurately graded loadings of 0 to 750 Watts (Knipping, 1929). He began the tradition of clinical ergo-spirometry with a device that combined an arm-crank dynamo ergometer and a spirometer that could measure oxygen intakes to a ceiling of 2 L/min.

The first dynamometers for measuring muscle strength appeared in the early 18th century (Shephard, 2013a). In 1921, E.V. Collins of Iowa State College developed a draft-horse dynamometer, measuring a horse's pulling capability against weights that were set on a vertical track (Caine and Collins, 1926). Handgrip dynamometers became widely used for clinical assessments of muscle strength during the mid-1950s. Commonly, resistance to muscle contraction was provided by a strong spring, but occasionally laboratories used an electrical strain gauge to measure the force that was developed. An evaluation of available instruments by the Californian Medical Association led to recommendation of the Jamar handgrip dynamometer as the best option (Kirkpatrick, 1957).

The cable tensiometer was seen as offering a simple method of quantifying the force developed by larger muscle

groups (Clarke, 1973), although unfortunately the scores that were recorded varied with leverage, thus reflecting differences in an individual's limb length as well as muscular strength.

Aerobic power, anaerobic capacity and anaerobic power. The British physiologist and Nobel Laureate Archibald Vivian Hill spent his early years researching in Germany, at Cambridge University, and briefly at the University of Manchester, However, it was as successor to Ernest Starling at University College in London that he provided the classic description of aerobic and anaerobic contributions to exercise (Hill et al., 1924). Hill suggested that the maximal oxygen consumption provided a useful criterion of cardiopulmonary performance. He also developed the concepts of oxygen deficit, oxygen debt and steady-state exercise (Hill, 1925). During the 1930s, Hill played an active role in helping several Physiologists escape from Nazi Germany.

The German internist R. Herbst made some early measurements of maximal oxygen intake for participants in various sports events (Herbst, 1928). Sid Robinson (1902-1982 CE), an American middle-distance runner, participant in the 1928 Olympics and former football coach was one of the first to collect a substantial volume of data on the maximal oxygen intake of non-athletic individuals. He studied subjects of all ages from 6 to 91 years while he was completing his Ph.D. dissertation at the *Harvard Fatigue Laboratory* (Horvath and Horvath, 1973). Robinson showed that both maximal heart rate and maximal oxygen intake were lower in older individuals (Robinson, 1938). The widely used prediction of an individual's maximal heart rate (220-Age in years) dates back to Robinson's research. The now widely-accepted standard criterion of an oxygen consumption plateau (an increase in oxygen consumption of less than 150 ml/min or 2.1 ml/[kg.min] with an increase of work rate) was proposed in 1955 by three very well-known exercise scientists working at Ancel Key's *Laboratory of Physiological Hygiene* at the University of Minnesota (Henry Longstreet Taylor (1912-1983 CE), Elsworth Buskirk, and Austin Henschel (Taylor et al., 1955). Henry Taylor remained in Minnesota for most of his career; he also carried out important comparisons between sedentary and active railroad workers, contributing this data to the "Seven Countries" study (below). Taylor examined the possibility of conducting a randomized controlled trial of exercise in the primary prevention of heart disease, but he concluded that such an experiment was not practicable because of its complexity, magnitude and the number of confounding factors. Elsworth Buskirk (1925- CE) received his Ph.D. from the University of Minnesota, but devoted much of his career to the environmental physiology laboratory at Penn State University. Austin Henschel is best known for his studies of human starvation, conducted in collaboration with Ancel Keys.

Per-Olaf Åstrand collected a large body of maximal oxygen intake data on men, women and children in the course of completing his Ph.D. dissertation at the *Karolinska Institute* in Stockholm (Åstrand, 1952). His wife (then Irma Ryhming) used this data to develop the familiar nomogram that has been widely used to predict a person's maximal oxygen intake from sub-maximal oxygen consumption and heart rate data (Åstrand

and Ryhming, 1954). Åstrand's figures for maximal oxygen intake were substantially larger than the values reported in most surveys from other parts of the world (Shephard, 1966), helping to create the myth of the sixty-year-old Swede who could walk past his 20-year-old Canadian counterpart. When I visited Åstrand's laboratory in 1964, I was certainly impressed by the ashen faces of his subjects as they reached maximum effort. They were exercising much harder than subjects in many North American laboratories. But a further important issue was sampling bias; the idea of seeking out a representative National sample had yet to gain wide currency, and as Åstrand later acknowledged, the subjects that he studied were not representative of the Stockholm population.

An International Working Party met in Toronto in 1966 to standardize procedures for both direct and indirect (submaximal) estimates of maximal oxygen intake, in part as a prelude to the *International Biological Programme*. Although participants in the Toronto Working Party reached a consensus on appropriate procedures (Shephard et al., 1968a; Shephard et al., 1968b; Shephard et al., 1968c), standardization was not a total success, and many laboratories that had not been involved in the Toronto trials unfortunately opted to continue their widely divergent procedures.

Most exercise scientists found it was difficult to use the standard clinical method of measuring blood pressure during cycle ergometry because of the noise coming from the chain and gear wheels. Thus, in 1959 Wildor Hollmann and his colleagues in Cologne developed a semi-automated pressure blood pressure recording device (Hollmann, 1987).

The risks of maximal effort had yet to be clarified, and many clinicians were nervous about exercising their patients to a directly measured plateau of oxygen intake. One alternative that became popular, particularly in Scandinavia, was to report the individual's power output at a heart rate of 170 beats/min (the PWC_{170}) (Sjōstrand, 1947). When CAHPER obtained funding for a nation-wide fitness survey of Canadian children, they adopted the PWC_{170} approach because most of their testing was conducted by physical educators, without medical support (Howell and MacNab, 1968). One major difficulty when using the PWC_{170} in adults is that because of the age-related decrease in maximal heart rate, the effort required when performing the test is much more severe for an old person than for a young adult.

During the 1960s, Kristian Lange Andersen in Oslo and Rudolfo Margaria (1901-1983 CE) in Milan began to emphasize the division of human performance into an aerobic ability (the maximal oxygen intake), an anaerobic capacity (terminated by the intra-muscular build up of lactate within about 45 seconds) and an anaerobic power (based mainly on the breakdown of intra-muscular phosphagen molecules, the reserves of which were depleted within 2-4 seconds) (Andersen et al., 1971). However, investigators did not always appreciated that the three forms of effort could overlap, with anaerobic metabolism making an appreciable contribution to performance over times as long as 5 minutes. The development of the Wingate Test by Oded Bar-Or (1937-2005 CE) and his colleagues at the Wingate Institute in Natanya, Israel (Ayalon et al., 1974) offered a simple mechanical method of determining the anaeobic parameters.

Oded subsequently emigrated to Canada, and had a long and fruitful career in pediatric work physiology at McMaster University, Hamilton, ON. Other submaximal tests of cardio-respiratory performance have included determination of the lactate threshold (Hollman, 1963) and the anaerobic threshold (Wasserman and McIlroy, 1964).

Exercise Immunology. The Modern Era saw the first tentative steps in unmasking the intricacies of exercise Immunology. As early as 1893, Schulte had noted that a bout of exercise induced a leucocytosis, and in 1902, R.C. Larrabee reported a 3-5 fold increase in blood leukocytes following participation in a Marathon run (Larrabee, 1902). These observations were soon confirmed by several other exercise scientists (Aguirre et al., 1994; Anderssen, 1955 ; Casper, 1925; Dùner and Pernow, 1958; Karpovich, 1935).

Progress in exercise Immunology was slow while studies relied on the investigator completing painstaking differential cell counts using a light microscope and a graticule. The idea of automated cell counting dates back to 1934 (Moldovan, 1934), and by 1947, Wallace Coulter had developed a practical device that could detect the number and size of particles suspended in a fluid (Coulter, 1953). This instrument became widely available to clinical laboratories during the 1960s. Automated sorting of cell sub-types became possible with development of the fluorescence-activated cell sorter, the synthesis of appropriate monoclonal antibodies (Dittrich and Gohde, 1969), and the introduction of devices that could sort cells in terms of their volume (Fulwyler, 1965).

Another early area of enquiry for exercise immunologists was the influence of vigorous exercise upon an individual's resistance to infection. Early studies in rabbits (Bailey, 1924) and guinea pigs (Nichols and Spaeth, 1922) had shown that exercise increased the animal's susceptibility to experimental pneumococcal infections, particularly if activity had been undertaken during the infectious stage of the disease. The advent of powerful antibiotics reduced interest in this problem, although more recent research tended to show an adverse effect of heavy exercise upon viral, but not bacterial infections. Fatiguing exercise increased the severity of paralysis following inoculation of monkeys with poliomyelitis virus (Levinson et al., 1945), and retrospective questioning of human victims suggested an influence of exercise upon both the course of the disease and the location of the paralysis (Hargreaves, 1948 ; Horstmann, 1950 ; Russell, 1947 1949). Studies of patients that were infected with viral hepatitis also found an adverse impact of heavy exercise if activity was undertaken while the patient was still jaundiced (Barker et al., 1945 ; Chalmers et al., 1955 ; Krinkler and Zilberg, 1966). However, it was not until the late 1980s that David Nieman and his colleagues undertook important studies showing an increased vulnerability to upper respiratory infections following participation in Marathon and Ultra-Marathon events.

Politicians and Governmental Policies

In many parts of democratic Europe, changes in government were frequent during the Modern Era, giving individual politicians correspondingly little

opportunity to impose their concepts of health and fitness upon society. However, in the totalitarian regimes of Germany, Italy and Russia. fitness programmes became an important element of governmental policy. In the U.S. and Canada, social concerns included the resettlement of veterans following World War I, provision of assistance to those affected by the Great Depression, and the forwarding of aid to occupied Europe during and immediately following World War II. Health and fitness policies tended to take a back seat in North America, until Eisenhower established the *President's Council on Fitness*.

Germany. Following World War I, the Weimar Republic struggled with a reduced land mass, heavy reparations payments, rampant unemployment, mega-inflation, and uprisings by left- and right-wing paramilitary groups. In 1923, the price of a loaf of bread had risen to 100,000 Million Deutchmarks, and two hundred factories were working full-time at printing a paper currency of ever-decreas ing value. But from then until the Great Depression, currency reform brought a measure of stability to Germany. Physical education was a major emphasis at the German School Conference of 1920, and the curriculum of Prussian State boarding schools continued to emphasize a militaristic form of gymnastics. The *Reich Youth Badge* and the *Reich Youth Sports Competitions* were initiated under the Weimar Regime (Pine, 2010), although both gained greater prominence during the Nazi Era.

Under Adolf Hitler (1888-1945 CE), emphasis upon the need for the physical development of children and youth was increased. Existing youth organizations and the Youth Hostel system were abolished, and their assets were quickly appropriated by Baldur Benedikt von Schirach (1907-1974 CE), who was named as Youth Leader of the new German Reich. In a move typical of the early days of Nazism, fifty of Schirach's husky young acolytes made lightning raids on the headquarters of all existing youth groups. Files that were seized provided the new regime with detailed inside information on all citizens who had previously been influential youth workers. A "*Year of Physical Training*" was proclaimed in 1935, and medals were awarded to youth who performed rigorous athletic drills and achieved strict physical fitness standards. Membership of the *Nazi Youth Organization* was made compulsory in 1936, and by 1939 attendance at meetings of the *Jugend* was also mandatory, although many parents complained that weekend programmes were so exhausting that their children's schoolwork was suffering. The State Schools were theoretically independent of the Nazi Youth Organization, but the elderly and reputedly alcoholic Minister of Education, Bernhard Rust, was frequently out-manoeuvred by Schirach. Often, teachers who were Jews or who had Social Democratic leanings were dismissed from their posts as "unreliable" instructors. By 1938, Schirach was sufficiently entrenched that he could launch a massive attack on the State School system; he described it as hopelessly out of date and counter-revolutionary in its policies. Often, leaders in the *Jugend* assisted Schirach by denouncing teachers who were not sufficiently enthusiastic supporters of the Nazi regime (Kater, 2006). At the Nuremberg hearings, the Prosecutor noted that in his book "*Revolution der*

Erziehung; *Revolution in Education*," von Schirach (1944) had proclaimed the idea that schools should become mirrors of the State.

During the Nazi Era, the *Deutsches Jungfolk* served boys aged 10-14 years, and the *Hitler Jugend* was for those who were older. For the girls, there was the *Jungmadelbund* for those aged 10-14 years, and then the *Bund Deutscher Mädel*. These several groups had some superficial similarities to scouting, with an emphasis upon clean living, competition, drill, team-work, and sport. Other activities included singing both Patriotic and anti-Semitic songs, camping, field trips and attendance at large rallies. However, the main goal throughout was Nazi indoctrination (Fodor, 2004). Before each meal, members had to recite a prayer that praised Hitler. The boys also spent much time in military training (*Wehrsport*), with sessions of marching, map reading, bayonet drill, grenade throwing, trench digging, crossing barbed wire and pistol shooting. The girls' programmes had a more positive influence upon teenagers, permitting them to engage in such activities as camping and sports that had previously been denied to females (apparently to the disgust of Heinrich Himmler, who disapproved of all female sport). Girls were expected to run 60 metres in 14 seconds, throw a ball 12 metres, complete a 2-hour march, swim 100 metres and know how to make a bed.

The words of Hitler himself at a 1938 Nuremberg Rally described the objective of the boys' organizations:

"der deutsche Junge der Zukunft muß schlank und rank sein, flink wie Windhunde, zäh wie Leder und hart wie Kruppstahl. (The German boys of the future must be slim and lithe, swift as greyhounds, tough as leather and hard as Krupp's steel)"

The fitness of adults was addressed through membership in the "*Kraft durch Freude" ("Strength through Joy)"* programme of the *Nazi Labour Front.* This organized worksite military fitness training, as well as "cultural" events that included lectures on racial improvement and other Nazi doctrines (Nicholls, 2000).

Hitler himself appears to have lived a rather austere life. He was a vegetarian, a non-smoker and a non-drinker; his final state of health is said to have resembled Parkinson's Disease. However, some of his acolytes such as Hermann Goering lived a life of great luxury and self-indulgence. Goering himself had become a morphine addict after prolonged treatment with opiates following an injury that he had sustained in the failed Munich Beer-Hall Putsch of 1923.

Italy. The Italian futurist Filippo Tommaso Emilio Marinetti (1876-1944 CE) was a forerunner and ardent supporter of Mussolini. His attitudes to physical education and indeed to education in general show many parallels with subsequent Nazi ideas. As early as 1909, his *Futurist Manifesto* expressed a scorn for traditional education. He demanded the destruction of "*museums, libraries, and every type of academy*," and in 1919 he called for schools to promote the spirit of the *Arditi*, the Italian storm-troopers of World War I, with

"*a school for physical courage and patriotism*." "*We could gain all we desire....by insisting on an absolutely rigid, no, a merciless system of physical exercise in all our schools....teaching them about*

physical courage and scorn for danger (Marinetti et al., 2008)."

Benito Mussolini (1883-1945 CE) came to power in 1922. *Il Duce* (as he became known) exploited the popularity of Futurism, using a sophisticated propaganda machine to emphasize that Liberalism was *passé* and that Fascism was the wave of the future.

A youth *Squadre d'azione (Action Squadron*) was formed in 1919. Many students joined this group, but not all of them appreciated its military objectives. The *Squadre* gave birth in turn to the *Avanguardia Giovanile Fascista (Fascist Youth Vanguards)* and the *Gruppi Universitari Fascisti (Fascist University Groups)* during the early 1920s. The *Avanguardia* served youth aged 15-18 years, with separate sections for students and rural workers. It was soon supplemented by a *Balilla*, to indoctrinate boys of 8-14 years, corresponding groups for girls (*Giovani Italiane* and *Piccole Italiane*), and *Figli della Lupa ("Children of the She-Wolf")* for children aged 6-8 years. Initially, none of these groups attracted a very large membership.

However, the Fascist *Opera Nazionale Balilla* assumed direct control of all of these youth organizations through Mussolini's decree of 3 April 1926. Renato Ricci (1896-1956 CE), one of the main Nazi sympathiers in Italy, was appointed as Director, of the *Opera*, charged with the task of "*reorganizing the youth from a moral and physical point of view*." Ricci sought inspiration through a meeting with Robert Baden-Powell, the founder of scouting. The leaders of the Italian youth groups were commonly schoolteachers who had joined the *Fascist Teachers' Association*. The boys all wore a scaled-down version of the "Blackshirt" uniform, and as in Germany there were massive gymnastic displays, with the singing of Fascist anthems, and the award of medals by *Il Duce* himself (Koon, 1985). There was also a strong emphasis upon team sports. In 1924, Mussolini's official newspaper, *Il Popolo d'Italia,* underlined that sport should not be considered as an end in itself. It was a "*National necessity for the progress and prosperity of the race*." The *Opera Nazionale Balilla* was absorbed into the *Youth Section of the Fascist Party* in 1937. Other youth movements were banned, with the exception of one closely circumscribed Catholic group (the *Gioventù Italiana Cattolica*), and in 1939 membership of the official youth groups became mandatory (Koon, 1985).

Adult programmes were organized through an "After Work" group called the *Opera Nazionale Dopolavoro, OND.* This was established in 1925, at the request of Fascist unions that wished to compete with socialist cultural organizations. The OND was initially conceived as an "apolitical" and "productivist" group, modelled in part after the YMCA. It began under the direction of Mario Giani, who had been a Director of Italian Westinghouse; the Duke of Aosta, a relative of the Italian King, was its patron and nominal President. The stated objectives of this group were to promote (de Grazia, 1981):

"the healthy and profitable occupation of workers' leisure hours by means of institutions for developing their physical, intellectual and moral capacities"

Giani argued that if it was properly managed, the OND would increase worker output by restoring those who were fatigued after a day of heavy labour in the

field or the factory. After two years, Giani was replaced by Augusto Turati, the Fascist party secretary, and the OND became a mechanism of specific Fascist indoctrination (although it remained a much less successful propaganda instrument than the *Strength through Joy* movement in Germany). During the 1930s, the OND focussed on sports events and the construction of recreation rooms in factories, although it also reinforced female stereotypes by organizing sewing, cooking and home economics classes for women. By the end of the decade it had recruited some 80% of white collar and 40% of blue-collar workers (de Grazia, 1981). Moreover, 60% of companies employing over 100 workers had established special facilities for the OND, expecting to recoup the costs through increases in productivity. This penetration of work-site programmes compares favourably with what was achieved in the 1970s by the North American industrial fitness movement.

The Fascist regime quickly assumed a tight control over sports groups, and from 1927 onwards, all local and provincial sports associations had to include representatives of the Fascist Party on their Boards. Subsequently, men of known Fascist allegiance progressively replaced the existing Directors of these associations.

Mussolini himself appears to have adopted a rather phrenetic lifestyle, and although somewhat portly, he boasted that he never spent more than three minutes on a meal. He despised the inactive lifestyle of the Academic, and until middle age, *Il Duce* was obsessed with enhancing his fitness, spending much of his time riding, swimming, running, and playing tennis, fencing and football. His military inspections were conducted at the double, and Ministers were required to race across *Il Duce's* vast office on order to reach his desk with record speed. Mussolini suffered from a gastric ulcer, and on medical advice he gave up smoking and alcohol during his time in power. His diet was Mediterranean in style, comprising considerable fruit, three litres of milk per day and very little meat (Neville, 2004).

Russia. The Bolsheviks did not display any particular interest in youth during the Revolution. A few members of the scouting movement had fought with them, but the majority had sided with the White Russians. The first meeting of the *Komosol*, or *Young Communist League* (for those aged 14-28 years) was held in 1918. Younger children (aged 10-15 years) joined the *Young Pioneers*.

Many of the scouts emigrated once the Soviet regime was established, and the *Komosol* fought hard to eliminate the remaining influence of the scouting movement in Russia, replacing it with an organization that was committed to Communist teachings (Siegelbaum and Sokolov, 2004), albeit with some input from sympathetic scout leaders who had remained in the country.

Most Russian children still lived in the countryside during the early 1920s, and many had to endure the hardships associated with enforced collectivization of farms. Often, the physical demands of the collective precluded school attendance, and many activities of the *Young Pioneers* were designed to help farmers. One testimonial from the Caucasus described the activities of a 14-member group of *Young Pioneers*:

"*We are patrons of the colts and piglets, and the girls are patrons of the poultry*

farm...we guarded the harvest and helped with the mowing and the weeding...we clean the animals and teach them to jump over obstacles, so that if they grow up they will be ready for the Red Army.. I was awarded a Balalaika as a prize at the Georgievsk Raion rally."

Some *Young Pioneer* groups enjoyed summer trips to camp. The first youth camp was built in 1925, and by 1973 there were 40,000 such camps. Some focussed on sport, but others were for those interested in geology, nature study and other potential career paths. Often, the fee for attendance was paid by the parent's place of employment. Typical mornings began with physical exercise under the supervision of a physician, and there was a ceremonial line-up each morning and evening with orchestral accompaniment. At one such camp, the "*Little Octobrists*" were purported to have given an outstanding display of acrobatics (Siegelbaum and Sokolov, 2004) The clarion cry at a *Young Pioneer* meeting was "*Pioneer, in the struggle for the cause of Lenin and Stalin, be prepared*!"

As economic conditions in the Soviet Union improved, *Pioneer Palaces* for sports training, creative work and extracurricular activities were opened in many cities. The first such *Palace* occupied the former *House of Noble Assembly* in Kharkov (1935). Other early *Palaces* were based in the residences of the former nobility, but imposing purpose-built *Palaces* were constructed after World War II. *Young Pioneers* who excelled in academic study, work, sports or social activity were sent as delegates to *Young Pioneer* gatherings (including All-Union ones), with the most notable members recognized in the Organization's Book of Honour.

Spectator sports, particularly soccer, flourished in the mid-1930s, and large new stadia were constructed. Teams were sponsored by factories and State organizations. Thus, *Dinamo* was sponsored by the *NKVD (the People's Commissariat for Internal Affairs*), *Lokomotiv* by the *Ministry of Transportation*, and *Torpedo* by the *AMO automobile factory*.

In terms of personal habits, Lenin had a strong interest in physical activity (Shephard, 2013b). However, Joseph Vissarionovich Stalin (1878-1953 CE) was a heavy drinker, and was more interested in books than in sport. He often spent 5-6 hours at dinner, and sometimes slept till evening. He boasted a 20,000-volume library and was a voracious reader, sometimes scanning 500 pages in a single day. Stalin's left arm was deformed as a result of a carriage accident during his youth, and his only recreational interests were billiards, hunting and fishing.

Nikita Sergeyevich Khrushchev (1894-1971; First Secretary of the USSR from 1953 to 1964) had only a grade 4 education. He appeared to be substantially overweight, but when in office he had stopped smoking, probably because of concerns about a rising blood pressure. While First Secretary, Khrushchev enjoyed taking foreign guests on choreographed hunting parties. However, he suffered from a deep depression and a vulnerability to alcohol during his final years (Taubman, 2004).

Leonid Ilyich Brezhnev (1906-1982 CE) served the USSR as First Secretary from 1964 to 1982. His main passion was driving powerful foreign cars at high speed; at the peak of his career, he reportedly had 30 expensive vehicles stored in garages around Moscow. Brezhnev swam regularly, and was a keen

patron of football and ice-hockey games. However, he was also a chain smoker, and according to Andrei Gromyko (his foreign minister), he had a serious drinking problem A combination of this issue and aging left him an ineffective leader from the mid-1970s onwards (Bacon and Sandle, 2002).

France. France ended World War I financially bankrupt and severely traumatized by massive losses of its soldiers during the conflict. The inter-war years were marked by a rapid succession of rather unstable governments. The politicians with the greatest interest in sport during this period were Henri Paté (responsible for physical education in various governments between 1924 and 1930, and Léo Lagrange, who served in the government of the moderate left-leaning Léon Blum. Policies saw a drastic change in 1940, with the fall of France and installation of the Vichy regime.

Henri Paté (1878-1942). Paté was initially Commissaire for Physical Education and Military Training (the latter designation indicating the orientation of his thinking in regard to the primary purpose of physical education). Subsequently, Paté became Under-Secretary for Physical Education. He espoused the eugenic theories of his era (Arnaud, 1996; Boigey, 1917; de Lapouge, 1899), and in 1918 he formed an organization entitled *Comité Nationale d'education physique (et sportive), de l'hygiène sociale, et pour la régénération de la race (National Committee for physical education and sport, social hygiene and racial regeneration*). The magazine *Le Pays de France* (Volume 251, 9th August 1919) carried an article under his name advocating physical education and entitled:

"Pour l'avenir de la race" (for the future of the race)

Léo Lagrange (1900-1940 CE). During his youth, Lagrange had been a member of the secular scouting association *Éclaireurs de France*. After graduating as a lawyer, Lagrange became a writer with *Le Populaire,* organ of the SFIO (*La Section française de l'Internationale ouvrière, the French section of the Workers' Internationale*). With the victory of Léon Blum and the Popular Front in the 1936 elections, Lagrange was appointed Under-Secretary of State for Sports and for the Organisation of Leisure (1936-1938). Sport was viewed for the first time as a health issue, with Lagrange working under the Minister for Public Health, Henri Sellier. Before the Popular Front came to power, the SFIO had considered sport as a "bourgeois" and "reactionary" activity, something that could only be understood in terms of social privilege and restrictions. As economist Thorstein Veblen (1857-1929 CE) had put it, one had to be a member of the "leisure class" in order to be able to participate in such activities (Veblen, 1965).

However, Georges Barthélémy (1897-1944 CE), now SFIO deputy for the Seine region, declared that sports contributed to the *"improvement of relations between capital and labour, henceforth to the elimination of the concept of class struggle."* In his dealings with the government, Barthélémy raised many issues concerning sport, and he encouraged the building of athletic facilities in his sector of Paris. He supported the "scientific" racism that had previously been espoused by Paté, and at

the Workers' Olympiad of 1936 he declared that sport was:

"le meilleur moyen d'arrêter la dégénérescence physique et morale de la race" (the best means to halt the physical and moral degeneration of the race).

Lagrange was strongly opposed to the militaristic youth organizations seen in Fascist countries, declaring:

"... It cannot be a question in a democratic country of militarizing the distractions and the pleasures of the masses and of transforming the joy skillfully distributed into a means of not thinking."

The Blum government for the first time mandated a 2-week paid holiday for French workers (Colton, 1987), and Lagrange arranged cheap rail fares so that workers could enjoy the ski and coastal resorts that had previously been the preserve of the wealthy.

The athletic world was greatly disturbed at the prospect that Hitler would exploit the 1936 Olympic Games as an opportunity for Nazi propaganda, and in France the FSGT (*la Nouvelle Fédération Sportive de Gauche*) issued the cry:

"*Pas un sou, pas un homme pour les JO de Berlin!" ("Not a penny, not a man for the Berlin Olympic Games.")*

The magazine *Le Sport* commented on the 9th of October 1935:

"La loi olympique est violée chaque jour, aucune garantie de liberté n'est accordée aux sportifs juifs et catholiques. Dans ces conditions, notre devoir, ainsi que celui de tous les hommes d'honneur, est de dénoncer vigoureusement les pratiques Hitlériennes et de demander le transfert des Jeux dans un autre pays" (The Olympic law is violated every day; no guarantee of freedom is given to Jews or Catholics. Under these conditions, it is our duty, and the duty of every honourable person to denounce Hitler's practices vigorously and to demand the transfer of the Olympic Games to another country)."

Attempts to organize a rival sports meeting in Antwerp or Prague were unsuccessful, and Lagrange thus negotiated with Catalonia to host a *People's Olympiad* in Barcelona. Some 1200 French athletes registered for this *Anti-Fascist Olympiad*. A communist deputy declared:

"*Going to Berlin, is making oneself an accomplice of the torturers...."*

But Blum finally decided not to vote funds that would pay the expenses of athletes travelling to Barcelona. On 9th July, 1936, all of the French political right voted "for" participation in the Berlin Games, and the Left (including the Communist Party) abstained from voting — one notable exception being Pierre Mendès-France. Soon after the more determined athletes had reached Barcelona, outbreak of the Spanish Civil War forced cancellation of the Workers' Games.

On leaving the under-secretary's department, Léo Lagrange became president of the lay committee that managed the French Youth Hostel system.

Vichy France. Vichy's policy concerning sports began with the concepts of Georges Hébert (18751957 CE), who had denounced professional and spectacular competition. The moral aims of sport should be "*rebuilding the nation*",

and encouraging involvement of the Nation's youth in various Pro-German associations and federations. Policies were directed by a three-person *Commissariat Général à l'Education Générale et Sportive* comprising Jean Ybarnegaray (President of the *Basque Pelota League*) Jean Borotra (a former international tennis champion) and Joseph Pascort (a former rugby champion). A report submitted to Jean Borota in October of 1940 noted: "*Le sport bien dirigé, c'est de la morale en action*"*("well directed sport is morality in action.")* Beginning in 1941, a sportsman's pledge was exacted from all athletes (Jouaret, 2012); it stated (with a De Coubertin-like reference to honour rather than swearing):

"Je promets sur l'honneur de pratiquer le sport avec désintéressement, discipline et loyauté pour devenir meilleur et mieux servir ma patrie" ("I promise on my honour to practice sport with disinterested discipline and loyalty in order to become better and to serve my country better")

The Vichy Government showed particularly strong opposition to professional sport that was of British origin. Already, by October 1940, professionalism had been prohibited in tennis and wrestling, but a 3-year delay was accorded to football, cycling, boxing and Basque pelota. Female participation in cycling and football had also been prohibited, and (much as in Nazi Germany), the assets of several Sports Federations were forcibly transferred to a "*National Council of Sports*."

Britain. Britain faced severe economic problems during much of the Modern Era. The First World War had depleted British mines of their richest coal seams, and a return to the "gold standard" had made British exports overly expensive. At times, there were over 2 million unemployed in Britain, and the 9-day General Strike of 1926 apparently presaged a Communist insurrection. Prosperity only returned as the nation began to rearm, shortly prior to World War II. Nevertheless, some health initiatives were introduced, particularly under Lloyd George and Nevill Chamberlain. Promises of further social benefits spurred the British troops to victory during World War II.

David Lloyd George (1863-1945 CE). Lloyd George was the last Liberal Prime Minister in England, serving as head of a war-time coalition government from 1916 until 1922. He introduced many of the reforms that have led to the modern welfare state in Britain, including State support for the sick and the infirm.

Lloyd George liked to offer aid to the common man at the expense of those he termed "the Dukes." He had campaigned vigorously against the second Boer War (1899-1902), complaining that the costs of this campaign precluded necessary social reforms, that little provision had been made for sick and injured soldiers, and that Boer women and children were starving to death in British concentration camps. After World War I, the Fisher Education Act of 1918 raised the school-leaving age to 14 years (with prohibition of the employment of youth in many industries prior to completion of their schooling). This same Act allowed local education authorities to provide ancillary health services such as the regular medical inspection of schoolchildren, and it authorized the construction and maintenance of:

(a) Holiday or school camps, especially for young persons attending continuation schools;

(b) Centres and equipment for physical training, playing fields (other than the ordinary playgrounds of public elementary schools not provided by the local education authority), school baths, school swimming baths;

(c) Other facilities for social and physical training in the day or evening.

The Lloyd George government also provided substantial subsidies to local authorities, allowing them to replace the worst slums by public housing. Many of the ideas that Lloyd George had espoused were consolidated in the *Report of the Inter-Departmental Committee on Social Insurance and Allied Services,* popularly known as the *Beveridge Report* of 1942 (Beveridge, 1954). This report led to introduction of Britain's *National Health Service* in 1946.

Andrew Bonar Law (1858-1923 CE). Bonar Law's main claim to fame as a British Prime Minister is that he was Canadian by birth. His father was a rural New Brunswick Free Church of Scotland pastor, and Andrew worked on his father's small-holding there as a youth. He later moved to Scotland, where he was involved in banking and became an iron merchant. He succeeded Lloyd George as Prime Minister for just 222 days, dying shortly afterwards of a throat cancer, a reflection of his "*prodigious consumption of tobacco*." However, he was a teetotaler, apparently not as a matter of principle, but rather because he disliked the flavour of alcohol (Taylor, 2006). He pursued conservative policies, and was unenthusiastic about women's suffrage or improving the lot of the poor.

Stanley Baldwin (1867-1947 CE). Baldwin was the dominant figure in British politics between the two World Wars, serving as Prime Minister in three conservative governments between 1923 and 1937. He presided over a period of high unemployment, Nazi appeasement, and the abdication crisis, and made few innonovations in health or fitness, although some have praised him for moderating of the early Radical policies of the British Labour Party. Baldwin's main ambitions were "*to read the books I want, to live a decent life and to keep pigs."* (Whyte, 1926) In the latter part of his career, he was severely crippled by arthritis.

Ramsay MacDonald (1866-1937 CE). MacDonald was the first Labour Prime Minister in Great Britain. He began work as a Scottish farm labourer, but at the age of 19, he moved to Bristol, where he organized a "*Boys' Guild*" for one of the local churches (Morgan, 2006), presumably in the context of "*Muscular Christianity*" (Shephard, 2013b). After moving into politics, his main passion was reading, but he was also a keen walker; in later life, he was often observed walking in Central London (Morgan, 1987). A combination of the 1929 stock market crash, formation of a coalition government dominated by Conservative members and deteriorating health kept him from any great innovations while he was in office. However, he did arrange for Kurt Hahn, founder of the Spartan *Gordonstoun School* and *Outward Bound* to be exiled to Britain after Hahn had run afoul of the Hitler Regime in Germany.

Arthur Nevill Chamberlain (1869-1940 CE). Chamberlain was Prime Minister of Britain from 1937 until the

Allied retreat from Norway in 1940. He is best known for the notorious Munich Agreement, which conceded the Sudetenland territory to Hitler. However, he had served as Minister of Health from 1924 to 1929, and for much of his term as Prime Minister, Britain was reasonably prosperous. Positive domestic initiatives included the *Factory Act* of 1937 that restricted the hours of work for women and children, the *Holidays with Pay Act* that spurred the construction of holiday camps for working class people (Dawson, 2007), and a continuation of earlier initiatives in slum clearance and rent control. Chamberlain had also accepted the need for Treasury-funded communal feeding stations during the Great Depression, recognizing that the diet of the unemployed was (Self, 2006):

"insufficient to keep the workers in fit condition to take up work when this is made available"

As the military might of the Nazis increased, Chamberlain expressed disappointment that money ear-marked for public health had to be diverted to British re-armament.

Measures promoting recreation, probably initiated by Baldwin, were finally enacted in 1937, in the first few weeks of Chamberlain's Premiership. The *National Playing Fields Association* (NPFA) had been founded by King George V, back in 1925. It was managed initially by Brigadier-General Reginald Kentish. Kentish was an Edwardian military officer who had repeatedly urged formation of the *Army Sport Control Board*, until it was finally established in November 1918 (Mason and Riedi 2010). The NPFA received its official Royal Charter in 1933. It was a voluntary group, dedicated mainly to the objectives of acquiring, protecting and improving playing fields, playgrounds and play-space where they most needed. It also set standards of play-space for new housing developments (20,000 m^2 for every 1,000 people, of which at least 16,000 m^2 should be allocated for team games, tennis, bowls and children's playgrounds). The Association asked the support of the British public in meeting these objectives, appealing (McIntosh 1971):

"for the financial help of every citizen who recognizes the need for a greater cooperative effort to give our young people a chance to play the game and not merely to continue as onlookers."

In concert with the NPFA initiatives, Chamberlain's conservative government decided to give both financial and legislative support to physical recreation through the *Physical Training and Recreation Bill* of 1937. When Oliver Stanley (1896-1950 CE), a senior Cabinet Member and President of the Board of Education, introduced the Bill to parliament, he emphasized the training and therapeutic benefits of supporting the NPFA. Speaking in support of the motion, Wavell Wakefield, a conservative member of parliament and former England Rugby captain declared (MacDonald, 2011):

"our aim is to try to make the great mass of the people, young and old, physically fit and to provide facilities for improving their general physical fitness and well-being."

This message seemed in line with fears that the exclusivity of British amateurism was leaving the bulk of the nation unfit and at the mercy of totalitarian states that

were exploiting sports programmes for militaristic purposes. A substantial budget of £2,000,000 was voted for the establishment of a *National Fitness Council*. Edward Cadogan, Deputy Chair of this group, still thought it necessary to offer an apology for the possible military context of the fitness emphasis (MacDonald, 2011):

"Was it necessary for us...to encourage men, women and children to be lazy, obese and malformed in order to convince the world that we did not wish to fight?"

Certainly, the approach of fostering an enthusiasm for fitness rather than sport or play was roundly condemned from the opposition benches. Aneurin Bevan (1897-1960 CE), an aggressive labour party politician from the Welsh coalfields argued (MacDonald, 2011):

"the desire to play is a justification in itself....The idea that you must borrow some justification for playing is one of the worst legacies of the Puritan revolution."

Nevertheless, the message publicized by the newly formed Council was "*Get fit – Keep fit"* (MacDonald, 2011). In 1939, the outbreak of World War II stimulated a campaign that promoted "*fitness for service*." One sign of incipient Scottish nationalism was the need to establish a separate *Fitness Council* for Scotland.

Chamberlain did not set any great example in terms of his personal lifestyle. His recreations were "flowers, fishing and shooting." A terminal bowel cancer forced him to

"give up smoking altogether, and port no longer has any attractions for me."

Winston Leonard Spencer Churchill (1874-1965 CE). Winston Churchill is lauded mainly for his leadership of Britain during the dark days of World War II. He was born into the aristocratic Marlborough family. He had a "*touching faith in the moral efficacy of sport*" (Brendon, 1984), but he himself was not particularly athletic at school. As a politician, he had a legendary consumption of cigars and alcohol. His main hobbies were writing and landscape painting. As a young man, Churchill had expressed some desire for State intervention to improve health, and during his period in the "*political wilderness*," his syndicated newspaper column had recognized sport as an important stimulant of British Society. However, Churchill remained an agnostic concerning the role that the British government should take in encouraging the health and fitness of the population (MacDonald, 2011), and during the Post-War era he followed traditional conservative social policies.

Churchill headed a coalition government from 1940 to 1945, and despite the pressures of war, a number of measures were instituted that influenced recreational opportunities. In particular, the *National Education Act* of 1944 obliged local education authorities to provide all students with sports facilities.

Clement Richard Attlee (1883-1967 CE). Much to the surprise of the Conservatives, Attlee and the British labour party were given a strong majority mandate to govern Britain following World War II. Attlee had been converted from conservatism to a progressive political outlook by a period of work (1906-1909) as manager of Haileybury House, a charitable club for poor boys in

the east end of London (Brookshire, 1995). He came to recognize that the problems of the poor were too vast to be solved by charity alone; massive state intervention was required:

"Charity is a cold grey loveless thing. If a rich man wants to help the poor, he should pay his taxes gladly, not dole out money at a whim."

As a young man, Attlee enjoyed (but did not excel) in sports, and he was also an active cyclist. During the summer of 1911 he toured the small villages of Essex and Somerset on his bicycle, explaining Lloyd George's *National Insurance Act* at Parish meetings. During his term as Prime Minister, Attlee oversaw implementation of the social policies outlined in the Beveridge Report of 1942. This Report had attacked the five giant evils of squalor, ignorance, want, idleness and ill-health. With Aneurin Bevan serving as his Minister of Health, Attlee introduced the *National Health Service*, which gave all British citizens access to free medical and dental care. Lord Beveridge sensed there was too much enthusiasm for the socialist health and fitness programme, and speaking to the House of Lords, he warned that Britain would have reached the last stage of totalitarianism if: (Hansard, 22nd June, 1949):

"*the use of leisure was arranged for each citizen by the State*."

Despite continued rationing, shortages of everything from electrical power to clothing, and deep financial indebtedness, Attlee's government was encouraged by Philip Noel-Baker to sponsor the first post-war Olympic Games (London, 1948). It was a successful event, although it stood in stark contrast with the London Games of 2012, operating on a miniscule budget, and involving no construction of new facilities.

Robert Anthony Eden (1897-1977 CE). Like many British Prime-Ministers, Eden was educated at Eton, where he excelled at cricket, rugby and rowing. As a long-serving Foreign Secretary, he retained a spasmodic interest in physical activity, often rousing his secretaries for a 7 a.m. game of tennis (Trukhanovskiĭ, 1964). He was reputed to have a bad temper and suffered from periods of ill health, possibly associated with bouts of heavy drinking. As Prime Minister, he was forced from office in 1957, following the Suez debacle, and many have considered him as one of the least successful of British politicians.

In terms of health and fitness, his main influence was negative. He presided over the exodus of many scientists such as myself, who found little support for applied physiological research in Britain during the 1950s and 1960s.

Maurice Harold Macmillan (1894-1986 CE). Macmillan's family was well-known for its activities as scientific publishers. During Macmillan's term as Prime Minister, the British standard of living rose progressively. Macmillan boasted that Britons had "*never had it so good*," and he had the budget to implement a number of important public health policies (Lamb, 1995). Perhaps the most important was the *Clean Air Act* of 1956, which prohibited the burning of soft coal in domestic fireplaces. Previously, this practice had caused major smog epidemics, with thousands of deaths from respiratory illnesses in London and other large cities during some particularly

foggy weeks (Phair et al., 1958). Other initiatives of Macmillan's government included the construction of 300,000 new houses per year to replace slum and war-damaged property, the *Offices Act* (1960), a *Noise Abatement Act* (1960) and the introduction of a graduated pension scheme.

Alex Douglas Home (1903-1995 CE). Home replaced Macmillan following the Profumo sex scandal. He thus had a brief term as conservative Prime Minister in 1963 and 1964. He rejected the recommendation of the Wolfenden Committee to establish a *Sports Development Council*, but he assigned to his Chancellor, Lord Hailsham, the task of coordinating the support that various government departments provided for sport and recreation programmes. Lord Hailsham thus became, *de facto*, a Minister of Sport.

United States

The parade of U.S. Presidents during the Modern Era includes Harding, Coolidge, Hoover, Roosevelt, Truman and Eisenhower. Of these various administrations, those directed by Hoover and Eisenhower had the greatest influence upon population health and fitness.

Warren Gamaliel Harding (1865-1923 CE). During Harding's Presidency (1921-23), items relevant to this review included the establishment of a *Department of Public Welfare* and the *Veteran's Administration*. The latter was intended to deal with the 300,000 U.S. soldiers who had been wounded in World War I, although much of its early funding is said to have been diverted to enrichment of its first Director, Charles Forbes. Passage of the *Sheppard-Towner Maternity Act* had a more positive outcome, funding almost 3,000 *Child and Health Centers* across the U.S.; this legislation spurred physicians to begin thinking in terms of prevention rather than the treatment of disease.

Harding's personal lifestyle was not outstanding. He smoked and chewed tobacco, and large quantities of confiscated bootlegged alcohol were reportedly served at White House Parties in an era of nominal Prohibition. There were frequent political scandals, and his Secretary of the Interior, Albert Fall, was convicted of bribery and was sent to prison (Dean, 2004). Returning from a State Visit to Alaska in 1923, Harding stopped at the Shaughnessy Heights Golf Club in Vancouver, and after a game of golf he complained of nausea and upper abdominal pain. Food poisoning was the initial diagnosis, but clinical examination disclosed a rapid pulse, rapid breathing and an enlarged heart. Continuing southwards, Harding died in a San Francisco hotel room. Most of the attending physicians concluded the cause of death was congestive heart failure. However, there was also speculation that he may have been murdered by his disgruntled wife, his mistress, or one of his supposed underworld contacts.

John Calvin Coolidge(1872-1933). Coolidge served as U.S. President from 1923-29. He did much to restore that public confidence in the presidency that had been eroded under Harding's administration. The popularity of Coolidge was helped by a surge of economic growth during the "*Roaring Twenties*." Coolidge said little, either in public or in private, and I have not found any actions relevant to health and fitness

other than his honorary presidency of the *American Foundation for the Blind*.

Herbert Clark Hoover (1874-1964 CE). Hoover was the son of a Quaker blacksmith, and as a trained engineer he was a strong believer in the "*Efficiency Movement*" that was espoused by industrialists during the Modern Era. While attending Stanford University, Hoover served as student manager of both baseball and football teams. During World War I, his efforts to bring food supplies to Belgian cities starved by the German blockade were widely acknowledged, and after the cessation of hostilities he continued to work with the *Friends Service Organization*, supplying food to both Germany and Russia. When asked if he was not helping Bolshevism, Hoover retorted (Lester, 2010):

"*Twenty million people are starving. Whatever their politics, they shall be fed!*"

His interest in adequate nutrition continued after World War II, when he instituted a school meals programme (*HooverSpeisung*) for hungry schoolchildren in the U.S. and British Zones of Occupied Germany. Other contributions to child health included his presidency of the *American Child Health Organization*, the raising of private funds to promote health education in schools and communities, and vigorous fund-raising for the *Boys' Clubs of America*.

Hoover's Presidency (1929-33) coincided with the depths of the Great Depression. Many of the unemployed lost their homes, and were forced into Hoovervilles or shanty-towns. Hoover tried to counter the economic slump with volunteerism, public works projects such as the Hoover Dam (later renamed Boulder Dam by a vindictive Roosevelt), and public-private partnerships. However, financial constraints precluded the enactment of many of his more progressive proposals.

Franklin Delano Roosevelt (1882-1945 CE). Franklin Roosevelt was U.S. President from 1933-45 (Friedel, 1990). He was the fifth cousin of Theodore Roosevelt, and his wife Eleanor was Theodore's niece. Much of the family fortune had come from his maternal grandfather, who had engaged in the opium and tea trade with China. During his privileged teen years, FDR learned to ride, shoot, row, golf, sail and play polo and lawn tennis. As an adult, he remained a strong supporter of scouting.

In 1921, he contracted a paralytic illness, possibly polio but more probably Guillain–Barré syndrome, while vacationing at his summer retreat on Campobello Island, New Brunswick. He became permanently paralyzed from the waist downwards. Stimulated by this disability, he established the *National Foundation for Infantile Paralysis,* now known as the *March of Dimes*. He also developed a specialized hydrotherapy spa (Shephard, 2013b) at Warm Springs, GA, trying various treatments in an attempt to convince both the electorate and himself that his health was improving. With much perseverance, he taught himself to walk a few steps with the aid of hip and leg braces, and he kept the wheelchair that he normally used hidden from public view. During an era when polio was rampant in both Europe and North America, he offered remarkable encouragement to others who were affected by this illness.

Roosevelt tackled the Depression with the "New Deal," which included creation of a *Federal Deposit Insurance Corporation*

to safeguard the fluidity of banks, a *Federal Emergency Relief Administration*, a *Civilian Conservation Corps* that sent 250,000 unemployed young men to work on various rural projects, and a *Securities and Exchange Commission* to rein in less desirable forms of financial opportunism.

Roosevelt had various long-standing sexual affairs with staff members, and for the latter part of his life his wife lived apart from him. She refused to return home, even as his health deteriorated. At the Yalta tripartite conference, Lord Moran, Winston Churchill's physician, commented that Roosevelt seemed a dying man. In March of 1945, Roosevelt succombed to a massive cerebral haemorrhage while visiting the Warm Springs Spa.

Harry S Truman (1884-1972 CE). Truman succeeded to the Presidency with the death of Franklin Roosevelt. He is remembered particularly for authorizing the Nuclear attacks on Japan, and for the Anti-Communist witch-hunt headed by Senator McCarthy. As a boy, Truman's main interests were music, reading, and history. However, in 1905 he managed to enlist in the Missouri National Guard despite defective eyesight by dint of memorizing sections of the standard Physician's Eye Chart.

Dwight David Eisenhower (1890-1969 CE). As a boy in Abilene, TX, a local illiterate gave Eisenhower a strong interest in the outdoors, hunting, fishing, and card playing. His family had once been Mennonites, but later became Jehovah's Witnesses. Both of these sects were firmly opposed to war. However, Dwight entered West Point Military Academy because his family lacked the financial means to pay for any other form of University education. At West Point, Dwight showed a keen interest in sports. He qualifyied for the football team, and was disappointed not to make the baseball team. He broke his leg in his final football match at West Point, and the injury was exacerbated in subsequent horseback riding and boxing. He then switched to fencing and gymnastics.

Eisenhower became widely known as the Supreme Commander of Allied Forces in Europe during World War II. Although sometimes criticized as a golf-playing, absentee President, many decisive political actions were taken during his first term (1952-56) (Wicker, 2003). The Shah of Iran was deposed, a threat of nuclear intervention ended the Korean war, the *Nuclear Deterrent Policy* was initiated, the *Domino Theory* was articulated in relation to states threatened by Communism, U-2 surveillance of the Soviet Union was instituted, and pressure from the U.S, forced France and Britain to halt their Suez invasion. Strong measures continued into Eisenhower's second term as President (1956-60), with the U.S. invasion of Lebanon and the desegregation of both the U.S. Armed Forces and the U.S. school system.

Eisenhower was a chain smoker until March of 1949. His medical advisers then persuaded him to give up smoking because of a combination of cardiac problems and Crohn's Disease. However, he maintained a substantial consumption of alcohol. He complained of dizziness on a visit to Chequers in 1959, but a physician noted he had drunk "*several gin and tonics, and one or two gins on the rocks ...plus three or four wines with the dinner."* In 1955, he had a serious heart attack while vacationing in Colorado, but his cardiologist (Dr. Paul Dudley White)

recommended a second Presidential term as essential to his recovery. The heart attack left him with a ventricular aneurysm, which in turn caused a mild stroke on November 1957. He sustained several crippling heart attacks after leaving the White House.

Canada. Canadian Prime Ministers and Governors General during the Modern Era have shown a varying level of personal interest in physical activity and sport. Borden enjoyed middle-class social sports, Meighen was an active commuter, and St. Laurent was a 5 BX enthusiast, but Mackenzie King, Bennett and Diefenbaker found little time for physical activity in their busy routines. Among Governors General, we comment on the positive attitudes of Lord Tweedsmuir, the Earl of Athlone, Viscount Alexander, and Georges Vanier, with less obvious athletic commitment from Vincent Massey.

Sir Robert Laird Borden (1854-1937 CE). Borden grew up on his parents' farm in Acadia, but he expressed a vigorous dislike for the hard physical work involved in agriculture (Bélanger and Cook, 2007):

He recalled that he never had mastered "the mysteries of building a load of hay," and found hoeing vegetables "extremely disagreeable" and sawing cordwood for winter fires "unpleasurable."

However, Borden did volunteer for the 63rd (Halifax) Battalion of Rifles, and spent one year at the *School of Military Instruction* in Halifax (see Hansard, Feb. 14th 1884) before beginning his career as a lawyer (Brown, 1975). He also enjoyed playing tennis, water sports, and especially golf with his wife, and in later life he spent much time working in his garden. He served as Prime Minister from 1911 to 1920, and is remembered particularly with respect to the conscription crisis that brought his government into conflict with French Canada.

Arthur Meighen (1874-1969 CE). Meighen was the son of a small farmer and village schoolmaster who lived in Anderson, ON (Graham, 1965). Although Arthur did not show any great aptitude for farming, he helped his father on the farm, and expressed the opinion (Graham, 1963):

"*Of course useful exercise could be had by doing useful work on the farm; this was the best means yet discovered of strengthening moral as well as physical fibre*"

He qualified as a lawyer, and served as Prime Minister for two short terms, from 1920 to 1921 and in 1926. In his early fifties, he moved to Toronto to serve as Vice-President of a Bay Street Securities firm. Here, he became well-known for his active commuting, daily walking a distance of 5 km in each direction between his Rosedale home and his Bay Street office.

William Lyon MacKenzie King (1874-1950 CE). King was Meighen's successor, and at times his bitter opponent. King served three terms as Prime Minister (1921-26; 1926-30; 1935-48). He was born in Berlin (now Kitchener), ON, and his maternal grandfather was the Ontario reformer William Lyon MacKenzie who had led the rebellion of 1837.

One of King's major contributions to Canada was the far-sighted planning of

the *National Capital Region*. He also introduced family allowances, unemployment insurance and a needs-based old-age security plan, and he greatly expanded the role and funding of the *National Research Council*. His government established the *Canadian Broadcasting Corporation*, the *National Film Board*, and *Trans-Canada Airlines* (now *Air Canada*).. His interest in spiritualism led him to appease Hitler. King saw Hitler as akin to a mythical Wagnerian hero, with good and evil struggling in his soul. In King's view, good would eventually triumph and Hitler would lead his people to a harmonious, uplifting future.

King was unmarried and a solitary figure. He seems to have preferred his seances with various historical figures to more active pursuits. However, the 1945 Green Book proposals that were conceived as a part of post-World War II reconstruction are of interest in the context of public health. Like other developed nations, Canada was receptive to a governmental role in social welfare, given the widespread sacrifices made by the population during World War II and active memories of the Great Depression.

Henry Norman Bethune (1890-1939 CE) had previously urged the provision of socialized medicine in the mid-1930s, while he was serving as physician to poor patients in the Verdun district of Montreal (Jack, 1981). Bethune's reacted strongly to the rejection of his ideas by the local medical association (Jack, 1981):

"Their prime interest appeared to be their own social status, the direct results of their profits from the practice of medicine. Bethune posed a threat to this as the advocate of a scheme that would change radically their independent social and economic position."

In 1947, a National Conference that was examining proposals for pre-paid medical care collapsed, probably in part for the reasons identified by Bethune. But the Premier of Saskatchewan, Thomas Clement (Tommy) Douglas (1904-1986 CE) and his left-leaning *Co-operative Commonwealth Federation* (CCF), decided to go it alone, establishing Canada's first publicly-funded *Hospital Insurance Plan* (Margoshes, 1999). Other provinces - including British Columbia, Alberta, and Ontario followed suit, although a national plan, transferable between provinces, was not implemented until 1965.

Robert Bedford Bennett (1870-1947 CE). Bennett had a five year stint as Prime Minister during the worst part of the Great Depression, from 1930-35 (Boyko, 2010). His family, living in the community of Hopewell Cape, NB, was relatively poor, so Robert paid his way through the Law School at Dalhousie University in Halifax by working as a librarian. After qualification, Bennett joined a prosperous law firm in Calgary, AB, and in 1910 he became the Director of *Calgary Power* (now the *Trans-Alta Corporation*). During World War I, he attempted to enlist in the Canadian Army at the age of 44, but he was turned down on medical grounds.

His controversial and unpopular solution to the massive unemployment crisis of the Great Depression was to ship single unemployed men to remote government labour camps, where they worked for 20 cents/day. The economic situation was such that Bennett strongly feared a communist insurrection, and he invoked section 98 of the Canadian criminal code (which dispensed with the

presumption of innocence when trying individuals who were viewed as potential threats to the State). In 1931, 8 of 10 communist leaders, including the party secretary Tim Buck (1893-1971 CE) were arrested and detained under this legislation.

Bennett was reared by a stoutly Methodist mother who (like Wesley) did not believe in "*silly, profitless diversions*" such as sport, and Bennett's career was marked by long hours of work with little play. Even as a law student at Dalhousie, he was never seen on the sports field. His interests lay in the library and the debating room.

Louis Saint Laurent (1882-1973 CE). St. Laurent had French- and Irish-Canadian parents, and was fluently bilingual. Like many of his predecessors, he was a lawyer, and he became Professor of Law at Laval University in 1914. He supported Mackenzie King in the conscription crisis, and was thus seen as King's natural successor following World War II (1948-57) (Pickersgill, 2001). Canada had by now become relatively prosperous, and St. Laurent paid down accumulated national debts, still finding sufficient revenues to establish the *Canada Council for the Arts*, and to expand social welfare programs (family allowances, old age pensions, grants for university and post-secondary education and an early form of Medicare termed *Hospital Insurance*). Laurent himself is reputed to have pursued a very rigorous personal 5BX-type exercise regimen.

John George Diefenbaker (1895-1979 CE). Diefenbaker went to France with a group of young military officers in 1916, but he soon returned to Canada with what one biographer has classed as a psychosomatic injury (Smith, 1995). Diefenbaker led the conservative party to its greatest electoral victory in 1957, and he served as Prime Minister for 6 years. From the viewpoint of this review, he established the *Royal Commission on Health Services* (the *Hall Commission*, 1961), the first practical step towards establishing universal medical care. The mandate of the *Commission* was:

"to inquire into and report upon the existing facilities and the future need for health services for the people of Canada and the resources to provide such services, and to recommend such measures, consistent with the constitutional division of legislative powers in Canada, as the Commissioners believe will ensure that the best possible health care is available to all Canadians"

Diefenbaker enjoyed hunting and fishing, but does not seem to have had time for other athletic pursuits.

John Buchan (1875-1940 CE), Lord Tweedsmuir. Buchan was a Scottish novelist, historian, partner in the publishing house of Thomas Nelson, barrister, and guru of military intelligence. In 1935, he became Lord Tweedsmuir, and he served as Governor General of Canada from 1935 to 1940. His autobiography "*Memory Hold-the-Door"* (Buchan, 1940) offers an interesting commentary on his attitudes towards physical activity.

As a young man, he chose to study at Brasenose College, Oxford, where a place on the *"rowing eight"* was the established student norm, but Buchan showed little interest in competitive sport. Nevertheless, he greatly valued other forms of physical activity, and he wrote

lyrically of his experiences when climbing the craggy peaks on the island of Skye. He also thought little of taking a weekend train from London to Brighton, so that he could walk the 100 km return journey. What a contrast with current expectations, when the *Canadian Association of Sports Sciences* and the *American College of Sports Medicine* plead with the general public to engage in 30 minutes per day of moderate exercise!

Prince Alexander of Teck (1874-1957), Earl of Athlone. Prince Alexander of Teck, an uncle of King George VI, had an unpromising start in life. His parents were obliged to flee to Europe because of massive unpaid debts in Great Britain.

The Earl of Athlone was appointed as Governor General of Canada following the sudden death of Lord Tweedsmuir (Cowan, 1952). While still in England, the Earl chaired the *Athlone Committee* of 1921. This created several British Post-graduate medical schools, including the *Royal Postgraduate Medical School* at Hammersmith, and the *London School of Hygiene & Tropical Medicine*. Much of the period of his Canadian mandate (1940-46) was focussed on boosting the Canadian war effort. However, he also established the *Athlone-Vanier Engineering Fellowship* at the Engineering Institute of Canada, and during his term of office he enjoyed active social events around Ottawa, hosting tobogganing parties, skiing in the Gatineau and learning how to skate.

Field Marshall Harold Rupert Leofric George Alexander (1891-1969 CE). Alexander became Governor General of Canada from 1946 to 1952. During his period at Rideau Hall, he became a keen devotee of the Canadian outdoors. He particularly relished the maple syrup season, and he became very enthusiastic about his official position as *Chief Scout of Canada* (a position attributed to Governors General since 1910). Alexander himself participated in a number of sports, including golf, ice hockey, and rugby and he was frequently observed in the grounds of the Vice-Regal residence practicing for his opening kick at the 1946 Grey Cup contest.

Charles Vincent Massey (1887-1967 CE). Massey came from a family of wealthy Methodists who owned the Massey-Harris agricultural equipment company in Brantford, ON. The Masseys made large donations towards the construction of Victoria College and Hart House at the University of Toronto, as well as a Toronto concert auditorium (Massey Hall), and the cathedral-like Toronto *Metropolitan Methodist Church* (now *Metropolitan United Church*) (Bissell, 1986).

Massey had befriended Mackenzie King while both were studying at Oxford University, in the U.K., and Massey became the first Canadian-born Governor General. During his term, from 1952-59, he journeyed extensively throughout the north. Using a canoe and a sled-team, he visited locations such as Hall Beach and Iqualuit, and shared in many physically demanding Inuit pursuits. However, Massey seems to have been more interested in the dramatic than in the athletic side of the new student facilities at Hart House. Here, he elected to participate as both an actor and a director of productions. In 1951, he recommended formation of the *Canada Council*; this was finally established in 1957.

Georges-Phileas Vanier (1888-1967 CE). The next Canadian Governor General was Georges Vanier, from the Province of Quebec. During his military service in France, Vanier had been shot in the chest and both legs (one limb being amputated), but he refused to be evacuated while the fighting continued. As Governor General (1952-59), he confronted the turmoil of the "Quiet Revolution," the upsurge of Quebec nationalism, and the terrorist actions of the *Front de Libération du Québec*.

Vanier was an avid sports fan. His favourite game was hockey, but he also instituted the *Governor General's Fencing Award*, and the *Vanier Intercollegiate Football Cup*. Despite declining health, Vanier still travelled widely, and through his role as *Chief Scout,* he encouraged Canadian children to realize their physical potential.

Authors

Space allows no more than a brief sampling of quotations from some of the better-known British and Canadian authors on topics relating to individual and community health, fitness and sport.

George Bernard Shaw (1856-1959 CE), The Irish playwright Shaw included much important social commentary in his writings. Like many thinkers in the early part of the Modern Era, he believed in "elective breeding." Thus, he anticipated that a super-race would emerge if women were willing to overcome social prejudices and select mates likely to give them superior children (Shaw, 1903):

"there should be no possibility of such an obstacle to natural selection as the objection of a countess to a navvy or of a duke to a charwoman."

In his preface to *The Doctor's Dilemma,* Shaw made it abundantly plain that he regarded much of traditional medical treatment as dangerous quackery. He argued strongly that it would be beneficial if the clinical practice of his time were to be replaced by an emphasis upon public health measures such as sound public sanitation, good personal hygiene and diets that were devoid of meat. Shaw also made the daring accusation that Edwardian doctors often performed unnecessary treatments in order to supplement their incomes. His solution was radical, given that the play was first presented in 1906 (Shaw, 1913):

"Make up your minds how many doctors the community needs to keep it well. Do not register more or less than this number; and let registration constitute the doctor a civil servant with a dignified living wage paid out of public funds."

"Use your health, even to the point of wearing it out. That is what it is for. Spend all you have before you die; do not outlive yourself."

Shaw visited Russia, and while in that country he became an ardent supporter of the fallacious *Lysenko theory of Lamarkian inheritance*, a Communist idea that was intended to boost the production of winter wheat. In a letter to the *Labour Monthly* he wrote (Shaw, 1949):

"Following up Michurin's agricultural experiments he found that it is possible to extend the area of soil cultivation by breeding strains of wheat that flourish in a sub-Arctic climate, and transmit this acquired characteristic to its seed"

Shaw's comments on sport do not

suggest a great personal enthusiasm for most forms of physical activity:

"Baseball has the great advantage over cricket of being sooner ended"
"Golf is a good walk spoiled."

Rudyard Kipling (1865-1936). Kipling was the first British author to gain a Nobel Prize for literature. He is known particularly for his stories of soldiers in India. George Orwell rightly considered him a prophet of British imperialism. Kipling had strong links with Baden-Powell and the scouting movement. He was also a strong exponent of exercise. In the *Jungle Book* (Kipling, 1894), he writes:

"in the Orient, blokes hit the road and think nothing of walking a thousand miles in search of something"

and in his poem the Camel's Hump (Kipling and Orwell, 1994) we find:

"The cure for this ill is not to sit still, or frowst with a book by the fire; but to take a large hoe and a shovel also, and dig till you gently perspire."

Bertrand Arthur William Russell (1872-1970 CE). Russell was born into an aristocratic family, and he became an eminent analytic philosopher, mathematician, historian and social critic. An ardent pacifist, Russell campaigned against Hitler, Stalin and the launching of the Vietnam War. He deplored the separation of academic learning from physical education (Russell, 1932/1988):

"I am not denying that in all modern schools there is physical care of children, and that a great deal is done to keep them in health, as compared with what used to be done in former times. What I am complaining of is that physical and mental care are so completely separated, and that the person who possesses the knowledge required for the one has, as a rule, no inkling of the knowledge required for the other. In an adult there is a considerable gulf between mind and body, but this gulf has no metaphysical necessity."

David Herbert Richards Lawrence (1885-1930). Lawrence was the son of a barely literate Nottinghamshire miner. Nevertheless, he became an important English novelist, poet, playwright, essayist, literary critic and painter. He is perhaps best known for *Lady Chatterley's Lover*, the book that in 1960 led to the prosecution of Penguin Books under the *Obscene Publications Act*. However, Lawrence also wrote extensively on the dehumanizing effects of industrialization in the Modern Era. He apparently despised athleticism and gymnastic drills (Lawrence and Herbert, 1987):

"The athlete is perhaps, of all the self-conscious objects of our day, the most self-consciously objectionable....Away with all physical culture."

But on the other hand, Lawrence recognized the deployment of physical skill in conquering the elements, and he saw sports contests and combat as an expression of human nature that could dignify and complete life (Lawrence and Herbert, 1987):

"If you will have the gymnasium, and certainly let us have the gymnasium: let it be to get us ready for the great contests and games of skill...Battle, battle, let that be the word that rouses us to pure physical efforts...Let us have a gymansium as the

Greeks had it...the prupose of pure perilous delight in contest and profound mystic delight in unified motion."

Thomas Stearns Eliot (1888-1965 CE). Although born in America, Eliot moved to England at the age of 25. In Britain, he became a publisher, playwright, literary and social critic and one of the most important English-language poets of the 20th century. The associations that he made when defining "*culture*" seem to point towards a low opinion of popular sport (Eliot, 1962):

Culture includes all the characteristic activities and intersts of a people: Derby Day, Henley Regatta, Cowes, the 12th of August, a cup final, the dog races, the pin table, the dartboard, Wensleydale cheese, boiled cabbage cut into sections, beetroot in vinegar, nineteenth century Gothic churches and the music of Elgar."

Aldous Leonard Huxley (1894-1963 CE). Aldous Huxley was a writer, and a member of the legendary Huxley family that included the physiologist and Nobel prize winner Andrew Fielding Huxley (1917-2012 CE). In "*Brave New World"* Aldous Huxley voiced his critique of the Modern Era, suggesting that the typical industrial worker was transformed into little more than a mindless automaton, biologically predestined to undertake any menial task that would maximize production.

George Orwell (1903-1950 CE). Eric Arthur Blair, better known under his pen name of George Orwell, was a powerful chronicler of English culture and social injustice. In his "*Road to Wigan Pier*," Orwell spent time living in the coal mining community of Wigan. He went down one of the local pits to see for himself the deplorable conditions faced by the workers, and he studied public health records in the local library to determine the prevalence of industrial illnesses. He found that often the miners faced a long walk to the coal face, down a narrow and low tunnel that was filled with obstacles (Orwell, 1937):

"If it is a mile from the coal face, that is probably an average distance; three miles is a normal one; there are even some where it is said to be five miles."

Barry Samuel Broadfoot (1926-2003 CE). Broadfoot was a Canadian radio interviewer and historian from Winnipeg, MA. In "*Ten lost years*," he offers a graphic history of the Great Depression and some of the hard physical labour that was still the lot of many Canadians during the Modern Era. I recall particularly his description of the coal delivery man (Broadfoot, 1997):

"each sack weighed 125 pounds, 16 to the ton, and... it was a 60 foot walk to the chute and...the snow was always two feet deep...you could just see him running down in the winter...how many's the time he's just lain down on the kitchen floor"

André Langevin (1927-2009 CE). Langevin was a French-Canadian author, and journalist at Quebec's most distinguished newspaper, *Le Devoir***.** In **"***Poussière sur la ville*" Langevin gives a graphic account of the lives faced by the asbestos miners of Quebec during the Modern Era (Langevin, 1953):

Dans les petites rues, c'est la farine souillée où l'on s'enlise. Même dans les champs, la neige a pris une teinte sale,

grisâtre.... Les arbres dressent là-dessus leur bois mort, déchiqueté. Des champs de poussière avec des formes calcinées (In the narrow streets, one becomes covered with dirty white flour. Even in the fields, the snow has taken a dirty grey colouring...the trees stand there, with their dead wood, leafless. Fields of dust with calcinous shapes)"

Stephen Leacock (1869-1944). The Canadian humorist Stephen Leacock offered a witty commentary on the decision of a Canadian court concerning North American sabbatarian laws (Leacock, 1923):

"*Golf may be played on Sunday, not being a game within the view of the law, but being a form of moral effort."*

Leacock also noted wryly the widespread Canadian tendency to equate the hunting of game with sport (Leacock and Nimmo, 1942):

"A sportsman is a man who every now and then, simply has to get out and kill something."

Mordecai Richler (1931-2001 CE). In *The Apprenticeship of Duddy Kravitz* (Richler, 1959), Richler gives a graphic account of the Canadian equivalent of a seaside holiday (a visit to a lakeside resort such as Ste. Agathe, in the Laurentian Hills of Quebec):

"*I want to buy this lake...I'm going to build a children's camp and a hotel here...".*

Health

In many Developed Nations, a lowering of the birth rate and an increase of lifespan led to a progressive increase in the average age of the population over the Modern Era. However, nutrition was poor among among the unemployed and their families during the dark days of the Great Depression, and food was in extremely short supply in many of the countries that were occupied by the Nazis during World War II. There was a gradual improvement of nutritional status in most of the Western world following the conclusion of hostilities, although devastating famines persisted in parts of India, Asia and Africa. The latter part of the Modern Era saw the introduction of definitive remedies for many of the more common acute infections, and in consequence death rates during childhood and early adult life decreased progressively. The discovery of insulin also enhanced life expectancy for those with type I Diabetes Mellitus. However, a progressive decline in habitual physical activity and other societal changes gave birth to a burgeoning epidemic of chronic ailments, including cardiovascular disease and obesity. During the Nazi era, substantial medical effort was diverted to attempts at genetic typing, in support of Hitler's racial policies. As the Modern Era progressed, the growing influence of radio and television offered health educators new opportunities to spread their message to the general public. Following World War II, most developed nations introduced State-sponsored systems of prepaid traditional medical care, but nevertheless a growing number of people were attracted to forms of alternative and complementary medicine, including acupuncture.

Demographics and birth control. Most developed societies have seen a substantial shift in the age distribution of the population over the 20th Century.

People in Canada and the U.S. still have a lower average age than in most European countries, but nevertheless North America has not been spared a progressive aging of the population. In particular, there has been a rapid growth in the numbers of very old people. In 1900, only 4.1% of Americans were over the age of 65 years, but this proportion had grown to 5.4% by 1930, 8.1% by 1950, and 9.9% by 1970. Corresponding figures for Canada were 5.0%, 5.6%, 7.8% and 8.1% (LaPierre and Hughes, 2009). In 1940, just over a million Americans were older than 85 years, but by 1980 there were 2.2 million in this age group, and by 2050, it is estimated that 16 million, or 5% of the total population will be aged >85 years (Spirduso and Eckert, 1988).

These dramatic changes reflect the combined influences of a decreasing fertility rate and the progressive control of acute diseases that previously had killed people in childhood or early adult life. Malthusians had long argued the need to limit the population to avoid global starvation. However, until recently, the leaders of many countries saw population expansion as important to increasing both domestic markets and military power, with a corresponding desire to restrict opportunities for contraception and abortion.

The palaeo-botanist and feminist Marie Carmichael Stopes (1880-1958 CE) opened the first birth-control clinic in England in 1921 (Hall, 1977). At the age of 23, Stopes had been the youngest person in England to earn a coveted D.Sc. degree from the University of London. Her teachings on contraception were well-received by the middle class, but despite free distribution of an abbreviated version of her book on *Married Love* (Stopes, 1918), she was viewed as a meddler by many poor slum dwellers.

In the U.S., the *Comstock Act* had made the distribution of contraceptive information illegal from the 1870s. Margaret Sanger was charged under this legislation in 1918, and the policy was only overturned by the *Griswold v. Connecticut* case of 1965. In Canada, birth control was ruled obscene by a law that was passed in 1892, but by the 1920s some feminists and proponents of the "*Social Gospel*" were beginning to question this legislation, and family size was shrinking fast in the upper strata of society. The first Canadian birth control clinic opened in Hamilton, ON, in 1932. Another early influence was the philanthropic owner of the Kaufman Rubber Company, Alvin Ratz Kaufman (1885-1979 CE) of Kitchener, ON. Kaufman mailed both birth control information and contraceptives through a "*Parents' Information Bureau*" (Revie, 2006). In 1936, Dorothea Palmer (1908-1992 CE), a field-nurse working for Kaufman's Foundation in a poor and mainly Catholic suburb of Ottawa, was charged with breaking the 1892 obscenity law. Kaufman spent the then considerable sum of $25,000 to defend Palmer, and she was acquitted on the grounds that her actions had been entirely for the public good (*pro bono publico*). Although contraception was not formally legalized in Canada until 1969, there were no further prosecutions, and the fertility rate decreased rapidly in Anglophone Provinces during the 1930s. In Quebec, a steep decline in fertility did not occur until the 1960s, when many of the population began to reject Roman Catholic teachings on contraception.

In France, also, birth control did not become legal until 1965, and in Italy the circulation of birth control information was not permitted until 1970.

Population aging has many important implications for proponents of increased health and physical fitness. The nature and prevalence of common ailments changes, and it also becomes mandatory to change the character of sports, fitness and recreation programmes to match the preferences of older people. Typically, walking, light gymnastics, yoga, golf and cross-country skiing replace skate-boarding, ski-jumping, wind-surfing and hang-gliding as activities of choice, and retirees also demand that sports facilities be available mid-week as well as at the weekend.

Many developing countries offered little Governmental support of the elderly even during the 20th century, and in consequence the rearing of a large family was still considered an important means of providing for one's old age (International Labour Organiusation, 1992). Premature death from malnutrition, disease, and inter-tribal conflicts further contributed to steepness of the population pyramid in many *Third World* countries, (Kalache, 1991). A steep population pyramid remains characteristic of Canada's indigenous populations, even today. In 1969/70, more than 31% of the Inuit community of Igloolik, Nunavuk, were under the age of 20 years, with a high birth rate and many teenage pregnancies (Shephard and Rode, 1996). Many Inuit women are reportedly disappointed if they are not grandmothers by the age of 30! Thus, in terms of age demographics, health and fitness programmes designed for southern Canada ae likely to be inappropriate for northern communities.

Nutrition. Both in Europe and in North America, many people were short of food during the inter-war years. The main issue was unemployment, which reached an official level of 25% in the U.S. and over 30% in Canada. In Russia, further factors were an excessive focus on the rapid development of heavy industry and enforced collectivization of small farms. In 1936, a Russian Young Pioneer complained (Siegelbaum and Sokolov, 2004):

"*Many of us don't go to school. We don't have bread, and some of us don't have shoes or clothing.. there are already people who are getting swollen from hunger."*

The persistent adverse effects of starvation in Africa are well documented, but it is less clear how far the food shortages of Europe and North America affected population health. Medical examinations conducted in working-class areas of London (1927) and the ship-building town of Jarrow (1933) disclosed many children with signs of calcium deficiency and the onset of rickets (Dawson, 2007). Indeed one of the patients I was required to examine for the clinical portion of my M.B.B.S. finals in 1952 was an advanced case of rickets.

School breakfasts and/or lunches were provided in an early attempt to correct the nutritional problems of young children (Drake, 1933; Vernon). School meals were first introduced in poor areas of Britain during the 1870s, and in 1944 (when standard household rations had become severely restricted), all state schools were required to provide lunches that met specified minimum nutritional standards. Free or subsidized school milk also became available from around 1935,

with every child receiving a third of a pint (190 ml) of milk each morning. This practice has recently been questioned, with some arguing that in today's sedentary society it increases the risk of atherosclerosis.

U.S. President Truman introduced the *National School Lunch Act* in 1946. Currently, it provides low cost or free lunches to 31 million schoolchildren. School breakfast programmes did not reach the U.S. until 1966, but by 1997 six million U.S. students were attending a breakfast club; it is claimed that the additional food has had beneficial effects upon both nutrition and learning.

Canada still has not implemented a national school meals programme, although volunteer organizations have been providing breakfasts at a number of schools for many years, as in the area of British Columbia where I am living.

If children are sent to school without breakfast, it seems logical that a morning snack will have positive effects upon their ability to learn. However, the provision of school meals apparently did little to stop the development of rickets during the inter-war years. Epidemiological studies showed that rickets was seen most frequently in urban areas, but surprisingly disease prevalence was relatively independent of social class. It was finally concluded that the most likely cause of rickets was intense air pollution from coal fires, rather than a nutritional deficiency. Until the mid 1950s, the sun in cities such as London was obscured by smog for much of the year (Hardy, 1992). Wealthy children sometimes gained protection by taking large daily doses cod liver oil. However, this was not a component of school meals, and the protein component of the meal was usually meat rather than fish. The rickets problem was largely solved once the burning of coal in the domestic fireplaces of Britain was prohibited, in 1956.

One consequence of food rationing during World War II was that many Europeans replaced their normal consumption of fat and sugars by vegetable fibre. There is some evidence that the enforced change of eating patterns had a beneficial effect upon the prevalence of cardiovascular disease in the affected cohort of the population (Barker and Osmond, 1986). The value of fibre in reducing cholesterol levels, cardiovascular disease and colonic cancer has subsequently attracted ever-growing interest among dieticians.

By the end of the Modern Era, Harvard Professor Jean Mayer (1920-1993 CE) was warning the public that U.S. children were growing increasingly fat, a trend that he attributed to an excessive watching of television and a lack of exercise (Mayer, 1960). The decline in daily physical activity has unfortunately increased further in subsequent decades.

Acute infections. In the 1920s and 1930s, infectious illnesses were still major causes of death. Children often died before they reached the age of maturity and outbreaks of tuberculosis and poliomyelitis brought panic to many communities. Marie Laberge paints a graphic sketch of Quebec during the 1930s, where a young lawyer was frightened that he would lose many of his clients if they heard that the daughter of his servant has been diagnosed as suffering from pulmonary tuberculosis (Laberge, 2000). As a medical student during the late 1940s, I sensed the powerlessness of many well-intentioned physicians. Viral pneumonia could kill in a night. Sanatoria were filled with young

people who remained in care for years on end because their lungs were being destroyed by tuberculosis, or their cardiac valves were being eaten away by rheumatic fever (Maughan, 1952). And as we visited the isolation hospitals, we passed row upon row of coffin-like artificial respirators, where victims of anterior poliomyelitis clung precariously to life. But as the Modern Era progressed, new discoveries allowed the resolution of many of these health problems.

The first ray of hope came in the mid-1930s. Gerhard Domagk (1895-1964 CE) was a German physician and professor of pathological anatomy, on secondment to the new laboratories of the Bayer pharmaceutical company. Domagk had been saddened by the inability of the medical profession to treat surgical infections during World War I, and he had the novel idea that coal tar dyes might bind preferentially to microorganisms, killing the bacteria but not the patient. After many trials, he found a red dye that protected mice against lethal doses of streptococci and staphlococci, and in 1939 he received the Nobel prize for this research (Hager, 2006). In 1935, the drug was marketed as *Prontosil Rubrum*. It proved particularly effective against rheumatic fever and puerperal fever, and it also played a major role in reducing wound infections at military hospitals during World War II. Bayer hoped to make large profits from this discovery, but it was soon pointed out that although the dye was very effective *in vivo*, it had little effect *in vitro*. Further research showed that this was because the dye released an active and colourless component (sulphanilamide) when in the intestines. Sulphanilamide had been known for many years, and unfortunately for the Bayer share-holders, the patent protecting sales of this drug had long since expired.

The treatment of superficial infections by an application of moulds was first suggested in ancient Greece, and over the centuries there have been reports of such therapy from Russia, Serbia, Poland and Sri Lanka. In the England of 1640, John Parkington, the King's herbarian and apothecary advocated the application of mould to wounds (Kavaler, 1967). In Victorian times, Sir John Scott Burdon-Sanderson noted that if a culture fluid was covered with mould, bacteria were unable to grow (1870). This prompted Joseph Lister to find that if urine samples were contaminated with mould, this also checked the growth of bacteria. Lister further noted that *penicillium glaucum* had an anti-bacterial action on human tissue (1871). Louis Pasteur (1877) found that cultures of anthrax were also inhibited by a strain of penicillin (*penicillium notatum*). Despite these findings, credit for the discovery of penicillin is generally attributed to Alexander Fleming (1928). Fleming noted a halo of inhibited staphylococcal growth near to a spot of blue-green mould in a petri dish that someone had carelessly left uncovered near an open window. He concluded that the mould was secreting an inhibitory chemical, and he succeeded in isolating the penicillin that was responsible for this effect. However, it was not until the early 1940s that a team of chemists led by the Australian-born pharmacologist Howard Walter Florey (1898-1965 CE) discovered a form of penicillin that was stable enough for mass production. Florey shared the 1945 Nobel Prize with Fleming and Ernest Boris Chain (Hobby, 1985).

By 1946-47, Albert Schatz, a graduate student working at Rutgers University

under the biochemist Selman Abraham Waksman (1888-1973 CE) had discovered another important antibiotic (streptomycin) (Kingston, 2004); Waksman received a Nobel prize for this research in 1952, although it has been suggested that he fraudulently fabricated evidence excluding the contribution that Schatz had made to discovery of this drug (Pringle, 2012). Sir Geoffrey Marshall (1887-1982 CE) then completed a double-blind placebo controlled trial at the British *MRC Tuberculosis Research Unit*, showing the efficacy of streptomycin against *mycobacterium tuberculosis*. Unfortunately, it has since been necessary to abandon use of this drug, because of the widespread development of resistant bacteria (Metcalfe, 2011).

Anterior poliomyelitis had been known for several millennia, but major epidemics occurred during the 20th century, with the open toilets on passenger trains apparently contributing to spread of the disease along the railroad tracks. At the peak of the epidemic, during the 1940s and 1950s, half a million people were paralyzed or killed by poliomyelitis each year (Trevelyan et al., 2005). Vaccines became available during the 1950s. Jonas Edward Salk (1914-1995 CE) of the University of Pittsburgh developed an inactivated polio virus, and as mass vaccinations began in 1967, there was a dramatic ten-fold decrease in the incidence of poliomyelitis in the United States (Sass et al., 1996). Some 8 years later, Albert Bruce Sabin (1906-1993 CE), a paediatrician at the University of Cincinnati, introduced an oral attenuated polio virus. This was much easier to administer, and its effects lasted longer than the Salk vaccine; within a few years no new cases of anterior poliomyelitis were being reported in the U.S. (Sabin et al., 1960). One side effect of the epidemic of poliomyelitis was an increased interest in techniques of physical rehabilitation. Franklin Roosevelt became convinced of the value of hydrotherapy; in 1926, he bought a resort at Warm Springs, Georgia, and this facility still operates as the *Roosevelt Warm Springs Institute for Rehabilitation*.

Insulin. The pancreatic extraction of insulin by Frederick Grant Banting (1891-1941 CE) and Charles Herbert Best (1899-1978 CE) was a unique Canadian contribution to health during the 1920s. Banting was born on a farm near Alliston, ON, and transferred from divinity to medicine while attending the University of Toronto. After serving in World War I, where he won a Military Medal, Banting returned to Toronto, lecturing in pharmacology from 1921-1922, and receiving his MD degree with a gold medal.

Previous attempts to extract insulin from the pancreas had been thwarted because the proteolytic enzymes in that tissue broke down the insulin very rapidly. However, an article by Moses Barron had shown that ligature of the pancreatic duct led to death of the trypsin-secreting cells in the pancreas, without affecting the Islets of Langerhans. Exploiting this observation, Banting and his graduate student Best were able to extract useful quantities of insulin. A Nobel Prize was awarded for this work, but as in a number of instances, the honours were misdirected. Banting shared his portion of the prize money with Best, but the then professor of physiology at the University of Toronto, John Macleod, claimed an equal share in the discovery, apparently on the basis of a brief preliminary discussion with Banting,

where Macleod had poured scorn on Banting's ideas. When writing a 1929 article for the Encyclopaedia Britannica, Macleod gave no indication that either Banting or Best had played any role in the discovery (Jack, 1981).

The original source of medicinal insulin was the horse pancreas. Animals were bred for this purpose at the Connaught Laboratories on the northern outskirts of Toronto. However, much of the processing of the insulin occurred in the University of Toronto's *School of Hygiene*, in laboratories that I subsequently inherited for the *Toronto Fitness Research Unit*. In 1966, we were able to use some of the giant processing vats to develop our techniques of underwater weighing.

Based on the discovery of insulin, Banting was appointed as Director of the *Banting and Best Research Institute*. This laboratory went on to study other health problems, including silicosis, cancer, mechanisms of drowning, and loss of consciousness during exposure to high gravitational forces. During World War II, Banting headed the *RCAF's Number 1 Clinical Investigation Unit* (CIU), housed in a secret facility at the former Eglinton Hunt Club. He died in a plane crash, *en route* to the *RAF Institute of Aviation Medicine* in England for operational tests on the anti-g flying suit that had been developed by his colleague Wilbur Franks. The Eglington facility was the precursor of the *Defence & Civil Institute of Aviation Medicine,* now located in Downsview, ON.

Chronic disease. The French medical philosopher Georges Canguilem (1904-1995 CE) contributed to the discussion of preventive medicine by asking the question (Horton, 1995):

"Is it possible to be sick without having a disease, and conversely, is it possible to have a disease and not be sick?"

The 1940s saw a gradual increase in the prevalence of deaths from cardiovascular disease, attributable in part to a decrease of habitual physical activity in a large proportion of the population in developed societies. Towards the end of the Modern Era, as a sedentary lifestyle became ever more prevalent, many western nations also noted an epidemic of obesity, and epidemiologists began to advocate an increase of physical activity as a means of countering these problems.

Jeremy Noah Morris (1910-2009), a professor at the *London School of Hygiene*, was himself an enthusiastic exerciser; even in his mid 90s, he was still walking 30 minutes per day, swimming and pedalling a cycle ergometer. His analysis of the *Official Statistics of the Registrar General for England and Wales* demonstrated an epidemic of cardiovascular disease in Britain (Morris, 1951). This had apparently begun in the 1940s, and by 1946-48 the male death rate from acute coronary disease was more than double that for 1931-33. An analysis of similar data for the Province of Ontario (Anderson and Le Riche, 1970) showed that there had been a parallel trend in Canada. Many factors changed between 1930 and 1950, but one of the most prominent developments was a decrease in habitual physical activity, as industry became mechanized, and most households began to own one or more cars.

The date of onset of the obesity epidemic is less clearly established (World Health, 2000). In Victorian times,

much of the population was under-nourished, and the emphasis of public health was upon increasing body mass in relation to height. However, by the 1950s, there were some concerns about a growing prevalence of obesity, and one of the main motivations behind the 1953 *Canadian Survey of Heights, Weights and Triceps Skinfold Thicknesses* (Pett and Ogilvie, 1956) was to obtain some benchmark data. Thorkild Sorenson and colleagues found that the prevalence of obesity among the Danish military recruits that they examined between 1944 and 1964 was only 0.5% (Zimmerman et al., 2011). However, as early as 1962, the *U.S.National Health Examination Survey* found that 45% of adult Americans were overweight, and 13% were obese. In Canada, the statistics showed no change in the body mass of adults aged 20-64 years from 1953 to 1971-72; however, there was a substantial increase in body mass thereafter, affecting particularly the heavier half of the population (Katzmarzyk, 2002). Likewise, a comparison of Canadian skinfold data showed a substantial increase in the sub-cutaneous fat of men but not of women from the survey of Pett and Ogilvie in 1953 to the *Canada Fitness Survey* of 1983 (Shephard, 1986). Life Insurance companies quickly recognized the link between excessive body mass and reduced life expectancy, and they adjusted their premiums accordingly (Haslam and James, 2005).

Preventive value of physical activity. Just before his death, the poet John Dryden (1631-1700 CE) wrote (Williams, 2009):

"Better to hunt in fields for health unbought than fee the doctor for a nauseous draught. The wise for cure on exercise depend"

Dryden was perhaps the first person in recent history to suggest that exercise had therapeutic value. Other lone voices called for greater physical activity over the next two centuries. The physician William Heberden (1710-1801 CE) specifically commended exercise for a cardiac patient. He described a man with angina who (Heberden, 1772):

"set himself the task of sawing wood for ½ hour every day and six months later was nearly cured."

The Irish physician William Stokes (1804-1878 CE) who described Cheyne-Stokes breathing and Stokes-Adams disease also advocated exercise therapy in an early cardiology text (Stokes, 1855):

"The symptoms of debility of the heart are often removable by a regulated course of gymnastics or pedestrian exercise....I have seen the most remarkable examples in persons who have spent the summer walking through the Alps"

In Munich, Germany, Max Josef Oertel (1835-1897 CE) gave a careful description of the effects of exercise upon blood pressure, heart rate and fitness, and he recommended exercise for the treatment of hypertension and "hydrops" (apparently congestive heart failure) (Oertel, 1891). To the amazement of many of his medical colleagues, Sir James MacKenzie recommended gymnastics as a treatment for "*soldiers' heart*" during World War I (Mackenzie, 1919), and in 1921, Oskar de la Camp at the university

of Freiburg suggested that patients with heart disease would profit from an increase of physical activity (Berg and König, 2002). In1925, Ludwig Aschoff, a pathologist at the same university, argued that the large heart of the athlete was not a pathological phenomenon, but was rather a beautiful example of functional adaptation (Berg and König, 2002).

However, all idea of active treatment for cardiac disease then seems to have disappeared. Over the next 20 years, patients were not even allowed to brush their teeth or cut the food on their lunch tray for 2 weeks following a heart attack. Samuel Levine caused considerable controversy by recommending that cardiac patients move from their beds to an arm chair as soon as one week following a myocardial infarction (Levine, 1944). Many of those responsible for the health of athletes were still questioning the long-term value of physical activity as late as the 1950s. Thus, a study of athletic "*Letter Holders*" at the University of Michigan showed that this group had a substantially shorter lifespan than their peers who had attended the same university, but had not participated in Inter-collegiate athletics (Montoye et al., 1957). However, further investigation suggested several explanations of this finding. Many of the *Letter-Holders* had been football players, a sport where a mesomorphic body build not only gave them a physical edge over lighter opponents, but also predisposed them to cardiovascular disease in middle age. Moreover, by the time they had reached middle age, the Letter-Holders were in general physically less active and fatter than their peers.

Other studies of endurance athletes found a several year advantage of longevity relative to the general population (Karvonen et al., 1974), although again it was unclear whether this was due to a greater volume of habitual physical activity or to other characteristics such as an ectomorphic body build and abstinence from cigarettes.

Further studies of the possible benefits of habitual physical activity were based upon occupational comparisons*.* During the early 1950s, some jobs still demanded very high levels of energy expenditure, and it was thus reasoned that it would be informative to compare health outcomes between vigorously active and more sedentary employees. Jeremy Morris and his associates examined workers on London Transport buses; the London buses of that era mostly had upper and lower decks, and while the driver sat in the comfort of a leather-padded seat, the "*conductor*" had to climb repeatedly to the top deck of the vehicle in order to sell tickets to passengers (Morris estimated that the conductors climbed at least 600 steps per shift). At first inspection, this seemed an ideal epidemiological comparison. The population of London bus drivers and conductors was large, and both categories of worker came from a similar social milieu. However, a study of uniform sizes showed that there had been an important element of self-selection during the hiring process. At recruitment, the drivers had a larger abdominal girth than the conductors; they also had a greater body mass, and higher blood pressure and serum cholesterol values (Morris et al., 1956). Nevertheless, the lower risk of heart disease that was seen in the bus *conductors* could not be explained simply in terms of an advantage of physique. Morris embarked on a second, somewhat similar study, comparing post-office mail carriers vs.

post-office clerks; here again, he found less risk of heart disease in the active group (Morris et al., 1953).

In the United States, the comparison between active and inactive railroad workers has already been noted (Taylor et al., 1962). Ralph Paffenbarger (1922-2007 CE) noted that in the early 1950s, some categories of San Francisco longshoremen had a very high rate of energy expenditure (22-31 kJ/min). In his study, workers whose energy expenditure was less than 22 kJ/min had 3.3 times the risk of sudden death that was seen in their more active colleagues (Paffenbarger et al., 1970). However, one problem in analyzing his data was that following a heart attack, men tended to shift from heavy to light work; this made it difficult to categorize physical activity levels in older workers. Despite these problems, a review of 20 occupational studies found a substantially higher incidence of deaths, sudden deaths, and myocardial infarctions among those who were employed in less active occupations (Clarke, 1972).

Further proof of the exercise hypothesis was sought in longitudinal studies where questionnaires quantified the initial leisure time physical activity in selected groups of men such as executive-class civil servants in Britain (Morris et al., 1973), and Harvard Alumni in the U.S. (Paffenbarger et al., 1978). The quantitative validity of the physical activity questionnaires has since been challenged, although the instruments used were probably adequate to sort active from inactive individuals. Some of these studies pointed to the need for a minimum threshold intensity of effort (what Morris called "vigorous getting about") and/or a minimum weekly volume of exercise (Paffenbarger estimated this minimum at a gross additional energy expenditure of 4-8 MJ/wk).

In Germany, Peter Beckmann (1908-1991 CE) revived the concepts of Oertel, seeking to bring cardiac patients to a fitness level where they could participate in a mountain walking tour (Beckmann, 1961). In the U.S., the question of an appropriate level of physical activity for the coronary patient gained new urgency during the presidency of Dwight Eisenhower. Eisenhower nearly died of a heart attack in 1955 (above); Paul Dudley White (1886-1973 CE), a noted cardiologist and a strong advocate of exercise, attended the U.S. President. White was himself a vigorous walker and bicycle rider, and on one occasion he walked the 11 km from Washington's National Airport to the White House in order to consult with President Eisenhower.

Herman Hellerstein (1916-1993 CE), a Cleveland Clinic Cardiologist (Franklin, 1993), began an out-patient programme of exercise and diet for cardiac patients in the early 1950s, and by the time that we held the first *International Conference on Physical Activity and Cardiovascular Health* in Toronto (October of 1966), Hellerstein was able to report a favourable outcome in 485 of his patients (Hellerstein et al., 1967). Another early pioneer of cardiac rehabilitation was the Israeli physician, Viktor Gottheiner. He believed that a carefully graded outdoor exercise programme (walking, running, cycling, swimming and rowing) was more enjoyable than repeated hospital visits for exercise on a cycle ergometer. During the period 1959-1964, Gottheiner's programme at the *Ramat Chen Medical Rehabilitation Centre* received 548 patients with a diagnosis of myocardial

infarction and 555 with coronary insufficiency. Some of the group graduated to participating in an 11 km race around Mount Tabor, the best runner achieving a time of 58 min (Gottheiner, 1960, 1968). Gottheiner claimed a very low mortality rate for participants in his programme (0.88% per year, compared with an expected rate of 4.8%), although he had no control subjects, and he apparently overlooked issues of programme-selection by both the clinician and the participants, together with the benefits of health counselling that were gained from regular attendance at his rehabilitation centre.

Radio and health education. In Victorian times, the advent of mass circulation newspapers opened up a new potential channel for education of the general public about issues of health and personal hygiene (Shephard, 2013c). During the Modern Era, the task of educating the masses was progressively assumed by radio and television.

In Britain, the common-sense health advice of the "*Radio Doctor*" (Charles Hill, 1904-1989 CE) was much appreciated by the common people during World War II, when most husbands were away in the army, and the free consultations of the *National Health Service* had yet to become available. In Canada, Allan Roy Dafoe (1883-1943 CE), a country obstetrician from Callander, ON, gained instant fame with his successful delivery and guardianship of the Dionne quintuplets. He went on to fulfill a similar role to Dr. Hill, giving North American mothers homespun advice on health and nutrition during his thrice weekly broadcasts. Initially, his talks were aired by the Toronto radio station CFRB, but subsequently the broadcasts were syndicated by the Columbia Broadcasting System (Jack, 1981).

When television made its appearance, it focussed more on the development of fitness and athletic ability than on nutrition and medical problems (see below), although the "commercial breaks" proffered many supposed remedies for common ailments.

Racism. Racism dominated many aspects of German thinking under the Hitler regime. The racial instruction of Germans started as the age of 6, and Hitler decreed that (Mosse, 2003):

"no boy or girl should leave school without complete knowledge of the necessity and meaning of blood purity."

During the Nazi era, German physicians devoted considerable effort to issues of eugenics, and they exploited facial anthropometry in an attempt to determine which citizens were not of "pure Aryan descent."

Alternative Medicine. Although traditional medical care became progressively more effective, various forms of alternative and complementary medicine also flourished during the Modern Era. In the German Weimar Republic, there was a trend to nudism (naturalism), possibly stimulated by the problem of rickets in smog-laden cities. Rudolph Steiner (1861-1925 CE), the Austrian who also initiated the Waldorf school system (Paull, 2011), promoted a combination of theosophy and homeopathy, the so-called "anthroposophical medicine" (Ernst, 2004; Rosslenbroich et al., 1994). Waldorf schools tended to follow this doctrine, and it was claimed that their pupils had a

low incidence of allergies, possibly because they discouraged the use of antibiotics, antipyretics and vaccines (Flöistrup et al., 2006). However, the Waldorfians did not publish any information on the deaths that were caused to both their students and immediate contacts by their rejection of modern medical remedies!

Jesuit missionaries probably brought the concept of acupuncture from China to Europe as early as the 17th century (Couplet et al., 1671). Indeed, the Latin name of "*acupuncture*" probably derives from this source. Acupuncture is one form of alternative medicine that gained some credence in Western society towards the end of the Modern Era, with publication of an English-language text on this subject (Lawson-Wood, 1959), and demonstration of the technique to both Henry Kissinger (1971) and Richard Nixon (1972) during their respective visits to Communist China. The *U.S. National Acupuncture Association* was formed in 1972. Interestingly, Mao Tse Tsung had criticized acupuncture during the Chinese civil war, declaring it a superstitious and irrational practice that had become an obstacle to the communist party's dedication to scientific thinking. However, he later reversed his position, declaring that (Crozier, 1968):

"*Chinese medicine and pharmacology are a great treasure house and efforts should be made to explore them and raise them to a higher level."*

Acupuncture continues to find its advocates. But most scientists now consider any apparent effects of such treatment are too small to be of clinical relevance, and the supposed benefits can probably be explained by a combination of inadequate experimental blinding (Madsen et al., 2009), placebo effects (Ernst, 2006), and publication bias (Lee et al., 2006).

Physical Activity

There seems little objective evidence on possible changing patterns of physical activity in the general population during the Modern Era. But we may infer that the general trend was to a decrease in habitual physical activity, given the growing mechanization and automation of industrial processes, the introduction of labour-saving devices into the home, the widespread ownership of cars and motor-cycles, the partial mechanization of some sports (for example, the use of electric golf carts and the climbing of the Alps by cable-cars), and ever-growing opportunities for spectator sport. In North America, the expansion of suburbia, a lack of sidewalks, and the growing speed of motor vehicles rapidly hampered walking and cycling as means of personal transportation (Mumford, 1961). Between 1948 and 1958, car ownership in the U.S. increased from 30 to 67 million vehicles (Mumford, 1961).

The 1950s saw a further exacerbation of sedentary behaviour with widespread ownership of television sets. The Nuffield Foundation compared British children with access to television versus those without such access over the period 1954-1958; they found that "viewers" engaged in far fewer of the spontaneous, unorganized activities that had previously accounted for much of a child's total energy expenditure (Himmelweit, Oppenheim and Vince, 1958).

Fitness and physical education

In the early part of the 20th century, Dalcroze, Laban, Alexander and Pilates

attempted to meld some of the dramatic concepts of the stage with the processes of physical education. This approach became popular in schools for "young ladies," where physical education was seen as one facet in the process of enhancing a woman's natural graces so that she could attract a suitable husband. This set the stage for formation of the *Women's League of Health and Beauty*.

After commenting on the ideas of Dalcroze, Laban, Alexander and Pilates, we examine the course of Fitness and Physical Education programmes in various nations, including the German and Italian dictatorships and the Russian communist regime. We note also trends in France, Britain, the U.S. and Canada. This section concludes with specific comments on the history of the *Margaret Eaton School*, the appearance of University-recognized programmes of physical education in Canada, and the contributions of some prominent Canadians from this era (Tait McKenzie, Arthur Lamb, Tim Buck and Lloyd Percival).

Emile-Jacques Dalcroze (1865- 1950 CE). Dalcroze was a Swiss educator, musician and Professor of Harmony at the Geneva Conservatory. He developed what became known as the Eurhythmics system of rhythmic gymnastics; his primary objective was the teaching music to young students. Body movements were used to represent the musical rhythms which the students had just heard (Dalcroze, 2007). Movements of the arms represented the timing of the music, and note values were indicated by movements of the trunk and feet. Dalcroze Institutes were established in several major cities early during the 20th century, and many European schools adopted the Dalcroze method of instruction. His approach required concentration and rapid reactions. It contributed to the development of 20th century dance, and has continuing echoes in the *Orff Schulwerk* system of musical education.

The Dalcroze method became popular with institutions such as the Margaret Eaton School (below) that taught feminine graces to daughters of Toronto's "upper crust" through a combination of physical education and drama instruction.

Rudolf von Laban (1879-1958 CE). Laban was an aristocratic dance artist and theorist who was born in the {then) Hungarian city of Pozsony (Bratislava). In our present context, he is best known for the Laban system of movement analysis (*Kinetographie Laban*, or *Laba-notation*), as set out in the journal *Schriftanz* in 1928. The technique is still used by some dance studios (Bell-Kanner, 1998). Laban became director of dance festivals in Nazi Germany from 1934-36, obediently removing "non-Aryan" pupils from his classes, and writing in the *Deutsche Tanzzeitschrift* of May 1936:

"We want to dedicate our means of expression and the articulation of our power to the service of the great tasks of our Volk. With unswerving clarity our Führer points the way."

Despite this subservience to the Hitler regime, Laban was dismissed in 1938, apparently because one of his presentations was thought to do insufficient to promote Nazi ideology. He then became a refugee in England, founding the *Laban Guild for Movement and Dance*. After World War II, he sought to apply his ideas of movement analysis to industry, seeking to eliminate

unnecessary "*shadow movements"* that he believed were wasting the energy of the worker (von Laban, 1867).

Frederick Matthias Alexander (1869-1955 CE). Alexander was the son of a Tasmanian blacksmith. As a boy, he was not physically strong, and indeed he frequently complained of pains after undetaking physical exertion (Bloch, 2004). Nevertheless, he enjoyed such rural outdoor pursuits as fishing, shooting, riding and horse racing. As a young man, he moved to Melbourne, and began to give amateur Shakespearean recitals; however, he found himself plagued by persistent hoarseness. Traditional voice trainers did not seem able to cure his problem, so Alexander began to speak in front of mirrors, attempting a conscious control and re-education of the muscles that controlled his voice. He soon concluded that this same technique could improve many aspects of a person's health and well-being. Guided movement with light hand contact from Alexander was seen as a means of detecting and avoiding unnecessary effort when performing any type of task. Alexander rented an office suite at the prestigious *Australian Building* in downtown Melbourne, and he began giving consultations to develop the voice, cure stuttering and address other persistent muscular problems.

A lucky bet at the local race-track provided Alexander with passage-money to London. There, he established a West-End practice that quickly became very popular among stage and society. His fees of 4 guineas per consultation were quite high for the era, and Alexander soon became a relatively wealthy man. An initial good relationship with the medical fraternity ended abruptly when one of his former supporters, a Dr. Spicer, claimed that the corrections of posture and respiration taught by Alexander were a medical prerogative, and not matters for "*untrained amateurs and ignorant quacks."* Alexander responded with pamphlets accusing Spicer of plagiarism and distortion (Bloch, 2004).

In 1914, Alexander allied himself with Margaret Naumberg, an American disciple of Montessori, and *Alexander Institutes* were opened in the U.S. Alexander's English practice also continued to prosper after World War I; prominent patrons included William Temple (a future Archbishop of Canterbury), Joseph Rowntree (the chocolate manufacturer), and Ronald Searle (the cartoonist). The distinguished neurophysiologist Sir Charles Sherrington also reputedly supported Alexander's ideas.

In 1935, Irene Tasker, one of Alexander's pupils, carried the Alexander Technique to the Transvaal. Here, it attracted the attention of Dr. Ernst Jokl, then *Director of Physical Education* for the South African Government and subsequently one of the founding fathers of the *American College of Sports Medicine*. The president of the *Transvaal Teachers Association* praised the Technique, criticizing the current patterns of physical education in the Transvaal. Jokl saw this as a direct attack on the medical profession in general and himself in particular. Thus, he published a vigorous critique of the Alexander Technique in the *Transvaal Educational News* under the headline "*The Relationship between Health and Efficiency."* In 1944, Jokl wrote a further article for the journal *Volkskragte* (*Manpower*), describing the Alexander Technique as '*a dangerous and irresponsible form of quackery*.' Alexander responded to this challenge by sueing Jokl

for defamation. Anxiety about the outcome of the trial seems to have precipitated a cerebral stroke in Alexander, and he was unable to attend the hearings in person. His witnesses included such eminent individuals as Lord Lytton and Sir Stafford Cripps. Jokl's supporters included Nobel Prize-winners Edgar Adrian and Sir Henry Dale, together with the cardiologist Paul Wood. The defence lawyer extracted from Alexander's chief witness (Dr. Bill Barlow, an early pupil of Alexander's) an admission of the damaging belief that "*as a result of psycho-physical quidance under conscious control, resistance to infectious disease might be better*." Despite this evidence of ill-proven ideas, the court awarded Alexander damages of £1000 (he had asked for £5000). Furthermore, this judgment was sustained at Appeal.

Some investigators still see the Alexander technique as a useful tool (Little, 2008), although a 2004 report concluded that the Alexander technique was "*of unknown value or ineffective and so should not be considered*" as an evidence-based treatment for lower back pain (Maher, 2004). The *Feldenkrais Method* (Moshe Feldenkrais, 1904-1984 CE) is similar to the Alexander technique in that it seeks to reduce pain and promote well-being through an awareness of body movement (Feldenkrais, 1981).

Joseph Hubertus Pilates (1883-1967 CE). Joseph Pilates developed much of his system of physical education during the 1920s. His father was a prize-winning gymnast of Greek ancestry who had emigrated to Germany, and his mother had an interest in naturopathy. Joseph was a sickly child, suffering from asthma, rickets, and rheumatic fever, but nevertheless he decided to devote his life to enhancing his personal fitness through a programme of skiing, body-building, kung-fu, yoga and gymnastics. He moved to England in 1912, and became a self-defence trainer for Scotland Yard. Despite this government service, World War I saw him interned in Lancaster Castle as an "*enemy alien*." He continued to teach wrestling and self-defence while he was imprisoned, boasting that the inmates of Lancaster Castle would emerge fitter than when they were first interned.

He believed that the 20th century lifestyle, particularly bad posture and inefficient breathing, was responsible for much ill-health, and during his internment he found time to devise a system of simple mat exercises that were intended to correct these problems. Participants were required to apply the mind to control the muscles, particularly focussing on breathing and alignment of the spine (Pilates and Miller, 1945/2003). When the war ended, Pilates returned to Germany. Here, he collaborated with Laban, but around 1925 he was under pressure to teach his system of exercises to the German army, so he opted to emigrate to the United States. Here his studios became particularly popular with U.S. dancers and stage artists.

League of Health and Beauty. During the Modern Era, many women continued to view physical activity simply as a means of enhancing their physical attractiveness. Various programmes that combined exercise with acting skills fostered this approach.. Thus, in the London of 1930, Mollie Bagot Stack founded the *Women's League of Health and Beauty.* This movement promised outward beauty from inner vitality (Cruickshank and Stack, 1937), Stack's

vision was of "*a league of women who will renew their energy in themselves and for themselves day by day*." By 1937, her organization boasted 166,000 members, and it had spread to Canada, Australia, Ireland and Hong Kong. Hitler was sufficiently impressed to establish a rather similar organization in Germany (*Werk Glaube und Schönheit*; *Belief and Beauty Society*).

Germany. A German *Medical Association for the Promotion of Physical Activity* was founded as early as 1924 (Arndt, 2012), and in this era German exercise scientists were the dominant force in Europe. During the 1930s, the German state school system became subservient to the Hitler Youth Movement (above). The Nazi view was that the body needed education as much as the mind, and the State thus had to ensure development of a healthy body with character, will, and decision. Education should be cultural rather than technical. Military training was seen as the crowning step in education.

Another facet of Nazi policy was to honour manual labour equally with "*white collar*" work; manual workers often received higher pay than their sedentary peers. Hitler had a strong belief in the importance of physical education. He wrote (Hitler, 1925/2012):

"A man of little scientific education but physically healthy, with a good, firm character, imbued with the joy of determination and will-power, is more valuable for the national community than a clever weakling"

In the state school system, physical training was increased from 2 hours per week to 2 hours per day, and performance in physical education and sports assumed an important role on report cards, with pupils being graded by fitness tests (Ungerer, 1998). Sometimes, those who failed a fitness test were expelled from their school. The standard programme included athletics, gymnastics, swimming, playing, and boxing. Boxing classes were compulsory unless a medical certificate was provided, and physical weakness was despised (Blackburn, 1985):

"*My system of education is a harsh one. Weakness must be stamped out. The world will shrink in trepidation from the youngsters, who grow up in my Ordensburgen. A violent, masterful, dauntless, cruel younger generation-that is my aim. I want them trained in every form of physical exercise. I want them to learn to conquer the fear of death by undergoing the severest ordeals."*

Following World War II, sport in East Germany became subject to a new system of state control, similar to that which had evolved in communist Russia. Participants were required to belong to the communist youth organization (the *Freie Deutsche Jugend* (*FDJ, the Free German Youth*, analogous to the Russian *Komsomol*), or to the communist workers' organization (the *Freier Deutscher Gewerkschaftsbund* , or *FDGB, the Free German Trade Union Federation*). In 1948, the highly political *Deutscher Sportausschuss* (*German Sports Committee*) was established, followed in 1952 by a *State Committee for Sport and Physical Culture*. The heavy Russian influence was further underlined by the introduction in 1950 of the BAV medal (*Bereit zur Arbeit und Verteilung, Ready for Work and Detence*), and the

construction of a *College for Physical Culture* in Leipzig (an institution that became notorious for the doping of East German athletes). Two years later, the paramilitary *Gesellschaft für Sport und Teknik (Society for Sports and Terchnology)* was created (Johnson, 2008).

In contrast, the *Deutscher Sportsbund* (*German Sports Federation*) of West Germany, established in 1950, claimed complete freedom from all political, religious, racial and military influences. Nevertheless, in 1960 the *German Olympic Association* promulgated a "*Golden Plan for Health, Sport and Recreation*," with the West German government providing a budget of $6315 M Deutsche Marks, to be spread over 15 years.

Italy. The *Academy of Physical Education* (*Accademia fascista maschile di educazione fisica or Accademia fascista della Farnesina*) was the male centre for sport and political education in fascist Italy. It combined a traditional physical education curriculum with pedagogy and political indoctrination, and from 1929 onwards, all faculty members had to be accredited members of the fascist party. The Academy was initially housed in the Military Academy, but in 1932 it moved to the *Foro Mussolini*, with the objective of training physical education teachers and those working with the *Opera Nazionale Baililla*. In 1937 the *Opera* became the *Gioventù Italiana del Littorio* (GIL), and the name of the school became the *GIL Academy*. It comprised four sections: political, military, biological-scientific and sport, and its degrees were now awarded by *Il Duce* rather than the king of Italy (Di Donato, 1985). The impressive Academy building is still standing, and now serves as the headquarters of the *Italian National Olympic Committee*.

Physical education had been included in all Italian schools since 1878, and in 1909 physical education had become compulsory at all levels of education, but instruction was often only nominal, since the facilities and equipment in most schools were extremely limited. Under Mussolini, physical education became the responsibility of the *Opera*. New playing fields were constructed and new equipment was delivered to the local *Casa di Balilla*, but if children wanted to use these facilities after school, they had to join the *Opera*. For younger children, the programme continued to emphasize play, but as the children became older, a military emphasis was introduced. In addition to exercise and team sports, there were classes in fencing, boxing and shooting, together with 20 km marches and obstacle races. Successful completion of the physical education course soon became a requirement for completing a given Academic grade (Koon, 1985).

Russia. The Russian biologist, Peter Franzevich Lesgaft (1837-1909 CE) had developed an indigenous approach to physical education, and the St. Petersburg *Institute of Physical Culture* (still a respected Russian centre of kinesiology) is named after him. In the 1870s, Lesgaft took the forward-looking step of admitting women to the *Imperial Medico-Surgical Academy*. He also became a consultant in therapeutic gymnastics, and he wrote a history of sport and an article on natural gymnastics.

Lesgaft was assigned responsibility for the physical training of military cadets, and he studied possible systems of traIining in some 13 different countries. In 1877, he authored two texts: ''*Relationship of Anatomy to Physical*

Education" and "*The Major Purpose of Physical Education in Schools*."

Prior to the 1917 revolution, most Russian schools had adopted German or Swedish calisthenics or British sports (Schneidman). In the first decade of Soviet rule, the main objective of physical education was to help the emerging state to overcome the aftermath of the civil war. Military service had become compulsory in 1918, and physical education became the responsibility of the Red Army, under a *Department of Physical Development and Sport.* The first *All Russia Congress of Workers in Physical Culture, Sport and Pre-military Training* was convened in 1919. A resolution adopted at the Congress advocated the promotion of general health, military preparedness and all round physical development within the general framework of communist educational objectives. Subsequently, there was a protracted power struggle for the control of physical education, with the *Red Army*, the *Communist Youth Organization* (*Komsomol*) and the trade unions as main protagonists.

Russian opinion was divided concerning an appropriate intensity of effort for adult workers. Proponents of "*Normal Gymnastics*" focussed upon free and corrective gymnastics, running and jumping. They argued that the workers in many industries already had adequate physical activity during their employment, and they did not need supplementary bouts of heavy exercise in the gymnasium. The rival "*Spartak*" system criticized both the rejection of previous knowledge and the restriction of exercise intensity, arguing that sports and vigorous competition were essential to optimal physical development of the labour force, although *Spartak* supporters opposed specialization in any single sport. A.A. Zikmund (1886-?) and the *Moscow Central Institute for Physical Culture* proposed a third "*Soviet*" option of "*Industrialized Calisthenics,*" This third approach was very broadly based; it included improved personal hygiene, exposure to sun, air and water, the development of motor skills applicable to industry, and participation in various types of physical activity (games, gymnastics, sport, tourism and dancing) (Schneidman).

In 1925, a resolution of the *Soviet Central Committee* recognized that physical education was an important component in the overall instructioin of the working population, serving to draw the masses into social and political activity (Schneidman, 1978). In the 1930s, the *GTO (Ready for Labour and Defence of the USSR*) programme was introduced, with badges for personal attainments in 21 skills such as running, jumping, grenade-throwing, swimming, and cross-country skiing. Norms were published for 13 of these items. Initially, three age categories were distinguished, with appropriate levels of achievement specified for each age group. A second level of attainment was introduced in 1932, and in 1934 a third level was added for children aged 13-14 and 15-16 years, respectively. As war threatened in 1939, additional military skills were added to the programme, including tests of abilty to crawl over barbed wire, a fast foot march, grenade-throwing, rope and tree climbing, the ability to carry a cartridge box, and various martial arts. In 1946, it became necessary to revise the norms downwards, because of the poor physical health of the population at the end of the war. However, the programme continued until the end of the Soviet regime, and in

the year 1976, 220 million citizens were awarded badges.

A Party Resolution of 1959 placed a new emphasis upon top-level sport. The Soviet aim became dominance in international competition, and it was hoped that the achievements of top Russian athletes would motivate the general population to greater physical activity. A further reorganization occurred in 1966, at the end of the Krushchev Era. Revised policies recognized the importance of physical activity to health, and an attempt was made to organize activities that were appropriate not only for children, but also for the middle-aged and the elderly. The new programme had modest success, and by 1975 it was estimated that 28.7% of the population between the ages of 10 and 60 years were engaging in some form of regular physical activity (Schneidman, 1978).

France. Philippe Tissié (1852-1935 CE) headed the French *League of Physical Education* in the period during and following World War I. He strongly emphasized the Swedish system of physical education in his writings, and he also saw physical education as an important component of overall intellectual development (Tissié, 1922). Tissié advocated free play from the age of 4-7 years, vigorous team games from 7 to 12 years, and sport participation from 13 to 18 years. He was himself a cyclist and a member of a gymnastics club, but as a physician and a hygienist he did not believe in the constraints implicit in high-level competition. Thus, he had frequent occasion to cross swords with de Coubertin and those involved in the Olympic movement.

Georges Hébert (1875-1975 CE) was stationed in Lorient, as physical educator to the French marines. In contrast with the Swedish approach, Hébert promoted a "*Natural Method*" of physical education (Shephard, 2013b). Like many of his contemporaries, he was concerned about the progressive degeneration of the "White Race;" he thought the problem was that too few physical demands were made upon the bodies of French citizens, and he thus proposed a return to the origins of humankind (a trend in keeping with the modern anthropological determination of ideal patterns of physical activity for the human body). Hébert's ideas were influenced in part by the movement patterns of indigenous people that he had observed while serving with the marines in Martinique, and in part by the strength, flexibility and resistance of the "*gablers*" who tended the rigging on sailing craft. He believed that athletic skill must be combined with courage and altruism, and his motto was "*Être fort pour être utile" (be strong to be useful).* Hébert was an early advocate of regular physical exercise for women, criticizing not only the fashion of corsetry but also the physical inactivity that contemporary European society imposed upon most women (Hébert, 1921). He founded a number of gymnastic colleges or palestres for women and girls, the first of these being at Deauville, in northern France.

Pierre de Coubertin (Shephard, 2013b) wrote on sport pedagogy (de Coubertin, 1922). For him, sport was synonymous with health (*le sport, c'est la santé*). Sport participation generated a "*mens fervida in corpere lacertoso" (an ardent mind in a well-trained body*).

The influence of Paté and the viewing of physical education as a tool of scientific

eugenics is noted above. In a more positive vein, Paté's Ministry published a *Manual of Physical Education* that carried the following messages linking exercise physiology, physical education and health (Direction de l'artillerie de France, 1919):

"L'éducation physique est gouvernée par les principes de la physiologie" (Physical education is governed by physiological principles)."

"*Le developpement harmonieux de la charpente... son redressement lorsqu'elle déforme...l'amélioration du fonctionnement des organes...souplesse.... force.... précision.... vitesse doivent permettre d'assurer la santé" (the harmonious development of the body frame ... its recovery when deformed ... improved functioning of the organs ... flexibility .... strength .... precision .... speed should help ensure health*.

Maurice Boigey (1877-1952 CE), professor of physiology at the *Joinville-le-Pont Physical Education Academy* further emphasized the health value of individually prescribed physical activity (Boigey, 1923):

"Montrez...ce que vaut l'exercice comme élément de santé, apprendre à le proportionner aux forces de chacun, à le doser comme une remède" (show the value of exercise as a part of health, learning how to scale it to the individual's capacity, to dose it like a medication."

However, Bolgey was rigorously opposed to competitive sport for women (see comments on the Olympics). The Joinville School was directed for many years by Paul Chailley-Bert (1890-1973 CE), a distinguished sports physician, one of the founders of the Féderation Internationale de Médecine Sportive (*FIMS)*, and ultimately its President (Williams, 1973). The institution was renamed *l'École normale supérieure d'éducation physique et sportive (ENSEP*) in 1955.

Regional *Institutes of Physical Education* were attached to French medical schools in 1927, and a teachers' training college (*L'Ecole Normale d'éducation Physique*) was established in 1933. Further changes appeared under Pierre Dezarnaulds (1879-1955 CE), Leo LaGrange (above) and the Popular Front (1936-1940); in 29 *Department*s of France a programme of 5 hours of physical education per week was instituted, to be held when possible in the open air. Unfortunately, the detailed effects of this programme upon the health and fitness of students do not seem to have been documented, although literature of the period refers to a positive effect upon academic achievement, probably mediated through a refreshment of the pupil's attention.

During the Vichy regime, an increase of physical activity was seen as contributing to the needed "*renewal*" of France, and official attitudes towards physical education thus became relatively favourable. Objectives of the *National Programme* were to recapture the desire for effort that would build a strong people, and to reactivate a spirit of national patriotism. Efforts were made to increase physical education instruction for women, and the French Air Force initiated a youth programme called *Sport à Jeunesse et Montagne;* the latter initiative encouraged boys to engage in virile outdoor pursuits at high altitudes (cutting timber, rebuilding chalets and

footpaths and helping small farmers, with occasional bouts of recreational skiing and climbing). The Germans became suspicious of the group in 1943, demanding it be disbanded, but this proceeded sufficiently slowly that many participants had sufficient time to join the *Maquis* in their mountain hide-outs. The organization has persisted since the war under the title *Centre des Loisirs pour la Jeunesse*.

Leading figures in the development of French physical education after World War II were R. Marchand (who maintained a traditional programme, (Marchand, 1945/46)) and Pierre Seurin, *President of the International Physical Education Federation*, who adopted an existensialist approach to Swedish style gymnastics (Bazoge et al., 2013; Seurin, 1949).

Britain. In Britain, patterns of physical education during the Modern Era differed widely with social class. "Public" schools continued the sports tradition of the 19th century (Shephard, 2013b), whereas State Grammar and Secondary schools emphasized gymnastics. The British army remained relatively elitist, and in 1918 it established a "*Sport Control Board*" to regulate 9 *Synopsis Sports*, 28 *Recognised Sports* and 5 *Approved Sports*. In the dark days of World War II that followed the Dunkirk evacuation, the Board remained busy publishing a substantial manual {British Army Sport Control Board 1941}. Senior officers recognized that mechanization of the army was leading to a loss of fitness in their troops, and one or two afternoons per week were thus devoted to sports participation. When attending Officer Training School, I recall being warned not to be caught off the sports field on afternoons that were allocated for Games!

I had won an Open Scholarship to a minor "Public" school early in 1940, but because of the disruptions caused by World War II, it became necessary for me to attend State Primary and Grammar schools, both of which were fairly typical of the Modern Era. At the primary School, rhythmic gymnastics were performed mainly outdoors, with shivering boys stripped to the waist for a weekly gym class even in the snows of winter. The grammar school that I attended had been built during the early 1920s. It catered to students of both sexes, from ages 11-17 years. Sex-segregated gymnastics classes were scheduled for 40 minutes twice per week in a relatively well-equipped gymnasium that boasted wall-bars, parallel bars, rope ladders, ropes, boxes and jumping horses. Also, once a week, 40 minutes was allocated for games- in the summer, cricket for the boys and tennis for the girls, and in the winter field hockey for the girls and soccer for the boys. Students returned to their homes for lunch (for many, this was a journey of 2-3 km). Most cycled or walked, although a few attempted to find space on the crowded local bus for a part of the journey. The boys also had opportunity to play "drop-in" cricket and soccer for 15-20 minutes before morning and afternoon academic classes began.

United States. With entry of the United States into World War I in 1917, hundreds of thousands of young American men were drafted into the armed forces. A personnel assessment system for the selection of subordinate officers was developed by the applied psychologist Walter Dill Scott (1869-1955 CE); it included ratings of physical

qualities (physique, bearing, neatness, voice, energy, and endurance) as well as intelligence, leadership, personal characteristics and general value to the armed forces (Ballantyne, 2002). After the war, statistics from the military dfraft were released; it appeared that one out of every three potential recruits had been judged as unfit for combat and many of the remaining recruits were highly unfit when first enlisted (Barrow and Brown, 1988 ; Wuest and Bucher, 1995).

Legislation was thus enacted to improve physical education instruction in state schools. Unfortunately, the new interest in physical fitness was soon stifled by the pleasures of the "Roaring Twenties." Priorities became eating, drinking, partying, and entertainment (Jenkins, 1997). The ensuing financial woes of the Great Depression further blocked any interest in measures to improve the physical condition of the population. Programme funding was progressively limited and eventually cut (Rice et al., 1958; Welch, 1996). During World War II, draftees thus showed even poorer levels of fitness than those who had been recruited in World War I. Nearly a half of all World War II draftees were rejected or given non-combatant roles (Rice et al., 1958).

Thomas K. Cureton (1901-1992 CE) was a noted champion of physical fitness during the inter-war years. He was himself a champion swimmer, and he also served as research director of the *YMCA Aquatic Institute*. When studying engineering at Yale in the early 1920s, he became fascinated by the physiological research that was being carried out on the Yale rowing team (they were Olympic Gold Medalists in 1924). Cureton thus decided to transfer to Springfield College, and while attending that institution he produced a monograph entitled *Physical Fitness* (published in its entirety by the *Research Quarterly* in 1941). Thereafter, Cureton moved to the *Faculty of Physical Education* at the University of Illinois (Urbana-Champaign), where he trained a multitude of graduate students during the period 1941-1969 (his classes included a number of Canadian kinesiologists, who until the mid-1960s were unable to pursue a kinesiology Ph.D. degree in Canada). Cureton sought to measure physical fitness simply, and to determine which forms of exercise were effective in improving a person's physical condition. He also proposed various simple tests of cardio-respiratory endurance, muscular strength, and flexibility (Cureton, 1947).

During the early 1950s, the *Kraus-Weber Minimum Muscular Fitness Tests* (above) were applied widely to U.S. and European schoolchildren. Both the U.S. government and the American public were deeply concerned when it became apparent that some 58% of American children had failed the standards set for at least one of the six tests (usually the measure of forward flexion). In striking contrast, only 8% of children from Italy, Austria and Switzerland had failed the same test battery (Kraus and Hirschland, 1954). Along with his associate Bonnie Prudden (1914-2011 CE), Kraus warned Americans that their children were watching too much television and getting too little exercise. The *Metropolitan Life Insurance Association* found that one of every two U.S. adults was also overweight, and a Congressional hearing noted that the U.S. needed to call up seven men in order to obtain two acceptable soldiers; three of the remaining five would be turned down because of poor physical condition (McIntosh, 1971).

At a White House luncheon in July 1955, Kraus expressed the opinion that *"the U.S. is becoming the softest nation on earth"* (Schwartz, 2005). The President showed apparent alarm, and immediately instructed Vice-President Nixon to convene a "*Conference on the Fitness of American Youth*" (Nieman, 1990). This took place in June of 1956, at the U.S. Naval Academy. The main outcome was formation of the *President's Citizens Advisory Committee on the Fitness of American Youth* (July 1956); this had the rather woolly objective of "*serving as a catalytic agent*." A further conference on the *Physical Fitness of Youth* was held at West Point Military Academy in September of 1957. It attempted to develop an appropriate action plan, and Kraus subsequently worked with President Eisenhower to establish *the President's Council on Fitness* (1965). These several initiatives stimulated health agencies such as the *American Heart Association* (AHA), the *American Medical Association* (AMA), and the *American Association for Physical Education, Recreation, and Dance* (AAPHERD) to take a closer look at the measures needed to enhance the fitness of the U.S, population.

However, Kraus soon became concerned about a limited budget and lack of any real authority for the Council. Moreover, Richard Nixon (not exactly famous for his own physical fitness) was picked as head of the Council. Shane McCarthy, a public relations expert who knew little about fitness, was appointed as the Chief Operative. Kraus's campaign also met with strong opposition from both the *American Medical Association* and gym teachers. The latter reacted vigorously to what they perceived as a criticism of their leadership. They claimed that the results of the Kraus-Weber tests were largely worthless, because fitness was not something that could be quantified. In any event, there was a need to consider the entire spectrum of fitness, including not only physical fitness, but also its "*mental, emotional social and spiritual components*" (Schwartz, 2005). Finally, both gym teachers and parents argued that (Schwartz, 2005):

"*calisthenics and gymnastics are totalitarian and the proper physical activity in a democracy is team sports. Calisthenics and gymnastics would Hitlerize youth*..."

Senator McCarthy moved swiftly to reject Kraus's proposal that school sports teams be replaced by fitness-oriented programmes.

U.S. attitudes shifted under President John F. Kennedy, who was himself a major proponent of fitness and its health-related benefits. Kennedy appointed the coach, broadcaster and former football player Bud Wilkinson (1916-1994 CE) as head of the Council and he changed its name to the *President's Council on Physical Fitness.* He urged American citizens to improve their fitness, writing in a short article entitled "*The Soft American*" (Kennedy, 1960):

"*We are under-exercised as a nation; we look instead of play; we ride instead of walk"*

His commitment to fitness can be summarized by his statement (Kennedy, 1962):

"*Physical fitness is the basis for all other forms of excellence*."

The spread of television during the early 1950s offered the potential of a new approach to mass fitness teaching. This possibility was exploited by in the U.S. by Bonnie Prudden (1914-2011 CE) and Jack LaLanne (1914-2011 CE). Bonnie Prudden was a well-known rock-climber and an associate of Hans Kraus. She established a weekly TV gymnastics programme where she demonstrated exercise routines wearing sexy, form-fitting Spandex clothing (Schwartz, 2005). She also wrote 19 popular books on physical fitness, recorded six LP exercise albums, and set up many exercise and fitness programs in schools, hospitals, camps, factories, prisons and mental institutions. Lalanne was a chiropractor and body-builder who began airing the "*Jack LaLanne Show*." This TV programme featured aerobics, water aerobics, and resistance exercise routines, the first cable-pulley machine, and machines for performing squats and leg extension exercises.

The third popular figure in the fitness culture of the1960s was the former U.S. Air Force Colonel Ken Cooper (above). He authored the popular book "*Aerobics*" (Cooper, 1968a) and served as the charismatic Director of the *Cooper Aerobics Center* in Dallas, TX. Cooper became a dominant personality on the poular lecture circuit in the early 1970s. I recall the ease with which he packed the 2200 seat Convocation Hall at the University of Toronto for a talk on aerobic fitness. He gave a strong impetus towards the prevention of disease through greater physical activity, earnestly proclaiming the doctrine (Kokkinos, 2010):

"It is easier to maintain good health through proper exercise, diet, and emotional balance than it is to regain it once it is lost"

Canada. During the inter-war years, physical education and the promotion of physical activity in Canada continued along the course set during the Edwardian Era, with English Canada working under the militaristic provisions of the Strathcona Trust, and Quebec following the lead of Henri Scott. The last Strathcona syllabus, published in 1933, contained a section on play and games, but its general orientation remained militaristic and discipline-oriented. The *Dominion-Provincial Youth Training Act* was passed in 1939. This legislation included funding to support various Provincial physical recreation projects. The *National Physical Fitness Act* became law in 1943. Its objective was to promote fitness through a variety of programmes linked to physical education, sports and athletics. The Act was repealed in 1954, and for a short period the Federal Government was absolved of any responsibility for either sport or physical fitness. Bill C-131 (*An act to encourage fitness and amateur sport*" was enacted in 1961; this established a *Federal Directorate of Fitness & Amateur Sport*.

The *Sons of Freedom*, a Russian Doukhobor sect whose members had emigrated to British Columbia, were particularly opposed to the militaristic emphasis of Canadian physical education. Because of their religious beliefs, the Doukhobors refused to send their children to state schools. In 1953, this led the B.C. government of W.A.C. Bennett to enter the immigrants' farms and forcibly remove all children over the age of 8 years of age. The children were interned behind a 3-metre high chain-link fence at a residential school in New Denver, BC.

The Doukhobor parents responded (despite their supposed pacifist principles) by burning buildings, bombing state schools and parading naked through their villages in the BC interior (Hawthorn, 1980).

The rigid martial format of much Canadian physical education was also vigorously opposed by Arthur Lamb (below) and by a number of female physical educators, including Ethel Mary Cartwright (physical education director at McGill and subsequently at the University of Saskatchewan) and teachers at the *Margaret Eaton School* in Toronto (below), All of these voices argued the need to train physical education specialists through Universities and Normal schools, rather than resorting to rote instruction of school classes by retired army NCOs. They also pleaded strongly for an emhasis upon play when instructing young children.

The Montreal Gazette announced the formation of a *National Fitness League* in 1938. This was to be directed by Veronica Whalen, Director of Montreal's west-end YMCA. The mandate of the League was to plan a fitness drive across the Nation. However, this organization seems to have disappeared with the onset of World War II.

The Margaret Eaton School. The *Margaret Eaton School of Literature and Expression* was founded by Emma Scott Raff in 1906. It initially received strong support from Margaret, wife of Timothy Eaton, the Toronto Departmental Store owner. Although the School focused upon drama, Raff also valued physical education as a necessary and important component to any study of literature, languages, and dramatic arts (Jackson, 1953). The *School of Literature and Expression* closed in 1926, and the main focus of the Margaret Eaton School then shifted to the physical education of women and teacher training. Diplomas in physical education were granted after students had followed courses in such subjects as anatomy, physiology, hygiene, first aid and sports instruction.

In 1941, the Margaret Eaton School formally merged with the University of Toronto, to become a part of the *School of Physical and Health Education*. However, it remained very much a female enclave, and when I reached Toronto in 1964, I was invited to take tea with the Director on the strict condition that my wife accompany me as a chaperone!

University Programmes. During the 1920s and the 1930s, some Canadian universities required all students to complete a minimum number of hours of physical education or athletics as a part of their university instruction. University degree programmes in physical education were finally established during the 1940s: Toronto (1940), McGill (1945), the University of British Columbia and Queens (1946) and Western Ontario (1947). The *National Physical Fitness Act*, adopted in 1943 but repealed in 1954, was an important factor in stimulating the emergence of university programmes. This legislation offered (contingent on the voting of matching funds) $250,000 to each Canadian Province for the development of physical education programmes (West, 1973). By 1960, Canada boasted 12 Degree-granting *Schools of Physical Education & Health* (Harris, 1967). There was growing recognition of the subject as an appropriate University discipline (Van Vliet, 1965; Cosentino and Howell, 1971; Guay, 1981), and in 1968 the

Organization of Physical Education Administrators was formed. This subsequently became the *Ontario Council of Deans and Directors of Physical Education*. A Canada-wide grouping of Deans and Directors held its first meeting in Ottawa in 1971.

The emphasis of physical education programmes shifted progressively over the years, and this issue was discussed extensively at seminars organized by the Council of Deans and Directors. At a 1966 seminar, John Powell of Guelph acknowledged that "*science should be at the core,"* but he still envisaged teacher preparation as the main responsibility of the profession (Harrigan, 2004). In contrast, Norm Ashton of the University of Waterloo suggested to the same gathering that the future of the discipline would be found in kinesiology. Another hot topic at meetings of the group was whether athletic departments should be included or excluded from *Faculties of Physical Education.* The issue of whether to allow admission of students on athletic scholarships proved even more divisive (Harrigan, 2001), as did the decision of the University of Waterloo to drop activity practica from their degree requirements.

Robert Tait McKenzie (1867-1938 CE). McKenzie was born in Almonte, 46 km south of Ottawa, ON, to Scottish immigrant parents. James Naismith, the inventor of basketball, was his friend as a child, but McKenzie did not consider himself any sort of an athlete (McGill, 1980):

"Looking back with an eye of memory I see a rather delicate child, sensitive at being called pale-faced, a roamer of the woods and fields."

This self-perception changed during McKenzie's studies at McGill University. Here, he became involved in acrobatics and gymnastics, set a high jump record, ran hurdles, boxed, played football, and joined the tug-of-war team. Nevertheless, he continued to favour activities that required skill and coordination, rather than strength or stamina. After completion of his medical training, he became personal family physician to the then Governor General of Canada, the Marquis of Aberdeen. During the 1890s, he asked McGill University to establish a *School of Physical Education*. The university governors determined that this would be too costly, but in 1898 McKenzie was appointed as *Medical Director of Physical Training*, with responsibility for the physical examination of incoming students.

In 1905, he accepted a post as *Director of Physical Education* at the newly formed University of Pennsylvania; this gave him the opportunity to develop, test and implement his theories on health and athletics, an opportunity that sadly had been lacking in Canada. While in Philadelphia, McKenzie worked closely with Lord Baden Powell, founder of the scouting movement. During World War I, McKenzie encountered some bureaucratic hurdles in his attempts to join the Canadian Armed Forces, and he thus enlisted in the *British Royal Army Medical Corps*. Here, he assumed responsibility for the physical training of recruits, developed physiotherapy programmes and designed prosthetics for those who were injured.

After the war, McKenzie resumed teaching at the University of Pennsylvania until his retirement in 1930, when he purchased the historic Almonte mill, near

Ottawa, ON. He named this building the *Mill of Kintail*. It served as his summer home, and it provided an excellent backdrop for the display of his sculptures. These are very realistic, and reflect a deep understanding of both medicine and physical education. One of his earliest and best known sculptural efforts was a series of masks entitled *"Violent Effort, Breathlessness, Fatigue and Exhaustion."* Other sculptures have received awards in the artistic component of the Olympic Games.

Arthur Stanley Lamb (1886-1958 CE). Lamb was born in Ballarat, Australia, but moved to North America as a young man. He taught at the Vancouver YMCA in 1907, and graduated with a B.P.E. from Springfield College in 1912. He then moved to McGill University, serving as Instructor in the newly founded *Department of Physical Education* from 1912-1916. After receiving M.D. and C.M. (Master of Surgery) degrees from McGill university, Lamb served with the *Canadian Army Medical Corps* in France and Belgium. In 1920, he was appointed professor of physical education and director of the *Department of Physical Education* at McGill. He was director of the Canadian Olympic teams in 1924 and 1928. He also founded the *Canadian Physical Education Association (CPEA)* in 1933 and served as its president until 1939, when he was succeeded by Florence A. Summers. The CPEA became in turn the *Canadian Association of Physical Health Education and Recreation* in 1948, and *Dance* was added to this title in 1994. It is now known as *PHE Canada*.

Tim Buck (1893-1971 CE). Buck was secretary of the *Canadian Communist Party* during the Great Depression. One of his activities was organizing youth who had been sent to labour camps for the unemployed. Buck recruited them into the *Workers Sports Association (WSA*). This group flourished between 1924 and 1935. In keeping with its communist ideology, the WSA argued that the nation's elite was using employer-sponsored leisure programmes as a means of social control. However, it seems fair comment that the WSA was even more guilty of exploiting sport as a means of political indoctrination (Kidd, 1996; McQuarrie, 2010). Buck also urged the unemployed to participate in a trek, marching from Vancouver to Ottawa to protest the lack of work. However, after they had walked some 1600 km, the group of about 1600 marchers was forcibly halted by a bloody massacre in Regina on Dominion Day 1935.

Buck and his associates suggested that totalitarianism was influencing both education and youth movements in Canada. They campaigned vigorously against cadet training in schools, and underlined the fact that despite documented excesses of the Nazi regime, Baden-Powell still wanted the British scouting movement to cooperate with the Hitler *Jugend* (Niergarth, 2005). In Quebec, Buck alleged that a conservatively-oriented newspaper (*Le Devoir*) was worked with the Catholic hierarchy to promote Mussolini's ideology. Certainly, many articles and editorials appeared in *Le Devoir* between 1932 and 1938 promoting *Les Jeunes Canada*, a Right Wing and *Separatiste* youth organization (Niergarth, 2005).

Lloyd Percival (1913-1974 CE). Percival was an equally controversial figure in Canadian fitness and sport circles during the Modern Era. Percival

himself had been a tennis champion, a bantam-weight boxer and a member of the Canadian cricket team that toured England in 1936. He also had coached track and field and ice-hockey. In 1941, he initiated the *CBC Radio Sports College*. At its peak, this programme boasted some 750.000 registrants. However, Percival failed to lead by personal example. He was a heavy smoker, and preached the message "*become fit so that you can enjoy your vices more*."

In the 1960s, he opened a "*Fitness Institute*" at Toronto's Inn-on-the-Park. With the support of some wealthy business partners, this sports facility later moved to luxurious quarters on the northern outskirts of Toronto. Here, he hoped to gain large contracts for the coaching of Team Canada. The anticipated grants did not materialize, but his *Institute* remained a fitness resource for the wealthy, somewhat analogous to the Cooper Center in Dallas, TX.

National and international competition

In this section of the review, we note several landmarks in Canadian Sport during the Modern Era, commenting specifically on the progressive development of international athletic records and the struggle for female participation in major competition. In terms of the development and influence of the Olympic Games, it is interesting to note that the 1928 competitions were still of insufficient importance to draw Queen Wilhelmina back to Amsterdam from a holiday in Norway, although 1928 did see the first commercial sponsor of the Games (Coca Cola). However, the Olympics underwent a rapid politicization over the following 8 years, with Hitler seeing the celebration as an important opportunity to vaunt the Nazi regime. This was also the period when the *Workers' Olympiad* was viewed by some Communists and Socialists as a viable potential alternative to the more elitist Olympic movement.

Landmarks in Canadian sport. The idea of holding a Canada Games was first broached in 1924, although the concept did not become a reality until Canada's centennial, in 1967, when 1880 athletes met in Quebec City for the first *Canadian Winter Games*. Canada has subsequently seen an alternation of Summer and Winter events, each organized on a 4-year cycle. The participants in the Canada Games are often relatively young, and these competitions thus serve as a useful stepping stone in developing the talents of those who may go on to win international acclaim. The first example of such a progression is the figure-skater Toller Cranston, who competed at Quebec in 1967. The introduction of Annual Provincial Games such as the *Jeux de Québec* (initiated at Rivière du Loup, in 1971) has provided a further opportunity for young athletes to gain competitive experience.

The *Pan-American Games* began in Buenos Aires in 1951, also on a four-year cycle, with Winnipeg, Manitoba, serving as the host city in 1967.

The *British Empire Games* began with a meet held at Hamilton, ON, in 1930. This event was renamed the *Commonwealth Games* in 1952, and it has continued to complete the four-year cycle of events for Canadian competitors, with Vancouver serving as the host city in 1954.

The Ontario legislature enacted a 2% tax on the gross receipts of professional sports events in 1927. The money thus generated was intended to promote

sports that otherwise did not generate any revenue (Schrodt et al., 1980).

The *Lord's Day (Ontario) Act* of 1950 for the first time allowed commercial sport to take place on Sundays, if a municipality so desired. This was the first step towards dismantling English Canada's earlier "*Blue*" laws.

Canada's *Sports Hall of Fame* was inaugurated at the Canadian National Exhibition Grounds (Toronto) in 1954. A separate *Hockey Hall of Fame* was established in Kingston, ON, in 1943. It also moved to the Canadian National Exhibition grounds in 1961, but in 1993 it found a more elegant permanent home in a historic former Bank building at Front St. in downtown Toronto.

Progression of athletic records. Performance in most athletic events showed a steady progression over the Modern Era (Jokl and Jokl, 1968). Contributing factors were a combination of more effective training, begun at an earlier age, improved equipment, and a more complete search of national populations for individuals who were particularly suited to a given event. Restriction of a child to a single sport from an early age certainly enhances his or her performance, but it seems most undesirable from the viewpoint of the overall health, fitness and social development of the individual concerned.

One striking new athletic record was the completion of a "four-minute mile" by Sir Roger Bannister (born 1929), on May 6th, 1954. Bannister achieved this time during an Athletic meet when the *British Amateur Athletic Association* was pitted against Oxford University (Bannister, 2004). Bannister's achievement was repeated two months later, when both he and John Landy ran a mile in less than 4 minutes at the *British Empire and Commonwealth Games* in Vancouver, BC. A statue of the two runners now graces the entrance way to the *Pacific National Exhibition*. Bannister was a contemporary during my medical studies in London, and he told me that although he had engaged in some sport while he was at school, this was only so that the other students would give him the freedom to study for a coveted place in a London medical school. He began running more seriously while he was at Oxford, at the age of 17, and he became able to run a mile in 4 minutes, 24.6 seconds, after a period when he had trained for half an hour, three times a week! Much of the training for the four-minute mile was undertaken on a treadmill in the physiology Laboratory at the University of Oxford. Bannister later became chair of the *British Sports Council*, and he oversaw the building of many local sports centres and facilities in Great Britain.

The secular trend to an improvement of athletic performance showed a dramatic surge in some events, coincident with the introduction of new technology. For example, the height attained in pole-vaulting increased from 4.57 m in 1960 to 5.03 m in 1964 and 5.50 m in 1976, coincident with introduction of the fibre-glass pole. Alterations in the design of skis and racing bicycles, also, have contributed substantially to enhanced performance in these disciplines (Shephard, 1978a). Although new athletic records were created by such innovations, sport technology has not always had a positive impact upon population health. Often, the latest equipment has been extremely expensive, and the participation of ordinary people has been discouraged because they have believed that they would not enjoy a sport if they could not

afford to purchase the latest equipment for themselves (Shephard, 1986a). I cycled for some forty years in Toronto and Squamish, using a $60 CCM bicycle, finally selling it to our local cycle shop for $50. However, I was horrified to see that our local retailer is currently selling many of his bicycles for prices of over $4000.

Female participation. At the beginning of the Modern Era, there was a strong prejudice against female participation in any type of top-level competition. Maurice Boigey, of the *Jonville-le-pont School of Physical Education* in France appeared to argue against this dogma (Boigey, 1917):

"une femme n'a pas moins besoin d'activité qu'un homme .... elle doit être en bonne santé et vigoureuse" (a woman doesn't need activity any less than does a man...she must be vigorous and in good health"

but he quickly went on to clarify his thinking:

"la femme n'est point construite pour lutter mais pour procréer" "En aucun cas nous n'oserons soutenir l'utilité des compétitions sportives pour les femmes ; pas de courses de fond, pas de saut en longueur en hauteur ni en profondeur en vue de records, pas de lutte ni de boxe pas même d'équitation pour les femmes (a woman is not built to struggle, but rather to procreate,…In no event will we dare to maintain the usefulness of competitive sport for women: no distance events, no long-jumps or high-jumps, no wrestling or boxing, not even equitation)"

At the Paris Olympics of 1900, women were officially only allowed to participate in lawn tennis, croquet, golf and equestrian events, although at least one woman seems to have sneaked onto a sailing team. Swimmers were admitted in 1910, but there were no competitors from America, because all female contestants from the U.S. were required to wear long skirts. The IOC finally bowed to pressure from the *International Amateur Athletic Federation* in 1926, and female athletic and gymnastic competitors were seen at Amsterdam (1928). However, a number of women runners collapsed in the 800 m track event, and as a result female entries for races longer than 200 m were prohibited until 1960.

Women's shooting events were added to the Olympics in 1984, and weight-lifting in 2000. However, some Arab countries (Saudi Arabia, Qatar and Brunei) prohibited female participation in international sport until the London Games of 2012, when (under much international pressure) they permitted limited female involvement, with contestants wearing a "*sports hijab*."

In the Winter Games, women were restricted to figure-skating until 1924, when skiing was added. Despite strong pressure from Human Rights organizations, ski-jumping and Nordic combined events still remained a male prerogative in the Whistler Games of 2010, although it seems that this anomaly will be corrected in Sochi (2014).

Politicization. Before World War I, there had been a sharp conflict between the German *Turnerschaft* and the Olympic movement. More than a million *Turners* were dedicated to the idea of a free and united German Fatherland, and the Olympic idea of sport for sport's sake was seen as an example of imported and unwanted British hedonism. Until 1906,

the *Turners* refused to participate in the Olympic Games. However, the *German Olympic Movement* progressed steadily despite criticism from the gymnasts. This particular rift was healed following World War I, but several subsequent Olympic Games have had strong political overtones.

The issue of sabbatarianism has been noted in an earlier article in this series (Shephard, 2013c). The problem of exercising on the "Lord's Day" raised its head again during the Paris Olympic Games of 1924, when Eric Liddell, an outstanding British sprinter, refused to participate in the 100 m heats because they were scheduled for a Sunday. The drama was immortalized in the film "*Chariots of Fire*" (1981). Fortunately, a Jewish compatriot of Liddell, Harold Abrahams, was able to win the 100 m event for Britain, and since the 400 m heats were held on a weekday, Liddell was himself able to win that event. Efforts to prohibit Sunday sport remained strong both in Britain and in Canada through the 1950s, and it was not until 1960 that the British Football Association repealed Rule 25:

"Matches shall not be played on Sundays within the jurisdiction of this Association."

It still remained illegal to charge spectators for admission to Sunday games in Britain, and in 1961 the *Lord's Day Observance Society* brought an action against a soccer team that played a Sunday benefit match in aid of children with spastic conditions. The issue was discussed extensively by the *Wolfenden Committee* on the benefits of sport for working class children, and in an off-shoot report (Departmental Committee on Sunday Observance, 1964) the Committee made it plain that they could not:

"join forces with those who wished to impose their own interpretation of keeping the Lord's Day holy"

Nevertheless, the *Wolfenden Committee* did advance four restrictive principles: (1) it was wrong to take or make money from sport on Sundays, (2) sports events should not conflict with Sunday morning worship, (3) those who were unwilling to participate in Sunday events should not be excluded from weekday events, and (4) Sunday games should not restrict the Sunday religious observance of others because of the need to prepare grounds and facilities.

A much more blatant example of the politicization of sport was seen with the Berlin Games of 1936. The choice of host city had been approved in 1931, 2 years before the Nazis came to power. However, Hitler was determined to make the 1936 event much more spectacular than the preceding Games, which had been held in Los Angeles. The Führer authorized the construction of a 100,000-seat track and field stadium, six gymnasia, and many smaller arenas. He also installed a closed-circuit television and radio network that reached 41 countries, and in a more sinister fashion he planned that the Games should highlight his doctrine of Aryan racial supremacy. After nomination as Chancellor (1933), Hitler had stripped "*Non-Aryan*" German athletes such as the boxer Erich Seelig of their titles, and he proposed to exclude "Blacks," "Jews" and those of Roma ancestry from attending the Olympic Games. Hans von Tschammer und Osten, the *Reichssportführer*, saw sport as (Bobrick, 2012):

"*the way to weed out the weak, Jewish and other undesirables*."

This overt racism quickly provoked a search for an alternative venue for the Olympic Games. Barcelona had previously been a candidate city, but de Coubertin had urged against this because he feared the rising influence of Spanish Republicans. The *Generality of Catalonia* issued invitations for a *Popular Olympics*, with the opening ceremony set for July 19th, 1936. Six thousand athletes from 22 countries registered for this rival event, including exiles from Germany and Italy. Most were associated with *Workers' Sports Movements*, and very few were supported by their National Olympic Organizations. The hosting of the Barcelona event was eventually foiled by the outbreak of civil war in Spain.

The *Fédération ouvrière Suisse de gymnastique et du sport* brought particularly strong pressure to bear against the Berlin Games, and initially the Swiss government had refused to provide financial support to athletes who wished to travel to Berlin; 300 Swiss contestants had opted for the Barcelona Games. In the Netherlands, the Anti-Facist group *De Olympiade Onder Dictatuur (DOOD, The Olympics without Dictatorship)* also urged a boycott of Berlin, and similar pressure was felt in France after the left-wing political victory of 1936. However, in response to these various pressures, Hitler reversed his racist policies for the duration of the Games. He added a token woman with a Jewish father (Helene Mayer) to the German team, and he ordered the temporary removal of "*Jews not wanted*" signs from central Berlin. In the end, Berlin welcomed a record number of participants from most countries around the world, with the exception of the Soviet Union and Spain, which continued to boycott the Nazi Games (Mandell, 1987). Much to Hitler's chagrin, Jesse Owens (1913-1980 CE), a U.S. Negro track and field star was the hero of the Games, winning four gold medals (a performance unequalled until the triumph of Carl Lewis in 1984). The *Führer* nearly exploded when it was suggested that he should be photographed standing together with Owens (Mandell, 1987). Olympic officials insisted that Hitler congratulate all winners or none, so Hitler accepted the second option, merely holding a private ceremony for German athletes away from the stadium. The German architect Albert Speer reported that Hitler was (Speer, 1975):

"highly annoyed by the series of triumphs by the marvellous colored American runner, Jesse Owens. People whose antecedents came from the jungle were primitive, Hitler said with a shrug; their physiques were stronger than those of civilized whites and hence should be excluded from future games."

Nevertheless, it should not be forgotten that Jesse Owens faced less segregation in Berlin than he did as a "black" person living in the United States during the 1930s. The only two Jewish athletes on the U.S. team, Sam Stoller and Marty Glickman, were mysteriously pulled from the 4 x 100 m relay on the day of competition, leading to accusations of Anti-Semitism within the U.S. Olympic Committee.

During the 1950s, Soviet-Bloc countries saw the Olympic Games as an opportunity to showcase the advantages of the communist lifestyle, and they began

to pour large amounts of money into the selection and training of athletes. The Soviet Union quickly came to dominate the Games in terms of medal-counts. The financial resources that were made available to some communist teams called into question the whole Olympic concept of amateurism. By 1957, all sports organizations in East Germany were funded by the State, with the exception of clubs for the police (*Dynamo*) and the Army (*Forwärts*), where at least a pretense of amateurism remained (Johnson, 2008). In Britain, there was heated discussion of Government funding to cover the travel expenses of British athletes who were attending the Melbourne Games (1956). At a dinner intended to inaugurate a fund for this purpose, the guest of honour (the Duke of Edinburgh) stated in typical forthright fashion:

"The team we want to send should be composed of amateurs and not temporary civil servants"

The rigid distinction between amateur and professional athletes continued in Britain through the 1960s. In 1962, direct aid to British athletes totalled no more than £670,000, and the *Wolfenden Committee* vigorously rejected the idea of establishing a *Ministry of Sport*. One major reason for a continued rejection of professionalism was that most of the amateurs had been educated at "Public" schools, and they were reluctant to mix socially with those who had been educated in the state school system. One poignant example was the Rt. Rev. C.M. Chavasse, Bishop of Rochester. For a short period during his youth, he had played for a (professional) Rugby League club and for the rest of his life, the Rugby Union barred Chavasse from helping any of their clubs, even in an administrative capacity (McIntosh, 1971). The IOC was also categorical in its rejection of professionals. In its *Rule 26*, promulgated in 1958, it stated:

"An amateur is one who participates and always has participated in sport solely for pleasure and for the physical and mental benefits he derives therefrom, and to whom participation in sport is nothing more than recreation without material gain of any kind, direct or indirect."

Many Olympic Games have faced boycotts by various groupings of nations. We may note the Suez crisis (1956, with the withdrawal of Egypt, Iraq and Lebanon), the Russian invasion of Hungary (1956, with withdrawal of the Netherlands, Spain and Switzerland), the inclusion of "Formosan" competitors (1956, with withdrawal of the People's Republic of China), protests against Apartheid (South Africa banned from competitions between 1964 and 1992), a New Zealand Rugby tour of South Africa (1976, with withdrawal of 22 African nations), the Soviet invasion of Afghanistan (1980, with withdrawal of U.S.A. from the Moscow Games), the revenge for the U.S. boycott at Los Angeles in 1984 (the USSR and 14 of its allies), and the Seoul Olympics (1988, with withdrawal of North Korea). The most prolonged Olympic ban was for athletes from the Apartheid regime in South Africa. The International Olympic Committee cancelled its invitation to South Africa to the 1964 Summer Olympics when their Interior Minister (Jan de Klerk) insisted the team would not be racially integrated (Booth, 1998). In 1968, the IOC talked of readmitting

South Africa after assurances that its team would be multi-racial, but this was forestalled by a threatened boycott from African nations. South Africa was formally expelled from the IOC in 1970, and was not readmitted until 1991. In 1962, the IOC also barred all NATO countries from hosting the Games until they would agree to the admission of East Germans (McIntosh, 1971). Bruce Kidd, a former Dean of the *Faculty of Physical Education & Health* in Toronto, was active in organizing exclusion of athletes from Apartheid South Africa, and it seems likely that his action contributed, at least in small measure, to the eventual transfer of power to the *African National Congress*.

Workers' Olympiads. The *Socialist Workers' Sport International (German: Sozialistische Arbeiter Sport Internationale, SASI*) was a sports organization, based in Lucerne (Kidd, 1996; Wheeler, 1978). It was founded in 1920, and consisted of six National federations. It claimed a combined membership of about one million athletes. Its primary activity was the organizing of the *Workers Olympiads*, portrayed as a socialist alternative to the 'bourgeois' Olympics. A single red flag was displayed at the *Workers' Olympiads*, in contrast to the myriad of national flags seen at the Olympics.

The first *Workers' Olympiad* was held in Frankfurt-am-Main, Germany, in 1925, with around 150,000 spectators. A world record was broken in the 100 m women's relay race. A winter event was also held in Schreiberhau, earlier in the same year. The second *Workers' Olympiad* was in Vienna, Austria (1931). It attracted some 80,000 athletes and 250,000 spectators (incidentally, larger totals than those seen at the 1932 Los Angeles Olympics). The corresponding winter event at Mürzzuschlag, Austria, also outdrew the 1932 Lake Placid Olympics.

A third *Workers' Olympiad* was held in Antwerp, Belgium, in 1937, but a gathering projected for Helsinki, Finland, in 1943 was abandoned because of the outbreak of World War II.

Maccabiah Games. The Maccabiah Games are an event open to every Israeli citizen and every Jew of the diaspora, with three categories (open, junior and masters). The first such Games were held in 1932, to mark the 1800th anniversary of the *Bar Kochba* revolt. The event has been held in Israel every four years since 1957, and currently attracts some 8000 participants from around the world.

The Paralympic Games and other events for those with disability. Special athletic events for the deaf have quite a long history, with a *World Games for the Deaf* being hosted in Paris in 1924. With the exception of 10-year hiatus associated with World War II, the *Games for the Deaf* have been held on a quadrennial basis, one year following Olympic competitions (Ammons, 1986). A quadrennial *Winter Games for the Deaf* saw its beginnings in Austria in 1949, and a *Pan-American Games for the Deaf* was initiated in 1958 (Shephard, 1990).

The concept of wheelchair sports took shape immediately following World War II, when the German-born Ludwig Guttman (1899-1980 CE), then director of the *Stoke Mandeville Rehabilitation Centre* in England, argued that competitive sport could play a vital role in countering the anxiety, self-pity, lack of self-confidence and antisocial behaviour of many military veterans with paraplegia and quadriplegia (Guttman, 1973). The first

formal *Wheelchair Games* were held at Stoke Mandeville in 1948, with 14 male and 2 female participants; there were competitions in archery, table tennis, bowling, punch-darts and snooker. These initiatives were quickly followed by the addition of more vigorous sports, including polo, badminton and basketball. The first *International Paralympic Games* (Rome, 1960) attracted 400 competitors, and 390 competed in Tokyo (1964). However, a *Paralympic Games* did not follow the able-bodied events in Mexico City in 1968 because of fears that the high altitude of the stadium would place an excessive stress on those who were disabled. In that year, the Paralympic competitions thus took place in Tel Aviv (Shephard, 1990; Steadman and Walsh, 1986). The *Winter Paralympics* began with an event at Örnsköldsvik, Sweden, in 1976.

Provision for the mentally retarded began in 1963, with the day camps organized by Eunice Kennedy Shriver (1921-2009 CE). These camps offered informal programmes of sport and physical activities (Shriver, 1983). Five years later, the Kennedy Foundation held the first *International Special Olympics* in Chicago. The *Winter Special Olympics* was inaugurated at Steamboat Springs, CO, in 1977. The first specific games for those with cerebral palsy was hosted by France in 1968 (Jones, 1984). Winter sports for amputees were brought to the United States from Germany and Austria in 1967, with 50 competitors at Winter Park, CO (Bennedik, 1985). However, amputee and blind athletes were not admitted to the Summer Games until Toronto (1976)(Buell, 1979). A Games for "*Les Autres*" (those with other forms of disability) was introduced by the *International Sports Organisation for the Diasabled (ISOD)* in 1976 (Lindstrom, 1984).

Doping

From the viewpoint of health and fitness, one unfortunate concomitant of top-level competition has been the trend for a proportion of competitors to enhance their performance by the administration of stimulants, depressants, and other drugs and to engage in various other procedures dangerous to health. The practice of doping has a long history, although international athletic governing bodies such as the IOC only began to implement serious measures to control such abuse in the mid 1960s. Still, it seems that anti-doping agencies remain several moves behind athletes who are determined to seek an unfair advantage over their fellow competitors.

Stimulants A number of early long-distance competitors are believed to have taken cocaine and strychnine in an effort to postpone fatigue and increase their endurance. This problem was particularly prevalent among long distance cyclists. The 1997 *International Olympic Committee* study on the *Historical Evolution of Doping Phenomenon* reported (apparently incorrectly) that Arthur Linton, an English cyclist with a dubious manager (Choppy Warburton, no relation of Darren!) had died in 1886, following a race from Bordeaux to Paris, where he had consumed a mixture of cocaine, strychnine and caffeine. The concoctions supplied by Choppy had supposedly killed 3 athletes, and Warburton was eventually banned from all further cycling competitions. One track cyclist of this era commented that he had (Woodland, 1980):

"developed such a tolerance to the drug (strychnine*) that he took doses large enough to kill smaller men*"

During the Olympic marathon race of 1904, the efforts of the eventual winner, Thomas Hicks began to flag. His coach thus pulled out a hypodermic syringe (Pariente and Lagorce, 2004):

"I therefore decided to inject him with a milligram of sulphate of strychnine and to make him drink a large glass brimming with brandy. He set off again as best he could [but] he needed another injection four miles from the end to give him a semblance of speed and to get him to the finish."

In this era, far from being banned, strychnine was considered essential to maximal endurance performance. The menace of doping to health and fair competition had yet to be appreciated. After this race, the official report on the event noted (de Mondenard, 2000):

"The marathon has shown from a medical point of view how drugs can be very useful to athletes in long-distance races"

The abuse of strychnine continued intermittently until the introduction of formal testing. Thus, one of the contestants at the Melbourne Olympics (1956) showed spasms that were thought to be typical of strychnine poisoning, and despite the introduction of a ban on drugs in 1965, two of 139 contestants in the World Cycling Championships of 1966 tested positive for strychnine.

Beginning in the 1930s, amphetamines replaced strychnine as the stimulant of choice for endurance performers. According to the *Council of Europe,* it was used by some competitors during the Berlin Olympics (1936) (Council oif Europe, 1964). In November 1942, the Italian cyclist Fausto Coppi took "seven packets of amphetamine" in an attempt to beat the world one-hour track record (Brera, 1995). At the winter Olympics in Oslo (1952), several speed-skaters needed medical attention, and ampoules of amphetamine were found in their quarters (Kremeneik et al., 2006). During the Rome Olympics of 1960, a Danish cyclist (Knud Enemark Jensen) collapsed during the 100 km team trial, fatally fracturing his skull. The temperature was 34° C, and the official diagnosis was heat stroke, a verdict that was energetically sustained by a Danish sport historian (Møller, 2010). However, his trainer initially admitted (but later denied) that Jensen had taken the peripheral vasodilator *Ronicol* (nicotinyl alcohol tartrate). Moreover, an autopsy revealed traces of several amphetamines in his blood, and two of Jensen's team-mates became gravely ill, although they later recovered in hospital.

The incidents at the Rome Olympics triggered a call for more effective measures against doping. Nevertheless, abuse continued. Three women's swim teams were accused of using amphetamines in the Olympic trials of 1961 (Kremeneik et al., 2006). Two French contestants (André Bayssière and Charly Grosskost) admitted taking amphetamines during the *Tour de l'Avenir* of 1965, and the same year three contestants in the British "milk race" were disqualified because urine testing disclosed traces of amphetamines (Woodland, 1980). At the *World Cycling Championships* in Holland (1967), 11 of 139 competitors were still using

amphetamine or ephedrine, and at the *Pan-American Games* in Winnipeg the same year, amphetamines were found in the urine of 8/57 cyclists (Shephard, 1978a). The British contestant Tom Simpson died when ascending Mount Ventoux, during the 1967 *Tour de France*, and this incident was blamed on ingesting a combination of amphetamines and alcohol under hot conditions (Fotheringham, 2002). A major league Greek soccer player also died in 1973. One British physiologist concluded (Mottram, 1996):

"there are numerous examples of fatalities arising from the use of amphetamines by cyclists."

Other stimulants discovered during drug testing include *reactivan* (fencanamine), detected in the Belgian cyclist Eddy Merckx during the 1969 *Giro d'Italia*, and *coramine* (nikethamide), found in the Dutch cyclist Aad den Hoek at the Munich Olympics (1972).

Alcohol. At the 1920 Olympics in Antwerp, an American 100-m contestant drank sherry and raw eggs before his event, and nevertheless he was awarded a Gold Medal (Eichner, 1997), but at the Berlin Olympics of 1936, an American swimmer (Eleanor Holm) was disqualified for acute alcoholism (Prendergast et al., 2003). The usual reason for athletes to take alcohol and other depressants such as barbiturates, morphine and heroin has been to suppress hand tremor during pistol shooting events. In the Mexico City Olympics of 1968, the Swedish pentathlete Hans-Grunner Liljenwall was disqualified for drinking two beers immediately before competition (Shephard, 1978a).

Varidase. During the 1960 Olympics, boxing contestants reportedly used *varidase*, a mixture of streptokinase and streptodornase (Rutter et al., 2000) in an attempt to reduce bruising and to speed the subsequent healing of injuries (McIntosh, 1971). The medication has now been withdrawn from pharmacies, and it is unclear if it conferred any benefits relative to the use of simpler preparations such as zinc oxide.

***Steroids*.** Adolf Burenandt, a Marburg chemist, succeeded in isolating androstenone from urine in 1931, and in 1935 he received a Nobel prize for synthesizing testosterone. There was mention of the use of testosterone proprionate in a 1938 body-building magazine (Hoberman and Yesalis, 1995), and there were rumours that some German soldiers had received injections of testosterone during World War II in an attempt to increase their aggressiveness (Lenehan, 2003). The Soviet Olympic team first used anabolic steroids to increase the strength and power of their weight-lifting competitors in the 1950s. The practice soon spread to the U.S., with the development of a variant with lesser androgenic effects (methandrostenolone) and athletes in various power sports became involved in this practice (Fair, 1993). The weight of shot-putters increased by 14% between 1956 and 1972, and some physicians argued that because steroid use was so prevalent, its supervised use should be legalized. The situation was highly dangerous, since some athletes were giving themselves up to 20 times the therapeutic dose of steroids for long periods (Wade, 1972).

The Canadian shot-putter Dave Steen admitted to taking a course of 25 *Danabol* tablets in preparation for his Gold Medal performance at the *Commonwealth Games* in Kingston (1966), and many other strength athletes have made similar admissions.

When the Berlin Wall fell, details of the East German government's systematic programme of administering steroids and other drugs to young athletes was exposed. It yielded a crop of Gold Medalists (particularly in young female athletes, who responded dramatically to androgens), but it also precipitated medical abnormalities, including premature death (Franke and Berendonk, 1997).

Doping control. In 1928, the *International Amateur Athletic Federation* became the first agency to ban the practice of doping athletes (specifically, the administration of stimulants). Many other sports organizations soon followed this example, but the restrictions remained largely ineffective, as no tests of compliance were undertaken. The death of Knud Jensen at the Rome Olympics increased the pressure for sports authorities to introduce effective drug testing, but in 1963 the *Union Cycliste Internationale* still concluded that "nothing" could be done to prevent cyclists from abusing drugs.

Albert Dirix, Ludwig Prokop and Arnold Beckett took the first tentative steps towards enforcement of doping regulations at the Tokyo Olympics (1964), searching equipment and clothing and testing the urine for amphetamines (Dimeo, 2007). In 1966, the *Union Cycliste Internationale (UCI)* and the *Féderation Internationale de Football Association (FIFA)* introduced doping tests into their respective world championships, and the following year the *International Olympic Committee* established a Medical Commission, specifying a list of prohibited substances. Drug testing was instituted at the Olympic Winter Games in Grenoble and at the Olympic Games in Mexico City. Full-scale drug testing was finally implemented at the Munich Olympics of 1972 (Prendergast et al., 2003).

Sports Medicine.

There was substantial growth of knowledge in many areas of sports medicine during the Modern Era. This led to the appearance of specialized textbooks and the emergence of national and international professional organizations. Many competitors and coaches welcomed the growth of sports medicine as a specific discipline, but some sociologists criticized this trend, arguing that physicians were moving far beyond their mandate of preventing and treating disease, to the point where they were seeking the medicalization of all aspects of life (Waddington, 1996).

Textbooks. Texts of sports medicine began to appear in Germany around 1910 (Shephard, 2013b), although Herxheimer's *Grundriss der Sportmedizin* was the first to incorporate the word sports medicine into its title (Herxheimer, 1933). Credit for the first English language text on sports medicine has sometimes been attributed to Charles Brehmer Heald, a graduate of St. Bartholomew's Hospital, London; in 1931, he published *Injuries and Sport: a general guide for the practitioner* (Heald 1931). Another early author was Dr. Walter E. Meanwell, team physician at the University of Wisconsin; that same year,

he collaborated with Notre Dame football coach Knute Rockne to publish *Training, Conditioning and the Care of Injuries*, the first U.S. work on sports medicine.

Most people give less than due credit to the Canadian contender, R. Tait McKenzie (1867–1938 CE). He published *Exercise in Education and Medicine* in 1915 (McKenzie, 1915), discussing the physiology of exercise and physical conditioning, and presenting recommendations based on the experience that he had gained while treating and rehabilitating soldiers who had been injured in World War I. Certainly, Tait McKenzie laid the groundwork for modern concepts of medical rehabilitation.

John Garett Pascoe Williams (1932-1995 CE) published two early English language texts (*Sports Medicine* and *Medical aspects of sport and physical fitness*) that discussed aspects of sports medicine other than the treatment of surgical injuries (Williams, 1962, 1965). Williams was a leading figure in British sports medicine for several decades, and he also served as Secretary-General of FIMS (below) from 1970 to 1980. After starting a clinic for athletes at the Middlesex Hospital, London, during the 1960s, he became medical director of the *Farnham Park Rehabilitation Centre*, with a particular interest in spinal mechanics and overuse injuries. He stimulated considerable controversy with his contention that many athletes were not particularly fit, and he staunchly maintained that sports medicine was the prerogative of physicians rather than kinesiologists. He thus offered fierce resistance to proposals that would have seen the inclusion of professionals other than physicians in the ranks of the *British Association for Sports Medicine* (Editor, British Journal of Sports Medicine, 1995).

In Canada, I published the first edition of *Endurance Fitness* in 1969 (Shephard, 1969). At that time, the University of Toronto Press considered physical fitness an area of dubious scientific interest. Instead of type-setting the book, the publishers insisted that I have my secretary type the entire manuscript in camera-ready condition (no easy task before the advent of word-processors). After the book had been typed and retyped many times, it sold for $6.50; the publishers made about $3 a copy, and I earned 50 cents per copy! In the U.S. early titles in this area of enquiry had included *Physical fitness appraisal and guidance* (Cureton, 1947), *Foundations of Physical Activity* (Adams, 1968) and *Foundations of Physical Activity: Applications as Disciplines and Professions* (Larson, 1976). However, the first widely known American text entitled *Sports Medicine* did not appear until 1974 (Ryan and Allman, 1974).

International Organizations. According to A.J. Ryan, our modern concept of sports medicine dates from the second Winter Olympics (St. Moritz, 1928), when two of the attending physicians convened a scientific meeting; thus, the *Association Internationale Médico-sportive (AIMS)* was born. Others point to the first *International Congress of Sports Medicine,* held in conjunction with the Amsterdam Summer Olympic Games of 1928. Some 280 sports physicians from 20 countries attended this congress, reporting on the anthropometric, cardiovascular, physiological and metabolic characteristics of Games participants. The international group underwent several subsequent changes of

name [in 1933: the *Fédération International Médico-Sportive et Scientifique*; in 1934: the *Fédération International de Médecine Sportive* and since 1998: the *Fédération Internationale de Médecine du Sport* (FIMS)] (Tittel and Knuttgen, 1988). In 1989, FIMS claimed to have affiliate organizations in 83 countries, and to have retained a strong association with the *International Olympic Committee* (La Cava, 1969). The *Journal of Sports Medicine and Physical Fitness*, which began publication in 1961, has strong ties to the *Italian Olympic Committee*.

The *International Council of Sport and Physical Education (ICSSPE*) was founded in Paris, France, in 1958, under the auspices of UNESCO (Bailey, 1996). Philip John Noel-Baker (1889-1980 CE, captain of Britain's Olympic track team in 1920 and 1924, and subsequently a Labour politician and pacifist) assumed the presidency of ICSSPE. The Council added the word "*Science*" to its title in 1982. The stated goals of ICSSPE were to address a widening gap between the fields of sport, sports science and physical education, to reinforce links between professionals and governmental and non-governmental organizations, and to seek a more inclusive perspective on sport and physical education. Specific objectives were to increase awareness of the human values inherent in sport and physical activity, to improve population health and physical well-being, and to develop physical activity, physical education and sport in all countries, bridging the gap between developed and developing nations.

An *International Committee for the Standardization of Physical Fitness Tests (ICPSPFT)* was founded in Tokyo, Japan in 1964. Leonard August Larson (1906-2003 CE), professor of physical education at the University of Wisconsin, Madison, WI, was the leader of this group. It initially published detailed recommendations for the conduct of various physical fitness tests (Larson, 1974). Subsequent to achieving this goal, the group continued to meet periodically. At a gathering held in Jyväskylä, Finland (1973), it decided to change its name to the *International Council for Physical Fitness Research*. A further change of name was agreed in Leuven, Belgium, (1992), with the group becoming the *International Council for Physical Activity and Fitness Research (ICPAFR)..*

The *Pediatric Work Physiology Group* was initially the brain-child of Josef Rutenfranz (1929-1989 CE), an exercise scientist at the Max Planck Institute in Dortmund. Attendance at meetings of this group was by invitation, and discussions focussed on the health and fitness of school-age children. The first meeting was held in Dortmund in 1967. Subsequent gatherings were held biennially, mainly in western Europe. Most of the participants were Europeans, although Oded Bar-Or from Hamilton, ON, and participants in the Trois Rivières study also played a major role in the early deliberations of this group.

German Professional Organizations. In view of the early appearance of German textbooks in sports medicine, it is not surprising that the first national professional organizations to discuss issues in sports medicine developed in Germany (Arndt, 2012). August Smith and Arthur Mallwitz studied the anatomic, anthropometric and cardiac functional characteristics of 1000 athletes between 1891 and 1906, and they organized the *Internationale Hygiene Austellung*

(*International Congress on Hygiene*) in Dresden in 1911. This group emphasized the health benefits of sport participation (Berg and König, 2002). A second congress was held in Oberhof the following year; this discussed a very modern range of issues, including overtraining, the ECG of athletes, doping, sexuality and women in sport. The *Deutsches Reichskomitee für die Wissenschaftliche Erforschung des Sports und der Leibesübungen (German Committee for the Scientific Investigation of Sports and Physical Exercise)* was also founded in 1912. The German President Friedrich Ebert opened an *Academy for Physical Exercise* in Berlin in 1920, and an *Institute of Sports Medicine* was inaugurated in Freiburg in 1924. In that year, the *Deutsche Gesellschaft zur Förderung der Leibesübungen (German Federation for the Promotion of Physical Exercise)* was founded (Hoberman, 1992). It immediately began publishing its own journal (*Der Sportartz*, *the Sports Physician*). Within a year, more than 700 physicians were participating and by 1933 this number had grown to 3000.

Unfortunately, the Nazi regime moved quickly to incorporate the *Federation* into the *NS Artzebund* and the *Sports Academies* were disbanded because some of the faculty had Jewish family members. As a result of this action, Fritz Duras emigrated from Freiburg to Australia, where he became one of the founding fathers of the *Australian Sports Medicine Association*.

After World War II, sports medicine in Germany was revived by the efforts of Herbert Reindell. The *German Federation of Sports Medicine* took shape in Hannover in 1950, the journal *Deutsche Zeitschrift für Sportsmedizin (German Journal of Sports Medicine)* resumed monthly publication, and annual congresses recommenced in 1951. Reindell established a chair of *Work Physiology and Sports Medicine* in 1956, and also a chair of *Circulation Research and Sports Medicine* at the University of Freiburg; the latter was subsequently occupied by the eminent exercise biochemist Josef Keul.

***British Professional Organizations*.** The pioneer of clinical sports medicine in England was of South African birth, Sir Adolphe Abrahams (1883-1967 CE). As a young man, he had won many track events, and he served as medical officer to the British Olympic team from 1912 to 1948. The *British Association of Sports and Medicine (BASM)* had its beginnings in 1953, as a group of doctors, medical advisers to the governing bodies of sport and others interested in medical aspects of sports medicine met at the Westminster Hospital in London. These gatherings were hosted by Abrahams and Sir Arthur Porritt (a 200 m finalist in the Paris Olympics of 1924). BASM began publishing the *British Journal of Sports Medicine* in 1964, and it also inaugurated a *Memorial Lecture and Medal* to honour the memory of Sir Adolphe; I was privileged to present one such lecture in 1988 (Shephard, 1988). The group was subsequently renamed the *British Association of Sport and Exercise Medicine*, in order to reflect the growing importance of exercise to health promotion. Under the auspices of BASM, several British universities began offering diplomas, M.Sc. degrees, and specialist registration in sport and exercise medicine.

U.S. Professional Organizations. In the U.S., the first scholarly group to show

an interest in fitness and health was the *American Academy of Physical Education*, which had its beginnings in 1904/05. Early meetings were organized by Luther Halsey Gulick (1865-1918 CE) a physician and physical educator who was superintendent of the physical education department at Springfield College from 1887-1900. He had also founded a group known as the "*Camp Fire Girls*." Discussions took place at the Gulicks' camp at Lake Sebago, Maine. More formal meetings began in 1926, under the aegis of 5 distinguished physical educators, including Clark W. Hetherington, champion of developmental play and educational athletics, and R. Tait MacKenzie. Five additional names were added to the roster each year, and when 30 names had been recruited a charter was esrablished. Members of the *Academy* are still identified simply by a number, signifying their date of recruitment. The 1930 Constitution specified that the purpose of the Academy was "*to advance knowledge in the field of physical education, to uplift its standards, and uphold its honor.*" The purpose was expanded in 1945, when the *Academy* was commissioned by the U.S. government to "*play a part in helping to bring national policies and practices in line with the best thinking in the field of health and physical education.*" Duties now included recommendations for the R.O.T.C. and military preparedness. The scope of the organization was further broadened in 1993, as it became the *American Academy of Kinesiology and Physical Education,* with a combined dedication to educational concerns and scientific advances in the fields of health and fitness.

The *National Athletic Trainers' Association* (NATA) was founded in 1950. Its objectives were to enhance the quality of health care provided by certified athletic trainers and to advance their professional status.

The *American College of Sports Medicine* (ACSM) had quite modest beginnings. At a meeting of the *American Association for Health, Physical Education, and Recreation* that was held in New York during the spring of 1954, 11 "*Founding Fathers*," physical educators and clinical scientists who recognized that health problems were associated with lifestyle choices such as poor nutrition and lack of exercise decided to form a group initially called the *Federation of Sports Medicine*. Under the presidency of J.B. Wolffe, the General Assembly of FIMS was contacted, and it voted to admit the "*American Chapter of FIMS*." By January of 1955, the name had been changed to ACSM, and by June of the same year there was a roster of 54 Charter Members, including the 11 Founders. In 1961, Grover Mueller became executive secretary, with a permanent office in Philadelphia. The South-West Regional Chapter, the first of many, was founded in 1962. Henry Montoye had a brief period as executive secretary from 1964-65, and the office then moved to Madison, WI, with Donald Herrmann assuming a paid role as secretarial assistant to President Bruno Balke. The first issue of *Medicine and Science in Sports* appeared in 1969, with Bruno Balke as Editor-in-Chief. The annual meeting of ACSM has subsequently grown to become one of the largest international gatherings in sports medicine, covering a broad range of topics in exercise, health, fitness and nutrition (Berryman, 1995).

The *American Medical Association* appointed an *ad hoc* committee on sports injuries in 1959, and this quickly became

a *Standing Committee on the Medical Aspects of Sports.* The *American Orthopedic Association* also established a *Committee on Sports Medicine* in 1962, and this eventually developed into the *American Orthopedic Society for Sports Medicine* (1975).

Canadian Professional Organizations. Until the mid-1960s, Canadian sports scientists found most of their intellectual stimulation through attendance at meetings of appropriate U.S. Professional Associations.. The *Canadian Physical Education Association* was formed in 1933, and it was renamed the *Canadian Association for Health, Physical Education and Recreation* in 1947. The emergence of other specific Canadian organizations such as the *Canadian Association of Sports Sciences* (1967), the *Canadian Athletic Therapists' Association* (1965) and the *Canadian Academy of Sports Medicine* (1969) will be discussed in the final article in this series of reviews.

Sport and leisure activities.

The introduction of paid holidays had a major influence on the leisure patterns of working class individuals in most western nations. Widespread availability of roller-skating rinks, Palais de Dance and public swimming pools provided the inhabitants of large cities with new opportunities for active leisure. It also fostered a growing public interest in aquatic events such as diving, marathon and synchronized swimming. Other new sports interests jncluded handball, netball, racquetball, volleyball, ringette and table tennis. A growing network of National and Provincial Parks and of Youth Hostels provided new facilities for active outdoor recreation. In Canada, mountaineers scaled previously unascended peaks, adopted the Swedish sport of orienteering and showed a growing interest in water skiing. However, for many people the construction of large sports stadia, greyhound racetracks, auto speedways, cinemas, and radio and television networks accelerated the secular trend to adoption of a sedentary lifestyle.

Paid holidays. During the Victorian Era, most countries required employers to provide a paid Saturday half-holiday, and this had a substantial influence upon patterns of sport and leisure activity (Shephard, 2013b). However, many workers still lacked the salary needed to take the luxury of a week's vacation without pay. One expedient, popular in the slums of central London, was for the entire family to spend a week picking fruit or hops in the nearby Kentish countryside. However, this was hardly relaxation for a manual labourer, and his wife faced the double duty of daytime field-work plus the need to feed a hungry family in a makeshift cabin during the evenings. Some of the urban poor profited from holidays that were organized by charitable organizations. For example, in Canada, the United Church offered many poor children a week at simple campsites and also organized summer outdoor recreational programmes around major cities.

During the 1920s, the trade unions in many European countries began to push demands for a week of paid vacation. They argued that such a plan would reduce absenteeism and boost productivity during the remaining 51 weeks of the year. Some large companies agreed to this proposal, but others made it contingent upon workers attending a territorial army training camp (Dawson,

2007).

In the British *House of Commons*, a labour member introduced a bill requiring an 8-day annual holiday. The idea was favourably received during debate, but was subsequently killed *in committee* by the conservative majority. A commission headed by Lord Amulree continued to explore the question during 1936; they encouraged voluntary compliance, and by 1938 the number of British workers who were receiving paid annual holidays had risen from 1.5 million to 4.5 million.

One concern of the commission was that if the remaining labour force of lower paid workers were able to spend a week at British seaside resorts, the cheaper hotels and resorts would be swamped by the "*wrong*" sort of people. Those concerned with public space saw '*appropriate conduct and aesthetic ability*' as crucial elements in deciding who should be allowed access to beaches and hillsides (Dawson, 2007). It was decided that many of these issues could be resolved by providing incentives for expansion of commercial "*luxury holiday camps*" of the type that were just being introduced by Billy Butlin and Harry Warner. Together, these two entrepreneurs were soon providing facilities for 140,000 working-class guests per season. Visitors to their camps were provided with accommodation in individual family chalets, catered meals and a variety of indoor and outdoor activities, both active and passive, at a low and all-inclusive cost. The slogan of Butlin was: *"Holidays With Pay, Holidays With Play at Butlin's"*. With logistic problems apparently resolved, Britain enacted legislation requiring paid annual holidays for all workers, beginning in1938.

In Germany, workers could enjoy attendance at *Strength through Joy* camps or the alternative of week-long trips on specially constructed cruise-boats. And in the Soviet Union, holidays at attractive summer camps were offered as premiums to those employees who exceeded their production quotas. After World War II, the communist satellite states followed a similar plan, and I remember attending a meeting of the *Pediatric Work Physiology Group* at a workers' summer camp in the rural community of Sec, Czechoslovakia, in 1972.

As early as 1910, President Taft had made the ambitious suggestion that every American employee needed 2-3 months of vacation per year, in order to continue working with optimal energy and effectiveness, but not surprisingly this proposal fell upon deaf ears. In Ontario, the *Vacations with Pay* Act became law in 1944, and most Canadian provinces now mandate a minimum vacation pay amounting to at least 4% of the individual's base salary for full-time workers. Unfortunately, many companies are still flouting this very reasonable obligation by replacing full-time by part-time staff. In the U.S., there is still no mandatory minimum vacation, although about two thirds of hourly workers now receive a paid vacation (Robinson, 2010). Some economists have argued that in North America, trade unions have shown greater interest in negotiating increases of pay than paid vacations. Others in the U.S. continue the struggle to get the *Fair Labor Standards* Act passed.

Public swimming pools. Some public swimming pools were constructed during the Victorian Era. London, England, boasted six indoor pools equipped with diving boards as early as 1837. However,

municipal indoor and outdoor pools became much more widespread during the first half of the 20th century. They offered opportunities for swimming and instruction in water safety to people who did not have easy access to the seaside or a pleasant riverside swimming location.

The availability of indoor pools fostered a growing interest in many aquatic events, including diving, marathon swimming and synchronized swimming. Competitive diving originated in Britain, with a *Competitive shallow plunge for distance* beginning in 1883, and continuing until 1937. The *Royal Life Saving Society* hosted the first "*graceful diving"* competition in the murky waters of Highgate Ponds, in north London, in 1895. Many early acrobatic divers were previously gymnasts, who had decided that they preferred landing on water than on a hard gymnasium floor. Diving events were included in the 1904 Olympic Games. The early diving boards were contructed from a type of wood that was not particularly springy, in contrast with the alloy boards used today.

The *Canadian Diving Council* was formed within the *Canadian Amateur Swimmimg Association* in 1966, and an independent *Canadian Amateur Diving Association* was established two years later (Schrodt, Redmond and Baka, 1980).

Marathon-distance swimming was popular in Victorian England. Captain Matthew Webb (1848-1883 CE) swam the English Channel in 1875, taking 21 hours, 45 minutes to cross from Dover to Calais. He unfortunately met a premature death when swimming in the eddies of the Niagara Rapids in 1883. Gertrude Ederle accomplished a record-setting cross-Channel swim in 1926, when she was 19 years old (Mortimer, 2008). Marathon swims became standard fare at Toronto's *Canadian National Exhibition* from 1927 to 1938. Ederle was among other women who competed in the Wrigley marathon swim championships of 1928, although in the 16 km race for a $10,000 purse she was defeated by Ethel Hertle of New York. Marilyn Grace Bell learned her aquatic skills at the Oakwood public swimming pool in Toronto. In 1954, at the age of 16, she swam 56 km across Lake Ontario from Youngstown, NY to Sunnyside, Toronto in a time of 21 hours (Tivy, 2003). There were high waves during the crossing, and lamprey eels attacked her as she swam. As ergogenic aids, she chose Pablum, corn syrup, and lemon juice! Bell undertook this outstanding feat as an unpaid act of Canadian nationalism, because she was upset that the *Canadian National Exhibition* had chosen to offer a purse of $10,000 to an American swimmer, Florence Chadwick, in an attempt to boost attendance at the Exhibition. Chadwick, incidentally, was forced to abandon the swim for which she received the large payment. In 1974, a native of Scarborough Ontario (Cindy Nicholas, also 18 years old), completed the crossing of Lake Ontario in 15 hours 18 minutes. Nicholas went on to set record times for one- and two-way crossings of the English Channel in a series of 19 attempts (Long, 1995; Schrodt, Redmond and Baka, 1980).

Synchronized swimming was originally known as water ballet. Competitive events were first held in Berlin in 1891. In Britain, synchronized swimming became a Music Hall attraction. Large glass tanks were installed in the theatres of London and Glasgow to permit on-stage performances. The discipline initially attracted men, but quickly became a sport exclusive to women. The first U.S. club was organized in 1923, and Canada was

not far behind, with a synchronized swimming competition also being held at the Montreal YMCA in 1923. This sport was drawn to the public's attention with a display by "*The Modern Mermaids*" at the Chicago World Fair of 1934. It was further popularized when the *National Amateur Athletic Union* swimmer Esther Williams appeared in films such as *Bathing Beauty* (1944) and *Million Dollar Mermaid* (1952). The *Amateur Synchronized Swimming Association* of Canada was formed in 1950. Synchronized swimming was introduced as an exhibition event at the Helsinki Olympics (1952) and it became a part of the regular programme at the Mexico City *Pan American Games* (1955) (Bean, 2005; Schrodt, Redmond and Baka, 1980).

Handball. Origin of the sport of handball is widely debated. Some think this activity can be traced back to the ancient Greek game of *urania*, to the Spanish *pelota*, and/or to English *fives*. Some also argue that it is derived from *Königsbergerbal*, a game introduced into Germany during the late 19th century to keep soccer players fit during the summer months. Outdoor handball was featured at only one Olympic Games (Berlin, 1936). Indoor handball emerged in Denmark during the 1940s, and has featured in Olympic Games since 1972. A third version of the sport, beach handball, has become very popular in recent years, and is a marked feature of Toronto's eastern beaches during the summer months.

The outdoor version of the sport was popular in Ireland, and Irish immigrants brought the game to the U.S. during the 19th century (McElligott, 1997). There were occasional reports of games in Canada during this period. The *Federation Internationale de Handball Amateur* was founded in 1928, and this became the *International Handball Federation* in 1946, with Avery Brundage (subsequently president of the IOC) as its first president. The *Canadian Handball Association* was not formed until 1962 (Schrodt, Redmond and Baka, 1980).

Netball. In 1892, Senda Berenson of Smith College, in Northampton, Mass, conceived netball as a form of basketball that would be appropriate to the needs and decorum of Victorian women. One year later, Martina Bergman-Österberg (1849-1915 CE)(Bloomfield, 2005), a physical education instructor who had trained under Per Henrik Ling introduced netball to students at the *Hampstead Physical Training College* in north London, using waste-paper baskets hung on the walls of the gymnasium as goals. Bergman-Österberg saw the sport as a means of enhancing fitness and preparing her pupils for motherhood. Over the next few years, the rules were codified at Bergman-Österberg's college (which by then had moved to Dartford, in Kent) and netball was soon being played widely at girls' schools in English-speaking countries.

The English *Women's Netball Association* was founded in 1926, and the *International Federation of Women's Netball Associations* was organized in 1960. West Indian immigrants intruduced netball to Montreal around this time, and the *Canadian Amateur Netball Association* was established in 1973 (Schrodt, Redmond and Baka, 1980).

Raquetball. Racquetball is closely related to handball and paddle-ball. It is played on either an indoor or an outdoor court, using a paddle with a hollow rubber ball and a racquet. The game is

attributed to Joe Sobeck of Greenwich, Conn, YMCA; he called it paddle-rackets. The idea was introduced into Canada via the YMCAs during the 1960s. The *International Racquetball Association* was founded in 1969, and the *Canadian Racquetball Association* was organized in 1971 (David, 1999; Schrodt, Redmond and Baka, 1980).

Volleyball. The game of Volleyball was developed from German *Faustball* by William Morgan, director of the Holyoke, Mass, YMCA, in 1895. He called it *mintonelle*. The rules were intended to make the sport less rough than basketball, and thus more appropriate for older members of the YMCA (Sherrow, 2002). The game was introduced into Canada around 1900, and it was carried to Europe by American troops during World War I. U.S. quartermasters distributed 16,000 volleyballs to their expeditionary force. Volleyball was a demonstration sport at the Paris Olympics of 1924, and was officially included in the roster of Olympic Events beginning in 1964.. The *International Volleyball Federation* was formed in 1947, and the *Canadian Volleyball Association* was established in 1953 (Schrodt, Redmond and Baka, 1980). Like handball, volleyball has recently become adapted as a popular beach sport, and this version of the game was added to the Olympic Games of 1996.

Roller skating. Roller skates were first seen on a London stage in 1743, and various designs of skates appeared during the 19th century (Trap et al., 1980). A public roller-skating rink was constructed in Newport, RI, in 1866, and the Royal Skating Rink opened in Brussels in 1877. By 1879, enthusiasts in Toronto were organizing a 75-hour roller-skating marathon. The ball-bearing design of skate was invented in 1884, and soon afterwards many ice-skating rinks began to be modified to accommodate roller-skaters during the summer months.

During the early part of the 20th century, many commercial roller-skating rinks opened in Europe; they offered a relatively inexpensive form of physical activity for the general population. An *International Roller-Skating Federation* was formed in 1924. In North America, public interest in roller-skating reached its peak during the 1970s, with roller-skating championships at the *Canadian National Exhibition* in Toronto, and formation of the *Canadian Association of Amateur Roller Skaters* in 1973 (Schrodt, Redmond and Baka, 1980).

Ringette. Ringette is a game of uniquely Canadian origin. It was invented by Sam Jacks, a resident of North Bay, ON, in 1963. It is an ice sport, and is now played in a growing number of countries where winter sports are popular. An air-filled ring is propelled by what is in essence a hockey stick without a blade. Body checking is prohibited. An *Ontario Ringette Association* was formed in 1960, and *Ringette Canada* was established in 1974 (Sam Jacks and National Ringette League, 2010; Schrodt, Redmond and Baka, 1980).

Parachuting. Parachuting contests began in the U.S. in 1926, but the first world championships were not held until 1951. The *Parachute Club of Canada* was formed in 1956*.* The sport is more a test of a person's nerve than a significant generator of physical activity. In North America, the death rate is about 1 in every 150,000 jumps (United States Parachute Association, 2012).

Ballroom dancing. The early part of the 20th century saw new dance crazes, many inspired by a growing interest in jazz. Some of the new dances required quite vigorous physical activity. During the 1930s, modern ballroom dancing was popularized by the films of Fred Astaire and Ginger Rogers. Large "*Palais de Danse"* were built in many cities, and organizations such as the Arthur Murray Company taught the basic steps of common dances to large segments of the urban population (Richardson, 1948).

Table tennis. Table tennis seems to have begun during the late 19th century, as a form of recreation for British army officers in India. It subsequently became an after-dinner parlour game for the upper classes in Great Britain. Sometimes books from the baronial library were used in place of a net, cigar boxes took the place of paddles, and champagne corks the place of balls (Letts, 2012). The celluloid ball was introduced during the 1880s, and the pimple-rubber covered bat appeared in 1901.

The *International Table Tennis Federation* was formed in 1926, and the first world championships were held that same year. The *Canadian Table Tennis Association* was established in 1929. However, table tennis did not become an Olympic Sport until 1988. In many parts of Canada, table tennis continues to offer a valuable source of indoor physical activity for the general population during the cold months of winter.

National and Provincial Parks. National and Provincial Parks now provide opportunity for the general population to engage at low-cost in outdoor recreational activities such as mountaineering, orienteering, camping, picnicking, hiking, swimming, and canoeing. However, much patient debate was needed before such facilities could become a reality. The idea of creating National Parks can be traced to William Wordsworth (1770-1850 CE), who described the English Lake District as (Wordsworth, 1835):

"a sort of national property, in which every man has a right and interest who has an eye to perceive and a heart to enjoy."

However, an 1884 campaign by a British parliamentarian, James Bryce, to assure public access to the British countryside failed. Many of the gentry continued to view the hills and streams as their preserve for hunting and fishing. Finally, in 1931 a Government inquiry recommended the creation of a *National Parks Authority,* and the designation of selected areas of the British countryside as *National Parks*, but still no concrete action was taken. In 1932, mass "trespasses" on a hill named Kinder Scout in the Peak District of England led to the imprisonment of 5 hikers. The British Act of Parliament creating *National Parks* was not passed until the Labour administration of 1949. Ten *National Parks* were designated during the 1950s, beginning with the Peak District.

Perhaps because of a larger unexploited land-mass, National Parks were created much earlier in North America than in Britain. The Yellowstone National Park was established in 1872. In Canada, the first National Park opened as the *Banff Hot Springs Reserve* in 1885. The *Dominion Parks Branch* was created in 1911, and the *National Parks Act* was passed in 1930. Large Provincial Parks were also established quite early in Canadian history, beginning with

Algonquin Park, ON (1893). In Ontario, a third stage in the provision of recreational space for a growing urban population was the establishment during the 1950s of a belt of regional parks a few km to the north of Toronto. These outdoor spaces were generally inaccessible by public transport, but they became available to most of the general population as households acquired one or more cars.

Mountaineering in the Swiss and Austrian Alps was a well-established pastime of the wealthy in Victorian times. In 1886, a mountaineering centre was opened at Glacier House, atop the Rogers Pass in the Canadian Selkirk Range. This centre was at first accessible by Canadian Pacific (CP) trains, but beginning in 1916, the 8 km Connaught tunnel took the railway under Mount Macdonald. Because visitors no longer had easy rail access, Glacier House was forced to close in 1925. Some of the first Rocky Mountain guides came from Switzerland. Mount Bonney (3305 m) was climbed in 1888, and Mount Assiniboine (3620 m) in 1902. The *Alpine Club of Canada* was established in 1906 with the strong support of the CP railway. Mount Robson (3854 m) was scaled in 1913, Mount Logan (5633 m) in 1925, and Mount Waddington (4020 m) in 1936 (Scott, 2000). The ultimate challenge, Mount Everest, was finally conquered in 1953, but it was not until several decades later that large commercial tourist parties began this perilous ascent.

Orienteering had its origins as a form of training for the Swedish army. The term orienteering was first used at the *Military Academy Karlberg* in 1886. Major Ernst Killander (1882-1958 CE), President of the *Stockholm Amateur Athletic Association*, organized the first large-scale orienteering competition in 1919. The sport spread through Scandinavia during the 1920s and 1930s, gaining popularity as compasses became more reliable. Bjorn Kjellstrom (1910-1995 CE), inventor of the modern compass, organized demonstration events in Toronto and Montreal in 1946. The *Canadian Orienteering Association* was established in 1967, and the first National championships were held in Gatineau Park in 1968 (Schrodt, Redmond and Baka, 1980).

Youth hostels. The idea of Youth Hostelling began in Germany just before World War I, through the initiative of a schoolteacher, Richard Schirmann (Shephard, 2013b). The *British Youth Hostel Association* (YHA) had its beginnings in 1930. Hostels offered young people basic accommodation in tiered bunk beds and simple meals or cooking facilities at a very low cost. The only conditions for visitors were a valid YHA Membership Card and arrival at the hostel under one's own power (by mountain hiking, cycling or canoeing). The distance between some hostels (100-125 km), and the requirement to share in the physical maintenance of the facilities at the nightly behest of the hostel warden ensured that users had a substantial daily dose of physical activity.

In 1932, the *International Youth Hostel Federation* was formed from 11 National associations, under the direction of Richard Schirmann, but within 3 years the Nazi government forced Schirmann to resign his post (Grassi and Hearh, 1982).

Sedentary activities. The construction of massive stadia for soccer, American football, baseball, ice-hockey, basketball and auto racing accelerated the trend to the watching of spectator sports during

the 20th century. The development of radio and television allowed people to feel involved in such events without even travelling to the site of competition, and their interest was further stimulated by new forms of gambling, including football pools and off-track betting. Movie theatres provided a new option for sedentary entertainment, and after World War II, the development of powerful amplifiers allowed massive public attendance at Rock concerts.

The radio was first used as a means for transmitting urgent messages, but in 1909 Charles David Herrold began broadcasting music from a studio in San Jose CA. The radio became more popular during the late 1920s, with the change from temperamental crystal sets to vacuum tube radio receivers. News broadcasrs from Detroit, MI, commenced in 1920, and in Britain Marconi initiated regular broadcasts in 1922 (Crisell, 2002). The *British Broadcasting Corporation* (BBC) was founded in 1927, and the *Canadian Broadcating Corporation* (CBC) was established in 1936. Some people listened to the radio while continuing to engage in more active domestic pursuits, but many chose to sit in a chair and enjoy their favourite sports, music and comedy shows.

John Logie Baird began television broadcasts in cooperation with the BBC in 1929. By the beginning of World War II, television broadcasts were reaching some 40,000 homes in Britain, although the screen was so small that the device had little more than novelty value. By the early 1950s, most people had purchased television sets with larger screens, and in contrast with the radio, there was little possibility of remaining active while they were watching television programming.

Louis Lumière (1864-1948 CE), the son of an artist in Lyon, France, is commonly credited with the invention of a portable motion-picture camera, processing unit and projector in 1895. He called his system the *Cinématographe*. He was sceptical concerning its practical value, commenting: "*The cinema is an invention without a future*." In North America, the Edison Company developed the first commercially successful projector in 1896. Despite the heroic efforts of a pianist or organist to animate the films, images were jerky and not particularly interesting to watch. However, projection systems improved, and by 1923 synchronized sound tracks were added. The movie companies quickly built massive (2000-3000 seat) cinemas in most major cities, and these facilities were filled consistently with people who sought 2-3 hours of sedentary entertainment during their leisure time.

Large-scale outdoor concerts became possible with the improvements in electronic amplifiers during World War II. During the 1960s, Rock festivals began to occupy entire summer weekends. The most well known of these events was the 3-day Woodstock Festival of 1969, which attracted an audience of 500,000. Rock concerts commonly combined a sedentary weekend with “free-love” and experimentation with a variety of pyschotropic drugs such as lysergic acid diethylamide (LSD).

The modern form of greyhound racing began in 1912, with introduction of the electric hare. The first commercial greyhound track opened at Emeryville, CA, in 1919. The concept was carried to Britain in 1926, and forty tracks were operating there within a year. Urban locations and evening racing made this sport attractive for the working-class

gambler. British greyhound tracks reached their zenith immediately following World War II, with an estimated 34 million spectators, but attendances declined when the *Betting and Gaming Act* of 1960 permitted off-course cash betting.

Early auto racing was of the city-to-city variety. A Paris to Rouen race was held in 1894 and a race along the Chicago lakeshore took place in 1895. The first purpose-built auto race track opened at Brooklands, on the southern outskirts of London, in 1907, and races continued there until the track was damaged by bombing during World War II. Stock-car racing was introduced at Charlotte, NC, in 1949, and a variety of "*Super Speedways*" were constructed around the world, beginning in the 1960s.

The idea of gambling on the results of English Association Football (the Football Pool) began in 1923, with John Moores, the founder of Littlewoods Pools (Munting, 1996). In some countries, such as Sweden, the pools became State monopolies. The entry coupons were cheap enough to have mass appeal, and there was a potential for a very large pay-out in the event of correctly predicting the outcome of all matches in the League on a given Saturday. Entry forms are now available via the Internet, but in the Modern Era the coupons were either mailed to customers or given to an agent of the company. Beginning in 1948, the British government began to accumulate substantial revenues from the taxation of football pools and greyhound racing,

Until the 1960s, a section of the 1892 Criminal Code limited Canadian gambling to horse-racing and (through a 1925 amendment) to the midways at agricultural fairs. However, this legislation was substantially revised in 1969. By this time, most Canadians were viewing moderate gambling as an acceptable use of leisure time and as a legitimate source of government revenue. Those who developed an excessive propensity for gambling were regarded as having a health problem that required psychological and/or medical treatment (Campbell and Smith, 2003).

Conclusions

Did human health and physical fitness improve or worsen during the Modern Era? The increasing longevity of populations in developed countries suggests that there was a general trend to better health, although there are still few statistics addressing the more important variable of the average quality-adjusted life-span. On the other hand, several factors point to a decrease in personal physical fitness during the 20th century.

On the positive side of the ledger, effective treatments were discovered for many previously fatal diseases, universal pre-paid medical care became available in most countries, and governments took active measures to meet the housing, nutritional and social needs of their poorer citizens. Information also began to accumulate demonstrating the importance of regular physical activity for the maintenance of good health. Textbooks and professional organizations provided new insights into many facets of sports medicine. The physiological basis of fitness was clarified, new and standardized laboratory tests of fitness were developed, and a growing understanding of environmental dangers increased the safety of exercise programmes. Paid holidays also gave new opportunities for workers to engage in active leisure, and the arrival of cinema, radio and television allowed diffusion of

health and fitness messages to wide segments of the general population.

But at the same time, mechanization of many heavy industries, widespread ownership of motor vehicles and the introduction of labour-saving domestic appliances reduced the daily energy expenditure of many previously active people Analysis of health statistics showed a growing population burden of diseases related to physical inactivity, particularly atherosclerosis. New forms of entertainment - the cinema, radio, television, rock-concerts and off-track betting all encouraged a sedentary use of leisure time. Even the potentially beneficial influence of the Olympic movement became high-jacked by political forces. Enormous expenditures were made for a brief extravaganza and the general public, rather than being inspired by the athletes, became disillusioned by repeated doping scandals.

In terms of fitness, the overall trend thus appears to have been negative, leaving health and fitness professionals with a major challenge during the Post-Modern Era.

Author's Qualifications

The author's qualifications are as follows: Roy J. Shephard, M.B.B.S.; M.D. [Lond.]; Ph. D.; D.P.E.; LL.D.

References

Adams, W. C. (1968). *Foundations of physical activity* Champaign, IL: Stipes.

Aguirre, G., Frontera, W. R., Colon, L. R., Amy, E., Micheo, W., Correa, J. J., and Camunas, J. F. (1994). Profile of health services utilization during the XVII Central American and Caribbean Sport Games: Delegation of Puerto Rico, Ponce 1993. *Puerto Rico Health Sci. J., 13*, 273-278.

Amar, J. (1909). *Le rendement de la machine humaine (The performance capacity of the human machine)*. Paris, France: Ballière et Fils.

American Association for Physical Education and Recreation. (1958). *Youth Fitness Test Manual*. Washington, DC: National Education Association.

American College of Sports Medicine (1975). Position statement on prevention of heat injuries. *Med. Sci. Sports, 7*, vii-viii.

Andersen, K. L., Shephard, R. J., Denolin, H., Varnauskas, E., and Masironi, R. (1971). *Fundamentals of exercise testing*. Geneva, Switzerland: World Health Organization.

Anderson, J. A. D., and Sweetman, B. J. (1975). A combined flexi-rule/hydrogoniometer for measurement of lumbar spine and its sagittal movement. *Rheumatology 14*, 173-179

Anderson, T. W., and Le Riche, W. H. (1970). Ischemic heart disease and sudden death, 1901-1961. *Brit. J. Prev. Soc. Med., 24*, 1-9.

Anderssen, K. L. (1955). Leukocyte response to brief, severe exercise. *J. Appl. Physiol., 7* 671-674

Aoyagi, Y., Park, H., Kakiyama, T., Park, S., Yoshiuchi, K., and Shephard, R. J. (2010). Yearlong physical activity and regional stiffness of arteries in older adults: the Nakanojo Study. *Eur. J. Appl. Physiol., 109*, 455-464.

Arnaud, P. (1996). *Sport, éducation et art : XIXe - XXe siècles* Paris, France: Comité des travaux historiques et scientifiques CTHS.

Arndt, K.-H. (2012). Gründung der weltweit ersten sportmedizinischen Organisation (Establishment of the World's first sports medicine organization). *Dtsch. Z. Sportmed., 63,* 93.

Arndt, K.-H. (2012). Deutscher Ärztebund zur Főrderung der Leibesũbungen (German Medical Association for the promotion of physical education). *Dtsch. Z. Sportmed., 63*, 120.

Åstrand, P.-O. (1952). *Experimental studies of physical working capacity in relation to age and sex*. Copenhagen, Denmark: Munksgard.

Åstrand, P. O., and Ryhming, I. (1954). A nomogram for calculation of aerobic capacity (physical fitness) from pulse rate during submaximal work *J. Appl. Physiol., 7*, 218-221.

Ayalon, A., Inbar, O., and Bar-Or, O. (1974). Relationships among measurements of

explosive strength and anaerobic power. In R. C. Nelson and C. A. Morehouse (Eds.), *Biomechanics IV. International series on sport sciences* (pp. 572-577). Baltimore, MD: University Press.

Bacon, E., and Sandle, M. (2002). *Brezhnev Reconsidered* Basingstoke, Hants, UK: Palgrave.

Bailey, D. A., Shephard, R. J., and Mirwald, R. (1976). Validation of a self-adminstered home test of cardio-respiratory fitness. *Can. J. Appl. Sports Sci., 1*, 67-78.

Bailey, G. W. (1924). The effect of fatigue upon the susceptibility of rabbits to intratracheal injection of type I pneumococcus. *Am. J. Hyg.,, 5,* 176-295

Ballatyne, P. (2002). Psychology, Society, and Ability Testing (1859-2002): Transformative alternatives to Mental Darwinism and Interactionism. Toronto, ON: York University Web-book. http://www.igs.net/~pballan/preface(2002).htm (accessed June 2nd 2012).

Bannister, R. (2004). *The Four-Minute Mile*. Guilford, Conn: Lyons Press

Barach, J. H. (1914). The energy index. Cardiovscular energy as indicated by the arterial pressure per minute. *JAMA, 62*, 525-526.

Barcroft, J. (1914). *The respiratory function of the blood*. Cambridge, UK: Cambridge University Press.

Barker, D. J. P., and Osmond, C. (1986). Diet and coronary heart disease in England and Wales druing and after the second world war. *J. Epidemiol. Comm. Health, 40*, 37-44.

Barker, M. H., Capps, R. B., and Allen, F. W. (1945). Acute infectious hepatitis in the Mediterranean Theater. *JAMA, 128* 997.

Barringer, T. B. (1917). Studies of the heart's functional capacity. *Arch. Int. Med., 20*, 829-839.

Barrow, H. M., and Brown, J. P. (1988). *Man and movement: Principles of physical education*. Philadelphia, PA: Lea & Febiger.

Bazoge, N., Saint-Martin, J., and Attali, M. (2013). Promoting the Swedish method of physical education throughout France for the benefit of public health (1868-1954). *Scand. J. Med. Sci. Sports, 23, 232-243. doi: 10.1111/j.1600-0838.2011.01363.x.*

Beckmann, P. (1961). [Early therapeutic procedures for cardiovascular patients as recovery procedures]. *Hippokrates, 32*, 82-86.

Behnke, A. R. (1942). Physiologic studies pertaining to deep-sea diving and aviation, especially in relation to the fat content and composition of the body *Harvey Lecture Series, 37*, 198-226.

Behnke, A. R., Feen, B. G., and Welham, W. C. (1942). The specific gravity of healthy men: body weight + volume as an index of obesity. *JAMA, 118*, 495-498.

Bell-Kanner, K. (1998). *Frontiers: The life and times of Bonny Bird, American modern dancer and dance educator*. Amsterdam, Netherlands: Harwood Academic.

Benedict, F. G., and Cady, W. G. (1912). *A bicycle ergometer with an electric brake. Carnegie Institute of Washington Publication 167.* Washington, DC: Carnegie Institute of Washington.

Berg, A., and König, D. (2002). History of Sports Medicine in Germany with special reference to the University of Freiburg. *Eur. J. Sports Sci., 2 (4), 1-7. On-line publication*

Berryman, J. W. (1995). *Out of many, one. A history of the American College of Sports Medicine*. Champaign, IL: Human Kinetics.

Beveridge, J. (1954). *Beveridge and His Plan.* London, UK: Hodder & Stoughton.

Bissell, C. (1986). *Vincent Massey.* Toronto, ON: University of Toronto Press.

Blackburn, G. W. (1985). Education in the Third Reich. Race and history in Nazi textbooks. Albany, NY: State University of New York Press.

Bliss, J. G. (1926). The validity of the medical examiner's rating. *Am. J. Publ. Health, 16*, 980-987.

Bloch, M. (2004). *F.M. The life of Frederick Matthias Alexander: Founder of the Alexander technique*. New York, NY: Bantam Books.

Blumchen, G., Roskamm, H., and Reindell, H. (1966). Herzvolumen und kõrperliche Leistungsfähigkeit (heart volume and bodily performance). *Kreisslaufforschung, 55*, 1012-1016.

Bobrick, B. (2012). *A Passion for Victory: The Story of the Olympics in Ancient and Early Modern Times*. New York, NY: Random House Digital.

Bock, A. V., Vancaulaert, C., Dill, D. B., Fölling, A., and Hurxthal, L. M. (1928). Studies in muscular activity. III. Dynamical changes occurring in man at work. *J. Physiol., 66*, 136-161

Bohnenkamp, H., and Ernst, H. W. (1931). Untersuchungen zu den Grundlagen des Energie- und Stoffwechsels. I. Mitteilung. Über die Strahlungsverluste des Menschen. Das energetische 0berflächengesetz (Studies on the basics of energy and metabolism. On the radiation losses of man. The over surface law). *Pflüg. Arch. ges. Physiol., 228*, 40-62.

Boigey, M. (1917). *L'elevage humain: Formation du corps, éducation physique*. Paris, France: Payot.

Boigey, M. (1923). *Manuel scientifique d'EP (Scientific manual of physical exercise)*. Paris, France: Masson.

Bornmann, R. (1992). Dr. Behnke, founder of UHMS, dies. *Pressure, newsletter of the Undersea and Hyperbaric Medical Society, 21*, 1-4.

Bosco, C., Luhtanen, P., and Komi, P. V. (1983). A simple method for measurement of mechanical power in jumping. *Eur. J. Appl. Physiol.,, 50*, 273-282.

Boyko, J. (2010). *Bennett: The Rebel Who Challenged And Changed A Nation*. Toronto, ON: Key Porter Books.

Brendon, P. (1984). *Winston Churchill: a biography*. New York, NY: Harper & Row.

Brera, G. (1995). *Le Géant et la Lime*. Vicenza, Italy: Ed. Campagnolo.

British Journal of Sports Medicine (1995). Dr John G P Williams, born 15 September 1932, died 18 July 1995: a pioneer of British sports medicine and soft tissue injury. *Br. J. Sports Med. , 29*, 220-222.

Broadfoot, B. (1997). *Ten lost years, 1929-1939: memories of Canadians who survived the depression*. Toronto, ON: McLelland & Stewart.

Brookshire, J. H. (1995). *Clement Attlee*. Manchester, UK: Manchester University Press.

Brouha, L. (1943). The step test: a simple method of measuring physical fitness for muscular work in young men *Res. Quart., 14*, 31-36.

Brown, R. C. (1975). *Robert Laird Borden. A Biography*. Toronto, ON: Macmillan.

Brozek, J. (1965). *Human body composition. Approaches and applications*. Oxford, UK: Pergamon Press.

Brozek, J., Grande, F., Anderson, T., and Keys, A. (1963). Densitometric analysis of body composition: revision of some quantitative assumptions. *Ann. N.Y. Acad. Sci. , 110*, 113-140.

Brozek, J., Mori, H., and keys, A. (1958). Estimation of total body fat from Roentgenograms *Science, 128*, 901.

Buchan, J. (1940). *Memory Hold-the-door*. London, UK: Hodder & Stoughton.

Caine, A. B., and Collins, E. V. (1926). Testing draft horses. *Iowa Exp. Sta. Bull. 240*.

Campbell, C. S., and Smith, G. J. (2003). Gambling in Canada- From vice to disease to responsibility; a negotiated history. *Can. Soc. Hist. Med. , 20*, 121-149.

Campbell, W. R., and Pohndorf, R. H. (1961). Physical fitness of British and United States children. In L. A. Larson (Ed.), *Health & fitness in the modern world*. Chicago, IL: Athletic Institute.

Canadian Association for Physical Education and Recreation. (1966). *Fitness Performance Manual*. Toronto, ON: Canadian Association for Physical Education and Recreation.

Carter, J. E. L., and Heath, E. H. (1980). *Somatotyping- development and applications* Cambridge, UK: Cambridge University Press.

Casper, H. (1925). Veranderung des weissen Blutbildes nach dem 100m Lauf bei Frau (Changes in white cell concentration in women after running 100 meters). *Zeit. Gesamte Phys. Therap., 30,* 5-14.

Chalmers, T. C., Eckhardt, R. D., Reynolds, W. E., Cigarroa, J. G., Deane, N., Reifenstein, R. W., Smith, C. W., and Davidson, C. S. (1955). The treatment of acute infectious hepatitis; controlled studies of the effects of diet, rest, and physical reconditioning on the acute course of the disease and on the incidence of relapses and residual abnormalities. *J. Clin. Invest.,34,* 1163-1235.

Clarke, D. H. (1973). *Muscle strength and endurance in man*. Englewood Cliffs, NJ: Prentice-Hall.

Clarke, H. H. (1972). Physical activity and coronary heart disease. *Physical Fitness*

Research Digest (President's Council on Fitness), 9, 1-25.

Colton, J. G. (1987). *Léon Blum, humanist in politics*. Durham, NC: Duke University Press.

Cooper, K. H. (1968a). *Aerobics* New York, NY: Evans.

Cooper, K. H. (1968b). A means of assessing maximal oxygen intake. Correlation between field and treadmill testing. *JAMA, 203*, 201-204.

Cotton, F. S., and Dill, D. B. (1935). On the relationship between the heart rate during exercise and that of the immediate post-exercise period *Am. J. Physiol., 111*, 554-558.

Coulter, W. H. (1953). U.S.A. Patent No. 2,656,508.

Council of Europe.(1964). *Doping of athletes: A European Survey*. Strasbourg, France Council of Europe.

Couplet, P., Alemand, L.-A., Boym, M., Hervieu, J. P., and Charvys, P. (1671). *Les secrets de la medecine des Chinois: consistant en la parfaite connoissance du pouls (The medical secrets of the Chinese: consisting of knowledge of the pulse)*. Grenoble, France: Philippe Charvys.

Cowan, J. (1952). *Canada's Governors General* Toronto, ON: York Publishing Co.

Crampton, C. W. (1905). A test of condition: Preliminary Report. *Medical News, 87,* 529-535.

Crisell, A. (2002). *Introductory history of British broadcasting*. Abingdon, Oxford, UK: Routledge.

Crozier, R. C. (1968). *Traditional medicine in modern China: science, nationalism, and the tensions of cultural change*. Cambridge, Mass.: Harvard University Press.

Cumming, G. R., and Keynes, R. (1967). A fitness performance test for school children and its correlation with physical working capacity and maximal oxygen uptake. *Can. Med. Assoc. J. , 96*, 1262-1269.

Cundiff, D. E., and Corbun, C. B. (1969). Some observations on selected electrophysical components of the resting cardiac cycles of world championship wrestlers. In B. D. Franks (Ed.), *Exercise and Fitness* (pp. 107-116). Chicago, IL: Athletic Institute.

Cureton, T. K. (1947). *Physical fitness appraisal and guidance*. St. Louis, MO: C.V. Mosby.

Dalcroze, E. (2007). *The eurhythmics of Jacques Dalcroze*. Rockville, MD: Wildside Press.

Damez, M. K., Dawson, P. M., Mathis, D., and Murray, M. (1926). Cardiovascular reactions in athletic and non-athletic girls. *JAMA, 86*, 1420-1422.

Dawson, S. (2007). Working class consumers and the campaign for holidays with pay. *Twenthieth Cent. Brit. Hist., 18*, 277-305.

de Coubertin, P. (1922). *Pédagogie sportive (Sport pedagogy)*. Paris, France: Vrin.

de Grazia, V. (1981). *The Culture of Consent: Mass Organizations of Leisure in Fascist Italy*. Canbridge, UK: Cambridge University Press.

de Lapouge, G. V. (1899). *L'Aryen: son rôle social (The social role of the Aryan)*. Paris, France: A. Fontemoing.

de Mondenard, J.-P. (2000). *Dopage : L'imposture des performances (Doping- imposture in performance)*. Wilmette, IL: Chiron.

Dean, J. W. (2004). *Warren G. Harding.* New York, NY: Macmillan.

Di Donato, M. (1985). L'evoluzione storica della formazione del personale insegnante di educazione fisica in Italia (Historical development of the teaching of physical education instructors in Italy). *Alcmeone (Rome), 5-6*, 179.

Dill, D. B. (1963). Historical introduction: Personal reminiscences. *Pediatrics 32*, 653-655.

Dimeo, P. (2007). *A History of Drug Use in Sport 1876-1976: Beyond Good and Evil*. London, UK: Taylor & Francis.

Diorectorate de l'Infanterie de France, (1919). *Projet de règlement général d'éducation physique*. Paris, France: Imprimerie Nationale.

Dittrich, W., and Gohde, W. (1969). Impulsfluoremetrie bei Einzelzellen in Suspensionen [Impulse fluorometry of single cells in suspension]. *Z.Naturforsch (B) e, 24* 360-361

Douglas, C. G. (1911). A method for determining the total respiratory exchange in man. *J. Physiol., 42*, 1p-2p.

Douglas, C. G. (1956). The development of experimental methods for determining the energy of man. *Pro. Nutr. Soc., 15*, 72-77.

Drake, B. (1933). Starvation in the Midst of Plenty: A New Plan for the State Feeding of School Children. *Fabian Tract no 240, December 1933*.

Drake, V., Jones, G., Brown, J. R., and Shephard, R. J. (1968). Fitness performance tests and their relationship to maximum oxygen uptake. *Can. Med. Assoc. J. , 99*, 844-848.

Dùner, H., and Pernow, B. (1958). Histamine and leukocytes in blood during muscular work in man. *Scand. J. Lab. Clin. Invest., 10*, 394-396.

Durnin, J. V. G. A., and Passmore, R. (1967). *Energy, work and leisure*. London, UK: Heinemann.

Durnin, J. V. G. A., and Womersley, J. H. (1974). Body fat assessed from total body density and its estimation from skinfold thickness: measurements on 481 men and women aged from 16 to 72 years. *Br. J. Nutr. , 44*, 275-286.

Edwards, D. A. W., Hammond, W. H., Healy, M. J. R., Tanner, J. M., and Whitehouse, R. H. (1955). Design and accuracy of calipers for measuring subcutaneous tissue thickness. *Br. J. Nutr , 2*, 133-143.

Eichner, R. E. (1997). Ergogenic aids: what athletes are using and why. *Phys. Sportsmed, 25 (4)*, 70-83.

Eisenmann, J. C., and Malina, R. M. (2000). Body size and endurance performance. In R. J. Shephard and P.-O. Åstrand (Eds.), *Endurance in Sport (2nd ed),* (pp. 37-51). Oxford, UK: Blackwell Science.

Ernst, E. (2004). Anthroposophical medicine: A systematic review of randomised clinical trials. *Wien. Klin. Wschr., 116*, 128-130.

Ernst, E. (2006). Acupuncture - a critical analysis. *J. Int. Med., 259*, 125-137.

Fair, J. D. (1993). Isometrics or Steroids? Exploring new frontiers of strength in the early 1960s. *J. Sport Hist., 20,* 1-24.

Feldenkrais, M. (1981). *The Elusive Obvious*. Cupertino, CA: Meta Publications.

Firstbrook, P. L. (1999). *Lost on Everest: The search for Mallory and Irvine*. London, UK: BBC Worldwide.

Flack, M. (1920). *The medical and surgical aspects of aviation.* Oxford, UK: Oxford University Press

Flöistrup, H., Swartz, J., Bergström, A., Alm JS, Scheynius A, van Hage M, Waser M, Braun-Fahrländer C, Schram-Bijkerk D, Huber M, Zutavern A, von Mutius E, Ublagger E, Riedler J, Michaels KB, Pershagen G; Parsifal Study Group. (2006). Allergic disease and sensitization in Steiner school children. *J. Allergy Clin. Immunol. , 117*, 59-66.

Fodor, K. (2004). *Hannah and Martin*. New York, NY: Dramatist's Play Service.

Foster, W. L. (1914). A test of physical efficiency. *Am. Phys. Ed. Rev, 19*, 632-636.

Fotheringham, W. (2002). *Put Me Back on My Bike: In Search of Tom Simpson*. New York, NY: Random House.

Fox, R. F. (1917). Demonstration of the mensuration apparatus in use at the Red Cross Clinic for the physical treatment of officers. *Proc. Roy. Soc. Med., 10*, 63-69.

Frank, O. (1899). Die Grundform des arteriellen Pulses (the waveform of the arterial pulse). *Z für Biol., 37*, 483-586.

Franke, W. W., and Berendonk, B. (1997). Hormonal doping and androgenization of athletes: a secret program of the German Democratic Republic. *Clin. Chem., 43*, 1262-1279.

Franklin, B. A. (1993). Dr. Herman Hellerstein, world-renowned cardiologist. *J. Cardiopulm. Rehabil., 13*, 379-380.

Franks, B. D. (1969). Effects of different types and amounts of training on selected fitness measures. In B. D. Franks (Ed.), *Exercise and Fitness* (pp. 139-160). Chicago, IL: Athletic Institute.

Friedel, F. (1990). *Franklin D. Roosevelt: A rendezvous with destiny*. New York, NY: Hachette Digital.

Fulwyler, M. J. (1965). Electronic separation of biologicl cells by volume. *Science, 150* 910-911.

Gärtner, G. (1887). Ueber die therapeutische Verwendung der Muskelarbeit und einen neuen Apparat zu ihrer Dosirung (Concerning the therapeutic application of muscular work and a new device for measuring it). *Wien. Med. Blätter, 10*, 1554-1582.

Gärtner, G. (1890). *Ergostat (patent)*. Vienna, Austria: Waldek, Wagner & Benda.

Good, J. M., Gregory, O., and Bosworth, N. (1819). *Pantologia. A new (cabinet) encyclopedia*. London, UK: J. Walker.

Gottheiner, V. (1960). *Herzinfarkt und sport (myocardial infarction and sport).* Paper presented at the Sports Medical Symposium of 17th Olympic Games, Rome (Cited by Gottheiner, 1968).

Gottheiner, V. (1968). Long-range strenuous sports training for cardiac reconditioning and rehabilitation. *Am. J. Cardiol. , 22*, 426-435.

Graham, R. (1965). *Arthur Meighen. A biography.* . Toronto, ON: Clarke, Irwin.

Grassi, A., and Hearh, G. (1982). *The Magic Triangle: a short history of the world youth hostel movement*. Welwyn Garden City, UK: International Youth Hostel Federation.

Grundstein, A. J., Ramseyer, C., Zhao, F., Pesses, J. L., Akers, P., Qureshi, A., Becker, L., Knox, J. A., and Petro, M. (2012). A retrospective analysis of American football hyperthermia deaths in the United States. *Int. J. Biometeorol., 56*, 11-20.

Hager, T. (2006). *The Demon Under the Microscope: From Battlefield Hospitals to Nazi Labs, One Doctor's Heroic Search for the World's First Miracle Drug*. New York, NY: Random House Digital.

Haldane, J. B. S., and Priestley, D. G. (1935). *Respiration*. Oxford, UK: Clarendon Press.

Haldane, J. S. (1918). *Methods of air analysis*. London, UK: Charles Griffin.

Hall, R. (1977). *Passionate Crusader*. San Diego, CA: Harcourt, Brace, Jovanovich.

Hall, S. S. (2006). *Size matters: How height affects the health, happiness and success of boys-and the men they become*. Boston, MA: Houghton Mifflin Harcourt.

Hand, J. G. (1938). A compact pendulum goniometer. *J. Bone Joint Surg., 20*, 494-495.

Hanriot, M., and Richet, C. (1887). Nouveau procédé de dosage de l'acide cabonique expiré et de l'oxygène absorbé dans les actes respiratoires (New experiments on the quantities of expired carbon dioxide and oxygen absorption during respiration). *C.R. Acad, Sci.,, Paris, 104*, 435-437.

Hardy, A. (1992). Rickets and the Rest: Child-care, Diet and the Infectious Children's Diseases. *Soc. Hist. Med., 5*, 389-412.

Hargreaves, E. R. (1948). Poliomyelitis: Effect of exertion during the paralytic stage. *BMJ., 2* 1021-1022.

Haslam, D. W., and James, W. P. (2005). Obesity. *Lancet, 366*, 1197-1209.

Heberden, W. (1772). Some account of a disorder of the breast. *Med. Trans. Roy. Coll. Phys., 2*, 59-67.

Hébert, G. (1921). *Muscle et beauté plastique: l'éducation physique féminine (Muscle and plastic beauty:female physical; education)*. Paris, France: Libraire Viubert.

Hellerstein, H. K., Hornsten, T. R., Goldbarg, A. N., Burlando, A. G., Friedman, E. H., Hirsch, E. Z., and Marik, S. (1967). The influence of active conditioning upon subjects with coronary artery disease. A progress report. *Can. Med. Assoc. J. , 96*, 901-903.

Herbst, R. (1928). Der Gasstoffwechsel als Maß der körperlichen Leistungsfähigkeit. I. Die Bestimmung des Sauerstoffaufnahmevermögens beim Gesunden (The gas metabolism as a measure of physical fitness. I. The determination of oxygen uptake in healthy people). *Dtsch. Arch. Klin. Med., 162*, 33-50.

Hermanssen, J. (1933). Untersuchungen über die maximale Ventilationsgrôsse (Atemgrenzwert)(Studies on the maximum ventilatory volume [breathing limit]). *Z. Ges, exp. Med., 90*, 130-137.

Herxheimer, H. (1929). Untersuchungen über die Änderung der Herzgrosse unter dem Einfluss bestimmter Sportarten (Studies on the change in heart size under the influence of various sports). *Z. klin. Med., 3*, 376-393.

Herxheimer, H. (1933). *Grundriss der Sportmedizin (Basics of Sports Medicine)*. Stuttgart, Germany: Thieme.

Hicks, C. D. (1960). *An evaluation of the Barach Index as a measure of cardiorespiratory fitness*. Toledo, OH: University of Toledo.

Hill, A. V. (1925). *Muscular activity*. Baltimore, MD: Williams and Wilkins.

Hill, A. V., Long, C.H.N. and Lupton, H. (1924). Muscular exercise, lactic acid and the supply and utilisation of oxygen: parts VII-VIII. *Proc. Roy. Soc, B , 9,7* 155-176

Hill, L. (1895). The influence of the force of gravity on the circulation of the blood. *J. Physiol., 18*, 15-53.

Hirn, G. A. (1858). *Recherches sur l'équivalent mécanique de la chaleur: présentées a la Société de physique de Berlin (Research on the mechanical equivalent of heat: Presented to the Society of Physics, Berlin)*. Colmar, Alsace: Bureau de la Revue d'Alsace.

Hirsch, C. (1899). Ũber die Beziehungen zwischen dem Herzmuskel und der Körpermuskulatur und über sein Verhalten bei Herzhypertrophie (on the relationship between the heart muscle and the muscles of the body and on its

behavior in cardiac hypertrophy). *Dtsch. Arch. Klin. Med , 64*, 597-634.

Hitler, A. (1925/2010). *Mein Kampf (*Translation). Bottom of the H ill Publishing..

Hobby, G. (1985). *Penicillin: meeting the challenge*. New Haven, Conn: Yale University Press.

Hoberman, J. (1992). *Mortal engines*. New York, NY: Free Press.

Hoberman, J. M., and Yesalis, C. E. (1995). The history of synthetic testosterone. *Sci. American, 272*, 76-81.

Hollman, W. (1963). *Höchst und Dauerleistungsfahigkeit des Sportlers* (maximum continuous power and ability of the athlete). Munich, Germany: J.A. Barth.

Hollmann, W. (1987). Übung Hypertonie: historisch, physiologische und klinische Aspekte der Ergometrie (Exercise hypertension: historical, physiologic and clinical aspects of ergometry). *Herz, 12*, 83-98.

Hollmann, W., and Prinz, J. P. (1997). Ergospirometry and its history. *Sports Med., 23*, 93-105.

Holmgren, A. (1967). Vaso-regulatory asthenia. *Can. Med. Ass. J., 96*, 853.

Hoogerhof, S. (1929). Elektrokardiographische Untersuchungen der Amsterdamer Olympiadekampfer (Electrocardiographic research on Amsterdam Olympic participants). *Arbeitsphysiol., 2*, 61-75.

Horstmann, D. M. (1950). Acute poliomyelitis. Relation of physical activity to the time of onset and to the course of the disease *JAMA., 142,* 236-239

Horton, R. (1995). Georges Canguilhem: philosopher of disease. *J. Roy. Soc. Med., 88*, 316-319

Horvath, S. M., and Horvath, E. C. (1973). *The Harvard Fatigue Laboratory: Its history and contributions*. Englewood Cliffs, NJ: Prentice-Hall.

Howell, M. L., and MacNab, R. B. J. (1968). *The physical work capacity of Canadian children 7-17 years*. Ottawa, ON.: Canadian Association of Health, Physical Education and Recreation.

Hunt, G. S., and Pembrey, M. S. (1921). Tests for physical efficiency. *Guy's Hosp. Rept., 71*, 415-428.

International Labour Organisation. (1992). *The ILO and the elderly*. Geneva, Switzerland: International Labor Organization.

Jackson, D. (1953). *A brief history of three schools*. Toronto, ON: University of Toronto Press.

Jenkins, P. (1997). *A History of the United States*. New York, NY: St Martin's Press.

Jokl, E., and Jokl, P. (1968). *The physiological basis of athletic records*. Springfield, IL: C.C. Thomas.

Jongbloed, J., and Noyons, A. K. M. (1938). Die Bestimmung des wahren Volumens und des spezifischen Gewichtes vom Menschen mittels Luftdruckveränderung (The estimation of the true volumes and the specific weight of men through variations in air pressure). *Pflüg. Archiv. ges. Physiol., 240*, 197-202.

Jouaret, J.-M. (2012). *La fédération des sections sportives des patronages catholiques (1898-1998): Que sont les patrons devenus? (The federation of sports sections of Catholic patronage (1898-1998): Who are the bosses now?)* Paris, France: Editions L'Harmattan.

Kalache, A. (1991). Aging in developing countries. In M. S. J. Pathy (Ed.), *Principles and practice of geriatric medicine, 2nd ed.* (pp. 1517-1528). Chichester, Sussex, UK: Wiley.

Kallfelz, I. (1962). *Die apnoische Pause. Untersuchungen über ihre Beziehungen zum Sauerstoffmangel-Belastungstest. (The apneic pause. Studies on its relationship to the oxygen deficiency stress test)*. Porz-Wahn, Rheinland, Germany: Zentrale für wissenschaftliches Berichtwesen der Deutschen Versuchanstalt für Luft- und Raumfahrt (Centre for Scientific Reporting of the German Institute for Aerospace).

Kalm, L., and Semba, R. (2005). They starved so that others be better fed: remembering Ancel Keys and the Minnesota experiment. *J. Nutr., 135*, 1347-1352.

Karpovich, P., and Karpovich, G. P. (1959). Electrogoniometer: A new device for study of joints in action. *Fed. Proc. , 18*, 79.

Karpovich, P. V. (1935). The effect of basketball, wrestling and swimming upon white blood corpuscles. *Res. Quart., 6,* 42-48.

Karvonen, M. J., Klemola, H., Virkajarvi, J., and Kekkonen, A. (1974). Longevity of endurance skiers. *Med. Sci. Sports, 6*, 49-61.

Kater, M. H. (2006). *Hitler Youth*. Cambridge, MA: Harvard University Press.

Katzenstein, G. (1891). Ueber die Einwirkung der Muskelthätigkeit auf den Stoffverbrauch des Menschen. (On the influence of muscular work on the metabolism of humans). *Arch. ges. Physiol., 49*, 330-404.

Katzmarzyk, P. (2002). The Canadian obesity epidemic: An historical perspective. *Obes. Res., 10*, 66-74.

Kavaler, L. (1967). *Mushrooms, moulds and miracles: the strange realm of fungi*. London, UK: Harrap.

Kennedy, J. F. (1960). The soft American. *Sports Illustrated, 13 (26)*, 15-17.

Kennedy, J. F. (1962). The vigor we need. *Sports Illustrated, 17 (3)*, 12-15.

Keys, A. (1980). *Seven Countries: A Multivariate Analysis of Death and Coronary Heart Disease*. Cambridge, MA: Harvard University Press.

Kidd, B. (1996). *The struggle for Canadian Sport*. Toronto, ON: University of Toronto Press.

Kingston, W. (2004). Streptomycin, Schatz v. Waksman, and the balance of credit for discovery. *J. Hist. Med. Allied Sci., 59*, 441-462.

Kirkpatrick, J. E. (1957). Evaluation of grip loss; a factor of permanent disability in California. *Industr. Med. Surg., 26*, 285-289.

Knipping, H. W. (1929). Die Untersuchung der Ökonomie von Muskelarbeit bei Gesunden und Kranken (The economy of muscle work in healthy and sick persons). *Z. ges. Exp. Med., 66*, 517-534.

Knuttgen, H. G. (1961). Comparison of Danish and American school children. *Res. Quart., 32*, 190-196.

Kokkinos, P. (2010). *Physical activity and cardiovascular disease prevention*. Sudbury, MA: Jones & Bartlett.

Koon, T. H. (1985). *Believe, Obey, Fight: Political Socialization of Youth in Fascist Italy. 1922-1945.* Chapel Hill, NC: University of North Carolina Press

Krakauer, J. (1997). *Into thin air: A personal account of the Mt. Everest disaster*. New York, NY: Random House Digital.

Kraus, H., and Hirschland, R. (1954). Minimum muscular fitness tests in school children. *Res. Quart,, 25*, 178-188.

Kremeneik, M., Onodera, S., Nagao, M., Yuzuki, O., and Yoneta, S. (2006). A historical timeline of doping in the Olympics (Part I: 1896-1968). *Kawasaki J. Med. Welfare, 12*, 19-28.

Kretschmer, E. (1921). *Körperbau und Karakter (Body build and character)*. Berlin, Germany: Springer.

Kretschmer, E., and Enke, W. (1936). *Die Personlichkeit der Athletiker*. (The persdonality of athletes). Leipzig, Germany: Thieme.

Krinkler, D. M., and Zilberg, B. (1966). Activity and hepatitis. *Lancet, 2,* 1046-1047

Krogh, A. (1913). A bicycle ergometer and respiration apparatus for the experimental study of muscular work. *Skand. Arch. Physiol., 33*, 375-380.

Krogh, A., and Lindhard, J. (1920). The relative value of fat and carbohydrate as sources of muscular energy. *Biochem. J., 14*, 290-363

Külbs, F. (1912). Ueber den Einfluss der Bewegung auf den wachsenden und erwachsenden Organismus (On the influence of movement in growing and adult organisms). *Dtsch. Med. Wschr., 38*, 1916-1920.

La Cava, G. (1969). The "Fédération Internationale de Médecine Sportive" (F.I.M.S.). *J. Sports Med. Phys. Fitness, 9*, 139-141.

Laberge, M. (2000). *Le gout de bonheur: Gabrielle*. Montreal, QC: Les Ėditions du Borėal.

Lamb, R. (1995). *The MacMillan Years, 1957-1963: The emerging truth*. London, UK: John Murray.

Langevin, A. (1953). *Poussière sur la ville*. (Dust over the town). Montreal, QC: Cercle du livre de France.

LaPierre, T. A., and Hughes, M. E. (2009). Population aging in Canada and the United States. In P. Uhlenberg, (Ed.), *International handbook of population aging* (pp. 191-228). New York, NY: Springer.

Larrabee, R. C. (1902). Leukocytosis after violent exercise. *J. Med. Res., 7,* 76-82

Larson, L. A. (1974). *Fitness, health, and work capacity: international standards for assessment*. New York, NY: Macmillan.

Larson, L. A. (1976). *Foundations of Physical Activity: Applications As Disciplines and Professions*. New York, NY: Macmillan.

Lawson-Wood, D. (1959). *Chinese system of healing: An Introduction to Acupuncture*. Rustington, Sussex, UK: Health Science Press.

Leacock, S. (1923). *Why I refuse to play golf. In: Over the Footlights and other fantasies.* London, UK: John Lane/Bodley Head.

Leacock, S., and Nimmo, B. (1942). *My Remarkable Uncle and other sketches*. New York, NY: Dodd Mead & Company.

Lee, A., Copas, J. B., Henmi, M., Gin, T., and Chung, R. C. (2006). Publication bias affected the estimate of postoperative nausea in an acupoint stimulation systematic review. *J. Clin. Epidemiol. , 59*, 980-983.

Léger, L., and Boucher, R. (1980). An indirect continuous running multistage field test: the Université de Montréal track test. *Can. J. Appl. Sport Sci., 5*, 77-84.

Leighton, J. (1959). An instrument and technic for the measurement of range of joint motion *Arch. Phys. Med. Rehabil., 36*, 571-578.

Lenehan, P. (2003). *Anabolic Steroids: And other performance-enhancing drugs*. Boca Raton, FL: CRC Press.

Lester, P. M. (2010). *On floods and photo ops : how Herbert Hoover and George W. Bush exploited catastrophes*. Jackson, MI: University Press of Mississippi.

Levine, S. A. (1944). Some harmful effects of recumbency in treatment of heart disease. *JAMA, 126*, 80-84.

Levinson, S. O., Milzer, A., and Lewin, P. (1945). Effect of fatigue, chilling, and mechanical trauma on resistance to experimental poliomyelitis. *Am. J. Hyg., 42*, 204-213.

Lewis, T. (1933). *The soldier's heart and the effort syndrome*. New York, NY: P.B. Hoeber.

Little, P. (2008). Randomised controlled trial of Alexander technique lessons, exercise, and massage (ATEAM) for chronic and recurrent back pain. *BMJ., 337:a2656*.

Lorell, B., and Grossman, W. (1986). Dynamic and isometric exercise during catheterization In W. Grossman (Ed.), *Cardiac catheterization and angiography*. Philadelphia, PA: Lea & Febiger.

Lovesey, P. (2001). Conan Doyle and the Olympics. *J. Olympic Hist., 10*, 6-9.

Mackenzie, J. (1919). Discussion on the soldier's heart *Proc. Roy. Soc. Med., 9*, 60.

Madsen, M. V., Gotzsche, P. C., and Hrobjartsson, A. (2009). Acupuncture treatment for pain: systematic review of randomised clinical trials with acupuncture, placebo acupuncture, and no acupuncture groups. *BMJ., 338, a3115*.

Magnus-Levy, A. (1893). Über die Grösse des respiratorischen Gaswechsels unter dem Einfluss der Nahrungsaufnahme (On the size of the respiratory gas exchange as affected by food intake). *Pflüg. Archiv. ges. Physiol., 55*, 1-126.

Maher, C. G. (2004). Effective physical treatment for chronic low back pain. *Orthop. Clin. North Am., 35*, 57-64.

Mandell, R. D. (1987). *The Nazi Olympics*. Urbana, IL: University of Illinois Press.

Marchand, R. (1945/46). *L'éducation physique moderne dans l'enseignement du 1er degré (Modern physical education in undergraduate education)*. Paris, France: J. Vautrain.

Margoshes, D. (1999). *Tommy Douglas: building the new society*. Montreal, QC: XYZ Publisher.

Marinetti, F. T., Berghaus, G., and Thompson, D. (2008). *Critical Writings*. New York, NY: Farrar, Strauss & Giroux/Macmillan.

Master, A. M. (1969). The Master two-step test. Some historical highlights and current concepts. *J. S. Carol. Med. Assoc. , 65 (Suppl 1)*, 12-17.

Maughan, W. S. (1952). *The Complete Short Stories of W. Somerset Maugham: II. The World Over*. Garden City, NY: Doubleday.

Mayer, J. (1960). Exercise and weight contol. In J. W.E (Ed.), *Science and Medicine of Exercise and Sport* (pp. 301-310). New York, NY: Harper & Row.

McArdle, W. D., Zwiren, L., and Magel, J. R. (1969). Validity of the post-exercise heart rate as a means of estimating heart rate during work of varying intensities *Res. Quart., 40*, 523-528

McCloy, C. H. (1931). A cardiovascular rating of present condition. *Arbeitsphysiol., 4*, 97-108.

McGill, J. S. (1980). *The joy of effort: A biography of R. Tait McKenzie.* Oshawa, ON: Clay Publishing.

McIntosh, P. C. (1971). *Sport in society.* London, UK: C.A. Watts.

McKenzie, R. T. (1915). *Exercise in education and medicine*. Philadelphia, PA: W.B. Saunders.

McQuarrie, F. A. E. (2010). The struggle over worker leisure: an analysis of the history of the workers' sports association in Canada. *Can. J. Admin. Sci., 27*, 391-402

Medical Research Council. (1922). *Report of the Medical Research Council, 1921-22*. London, UK: H.M. Stationery Office.

Metcalfe, N. H. (2011). Sir Geoffrey Marshall (1887-1992). *J. Med. Biogr., 19*, 10-14.

Mikawa, K., Yano, Y., and Senjyu, H. (2012). Development of a field test for evaluating aerobic fitness. *Int. J. Sports Med., 33*, 346-350

Millahn, H. P., and Helke, H. (1968). Über beziehungen zwischen der Herzfrequenz während Arbeitsleistung und in der Erholungsphase in Abhangigkeit von der Leistung und der Erholungsdauer (About relationships between the heart rate during labor and during the recovery phase as a function of power and the recovery time). *Int. Z. angew. Physiol., 26*, 245-257.

Moldovan, A. (1934). Photoelectric technique for the counting of microscopical cells. *Science, 80*, 188-189

Møller, V. (2010). Knud Enemark Jensen's death during the 1960 Rome Olympics: A search for truth? *Sport in History, 25*, 452-471.

Monge, C. M., and Monge, C. C. (1966). *High-Altitude Diseases. Mechanism and Management*. Springfield, IL: C.C. Thomas.

Montoye, H. J., Van Huss, W. D., Olson, H., Pierson, H. W., and Hudec, A. J. (1957). *Study of the longevity and morbidity of college athletes*. Ann Arbor, MI: Phi Epsilon Kappa Fraternity, Michigan State University.

Morgan, A. (1987). *J. Ramsay MacDonald*. Manchester, UK: Manchester University Press.

Morgan, K. (2006). *Ramsay MacDonald*. London, UK: Haus Publishing.

Morris, J. N. (1951). Recent history of coronary disease. *Lancet, (i)* 1-7.

Morris, J. N., Adams, C., Chave, S. P. N., Sirey, C., Epstein, L., and Sheehan, D. J. (1973). Vigorous exercise in leisure time and the incidence of coronary heart disease. *Lancet, 301*, 333-339.

Morris, J. N., Heady, J. A., and Raffle, P. A. (1956). Physique of London busmen: epidemiology of uniforms. *Lancet, 271,* 333-339.

Morris, J. N., Heady, J. A., Raffle, P. A., Roberts, C. G., and Parks, J. W. (1953). Coronary heart-disease and physical activity of work. *Lancet, 265*, 1053-1057.

Mosse, G. L. (2003). *Nazi culture intellectual, cultural and social life in the Third Reich*. Madison, WI: Univ. Wisconsin Press.

Mottram, D. R. (1996). *Drugs in sport*. London, UK: Taylor & Francis.

Müller, E. A. (1950). Ein Leistungs-Pulsindex als Mass der Leistungsfähigkeit (a power-pulse index as a measure of performance). *Arbeitsphysiol., 14*, 271-284.

Munting, R. (1996). *An economic and social history of gambling in Britain and the USA*. Manchester, UK: Manchester University Press.

Neville, P. (2004). *Mussolini*. Abingdon, Oxford, UK: Routledge.

Nicholls, D. (2000). *Adolf Hitler: A biographical companion*. Santa Barbara, CA: ABC-Clio

Nichols, E. E., and Spaeth, R. A. (1922). The relation between fatigue and suceptibility of guinea pigs to injections of type I pneumococcus. *Am. J. Hyg., 2*, 527-535.

Nieman, D. C. (1990). *Fitness and Sports Medicine: An Introduction*. Palo Alto, CA: Bull Publishing.

Niergarth, K. (2005). Youth againt Fascism. *Labour/Le Travail, 56*, 199-236.

Noakes, T., Mekler, J., and Pedoe, D. T. (2008). Jim Peters' collapse in the 1954 Vancouver Empire Games marathon. *S. Afr. Med. J., 98*, 596-600.

Oertel, M. J. (1891). *Allgemeine Therapie der Kreislauffstörungen (General treatment of circulating fluidized disorders).* Leipzig, Germany: Vogel.

Olafson, G. A. A. (1962). *The effects of an endurance exercise program on cardiovascular variables of a group of middle-aged men.* M.P.E. Thesis, Faculty of Physical Education, University of British Columbia, Vancouver, BC.

Orwell, G. (1937). *The Road to Wigan Pier*. London, UK: Victor Gollancz.

Paffenbarger, R. S., Laughlin, M. E., Gima, A. S., and Black, R. A. (1970). Work activity of longshoremen as related to death from coronary heart disease and stroke. *N. Engl. J. Med., 282 (20)*, 1109-1114.

Paffenbarger, R. S., Wing, A. L., and Hyde, R. T. (1978). Physical activity as an index of heart attack risk in college alumni. *Am. J. Epidemiol., 108*, 161-175.

Papanelopoulou, F. (2006). Gustave-Adolphe Hirn (1815-90): Engineering Thermodynamics

in Mid-Nineteenth-Century France. *Br. J. Hist. Sci., 39*, 231-254.

Pariente, R., and Lagorce, G. (2004). *La fabuleuse histoire des Jeux Olympiques (The fabulpous history of the Olympic Games)*. Geneva, Switzerland: Minerva.

Paull, J. (2011). Rudolf Steiner and the Oxford Conference: The Birth of Waldorf Education in Britain. *Eur. J. Educ. Stud., 3*, 53-66.

Peacock, T. B. (1865). *Valvular disease of the heart.* London, UK: Churchill.

Pett, L. B., and Ogilvie, G. F. (1956). The report on average Canadian heights, weights and skinfolds. *Hum. Biol., 28*, 177-188.

Phair, J. J., Carey, G. C. R., and Shephard, R. J. (1958). Measuring human reactions to air pollution. *J. Franklin Inst. Series, Monograph, 4*, 37-51.

Pickersgill, J. (2001). *Louis St. Laurent*. Toronto, ON: Fitzhenry & Whiteside.

Pilates, J. H., and Miller, J. W. (1945/2003). *Pilates' return to life through contrology*. Miami, FL: Pilates Method Alliance.

Pine, L. (2010). *Education in Nazi Germany*. London, UK: Berg Publishing.

Prendergast, H., Bannen, T., Erickson, T., and Honore, K. (2003). The toxic torch of the modern Olympic Games. *Vet. Hum. Toxicol., 45*, 97-102.

Pringle, P. (2012). Notebooks shed light on a discovery and a mentor's betrayal. *New York Times, June 11th 2012.*

Prout, W. (1813). On the quantity of carbonic acid gas emitted from the lungs during respiration at different times and under different circumstances. *Thomson's Ann. Philosoph., 2*, 328-342.

Pugh, L. G. C. E. (1962). Physiological and medical aspects of the Himalayan scientific and mountaineering expedition, 1960-61. *BMJ., 2*, 621-627.

Pugh, L. G. C. E. (1969). Athletes at altitude. Lessons of the 1968 Olympic Games. *Trans. Med. Soc. Lond., 85*, 76-83.

Pugh, L. G. C. E. (1972). Accidental hypothermia among hill walkers and climbers in Britain. In G. R. Cumming, D. Snidal and A. W. Taylor (Eds.), *Environmental effects on work performance*. Ottawa, ON: Canadian Association of Sport Sciences.

Pugh, L. G. C. E., Edholm, O. G., Fox, R. H., Wolff, S., Harvey, G. R., Hammond, W. H., Tanner, J.M., and Whitehouse, R. H. (1960). A physiological study of Channel swimming. *Clin. Sci., 19*, 257-273.

Revie, L. (2006). More than just boots! The eugenic and commercial concerns behind A. R. Kaufman's birth controlling activities. *Can. Bull. Med. Hist., 23*, 118-143.

Rice, E. A., Hutchinson, J. L., and Lee, M. (1958). *A Brief History of Physical Education*. New York, NY: The Rinal Press.

Richardson, P. J. S. (1948). *The history of English ballroom dancing (1900–1945)*. London, UK: Jenkins.

Richler, M. (1959). *The apprenticeship of Duddy Kravitz*. London, UK: Andre Deutsch.

Robinson, J. (2010). *Don't miss your life: Find more joy and fulfillment now*. Hoboken, NJ: Wiley.

Robinson, S. (1938). Experimental studies of physical fitness in relation to age. *Arbeitsphysiol., 10*, 251-323.

Rosslenbroich, B., Schmidt, S., and Mathiessen, P. F. (1994). Unconventional medicine in Germany: A report on the situation of research as basis for state research support. *Complementary Therapies in Medicine, 2*, 61-69.

Russell, R. W. (1947). Poliomyelitis. The pre-paralytic stage, and the effects of physical activity on the severity of the paralysis *BMJ.,ii*, 1023-1028

Russell, R. W. (1949). Paralytic poliomyelitis. The early symptoms and the effect of physical activity on the course of the disease *BMJ., i,* 465-471.

Rutter, P. M., Carpenter, B., Hill, S. S., and Lock, I. C. (2000). Varidase: the science behind the medicament. *J. Wound Care, 9*, 223-226.

Ryan, A. J., and Allman, F. L. (1974). *Sports Medicine*. New York, NY: Academic Press.

Ryhming, I. (1954). A modified Harvard step test for the evaluation of physical fitness. *Arbeitsphysiol., 15*, 235-250.

Sabin, A., Ramos-Alvarez, M., J., A.-A., Pelon, W., Michaels, R. H., Spigland, I., Koch, M. A., Barnes, J. M., and Rhim, J. S. (1960). Live, orally given poliovirus vaccine. Effects of rapid mass immunization on population under conditions of massive enteric infection with other viruses. *JAMA, 173*, 1521-1526.

Saltin, B. H., Larsen, H., Terrados, N., Bangsbo, J., Bak, T., Kim, C. K., Svedenhag, J., and Rolf, C. (1995). Aerobic exercise capacity at sea

level and at altitude in Kenyan boys, junior and senior runners, compared with Scandinavian runners. *Scand. J. Med. Sci. Sports, 5*, 209-221.

Sargent, D. A. (1921). The physical test of a man. *Am. Phys. Ed. Rev., 26*, 188-194.

Sass, E. J., Gottfried, G., and Sorem, A. (1996). *Polio's legacy: an oral history*. Washington, D.C: University Press of America.

Scharling, E. A. (1843). Versuche über die Quantität der, von einem Menschen in 24 Stunden ausgeathmeten, Kohlensäure (Research on the anount of carbon dioxide expired by a man in 24 hours). *Liebig's Ann. Chem. Pharm., 45*, 214-252.

Schieffer, K. (1907). Über Herzvergrößerung infolg Radfahren (about cardiac enlargement due to cycling). *Dtsch. Arch. Klin. Med., 89*, 604-625.

Schneider, E. C. (1920). A cardiovascular rating as a measure of fatigue and efficiency. *JAMA, 74*, 1507-1510.

Schneidman, N. N. *The Soviet Road to Olympus: Theory and Practice of Soviet Physical Culture and Sport*. Toronto, ON: Ontario Institute for Studies in Education.

Schrodt, B., Redmond, G., and Baka, R. (1980). *Sport Canadiana*. Edmonton, AL: Executive Sport Publications.

Schroeder, E. G., and Tuttle, W. W. (1931). The application of the pulse ratio test to efficiency in performing on gymnasium apparatus. The parallel bars. *Arbeitsphysiol., 4*, 443-452.

Schwartz, S. E. (2005). *Into the unknown: The remarkable life of Hans Kraus*. New York, NY: iUniverse.

Scott, R. A., Georgiades, E. W., Wilson, R. H., Goodwin, W. H., Wolde, B., and Pitsiladis, Y. P. (2003). Demographic characteristics of elite Ethiopian runners. *Med. Sci. Sports Exerc., 35*, 1727-1732.

Scott, V. T. (1924). Study of effects of daily exercise. *Military Surgeon, 55*, 334-336.

Self, R. C. (2006). *Neville Chamberlain: A Biography*. Farnham, Surrey, UK: Ashgate Publishing.

Seurin, P. (1949). *Vers une EP méthodique (Towards methodicval physical exercise)*. Bordeaux, France: Bière

Shaw, G. B. (1903). *Man and Superman*. Wesrminster, UK: Constable.

Shaw, G. B. (1913). *The Doctor's Dilemma*. London, UK: Constable.

Shaw, G. B. (1949). The Lysenko Muddle. *Labour Monthly* (January) also (abbreviated) with title "Behind the Lysenko Controversy", in Sat. Rev. Literature, April 16, 1949, p. 10.

Sheldon, W. H. (1963). *The varieties of human physique. An introduction to constitutional psychology.* New York, NY: Hafner.

Shephard, R., J. (1967a). Physical performance in Mexico City In R. Goddard (Ed.), *International Symposium on the effects of altitude on physical performance* (pp. 132-134). Chicago, IL: Athletic Institute.

Shephard, R., J. (1969). *Endurance Fitness*. Toronto, ON: University of Toronto Press.

Shephard, R., J. (1986a). *Economic benefits of enhanced fitness*. Champaign, IL: Human Kinetics.

Shephard, R. J. (1966). World standards of cardiorespiratory performance. *AMA Arch. Envir. Health, 13*, 664-672.

Shephard, R. J. (1967b). The prediction of maximum oxygen intake from post-exercise pulse readings *Int. Z. Angew. Physiol., 24*, 31-38

Shephard, R. J. (1974). What causes second wind? *Phys. Sportsmed., 2 (11)*, 36-42.

Shephard, R. J. (1978a). *The Fit Athlete*. Oxford, UK: Oxford University Press.

Shephard, R. J. (1986). *Fitness of a Nation: Lessons from the Canada Fitness Survey*. Basel, Switzerland: Karger.

Shephard, R. J. (1988). Adolphe Abrahams Memorial Lecture, 1988. Exercise and lifestyle change. *Br. J. Sports Med., 23*, 11-22.

Shephard, R. J. (2011). The developing understanding of human health and fitness. 1. Prehistory. *Health & Fitness Journal of Canada, 4 (4),* 3-19.

Shephard, R. J. (2011a). Is electrocardiogram screening of North American athletes now warranted? *Clin. J. Sports Med., 21*, 189-191.

Shephard, R. J. (2012a). The developing understanding of human health and fitness. 2. Early city life. *Health & Fitness Journal of Canada, 5 (1),* 27-46.

Shephard, R. J. (2012b). The developing understanding of human health and fitness: 3. The classical era. *Health & Fitness Journal of Canada, 5 (2),* 3-29.

Shephard, R. J. (2012c). The developing understanding of health and finess. 4.

Middle Ages. *Health & Fitness Journal of Canada , 5 (3),* 18-46.

Shephard, R. J. (2012d). The developing understanding of health and fitness: 5. The Renaissance. *Health & Fitness Journal of Canada, 5 (4),* 15-29.

Shephard, R. J. (2013a). The developing understanding of health and fitness: 6. The Enlightenment. *Health & Fitness Journal of Canada, 6 (1),* 82-118.

Shephard, R. J. (2013b). The developing understanding of health and fitness: 7. Victorian times. *Health & Fitness Journal of Canada, 6 (2),* 3-83.

Shephard, R. J., Allen, C., Bar-Or, O., Davies, C. T. M., Degré, S., Hedman, R., Ishii, K., Kaneko, M., LaCour, J. R., di Prampero, P. E., and Seliger, V. (1968c). The working capacity of Toronto school children *Can. Med. Ass. J., 100*, 560-566; 705-714.

Shephard, R. J., Allen, C., Benade, A. J. S., Davies, C. T. M., di Prampero, P. E., Hedman, R., Merriman, J. E., Myhre, K., and Simmons, R. (1968a). The maximum oxygen intake-an international reference standard of cardiorespiratory fitness. *Bull. W.H.O., 38*, 757-764.

Shephard, R. J., Allen, C., Benade, A. J. S., Davies, C. T. M., di Prampero, P. E., Hedman, R., Merriman, J. E., Myhre, K., and Simmons, R. (1968b). Standardization of submaximal exercise tests. *Bull. W.H.O., 38*, 765-776.

Shephard, R. J., and Rode, A. (1996). *The health consequences of 'modernization'*. Cambridge, UK: Cambridge University Press.

Siegelbaum, L., and Sokolov, A. (2004). *Stalinism as a way of life*. New Haven, Conn.: Yale University Press.

Simonson, E. (1928). Ein neuer Respirationsapparat (A new respiratory apparatus). *Arbeitsphysiol., 1*, 224-257.

Singh, M. H., Morgan, M. D., Scott, S., Walters, D., and Hardman, A. E. (1992). Development of a shuttle-walk test of disability in patients with chronic airways obstruction. *Thorax, 47*, 1019-1024.

Sjõstrand, T. (1960). Functional capacity and exercise tolerance in patients with impaired cardiovascular functiion. In American College of Chest Physicians (Eds.), *Clinical cardiopulmonary physiology*. New York, NY: Grune & Stratton.

Sjõstrand, T. (1947). Changes in respiratory organs of workmen at ore smelting works. *Acta Med. Scand., 128 (Suppl. 196)*, 687-699.

Sloan, A. (1966). Comparison of tests of physical fitness of student teachers. *Eur. J. Appl. Physiol., 23*, 24-33.

Sloan, A. W. (1963). Human physical fitness *S. Afr. J. Sci , 59*, 3-11

Smith, D. (1995). *Rogue Tory: The Life and Legend of John Diefenbaker*. Toronto, ON: Macfarlane Walter & Ross.

Smith, E. (1859). Experimental enquiries into the chemical and other phenomena of respiration and theiur modification by variousa agencies. *Phil. Soph. Trans. Roy. Soc. Lond.,149*, 681 (cited by Haldane, 1955).

Speck, C. (1892). *Physiologie die menschlichen Athmens, nach eigenen Untersuchungen. dargestellt (Physiology of human respiration asccording to personal observations)*. Leipzig, Germany: Vogel.

Speer, A. (1975). *Inside the Third Reich: A unique portrait of Hitler*. New York, NY: Avon.

Spirduso, W., and Eckert, H. (1988). *Physical activity and aging: The Academy Papers, 22.* Champaign, IL: Human Kinetics.

Steinhaus, A. H., Hoyt, L. A., and Rice, H. A. (1932). Studies on the physiology of exercise. X. The effects of running and swimming on the organ weight of growing dogs. *Am. J. Physiol. , 99*, 512-520.

Stokes, W. (1855). *Diseases of the heart and the aorta*. Philadelphia, PA: Lindsay & Blakiston.

Stopes, M. C. (1918). *Married Love, Or, Love in Marriage*. New York, NY: Critic and Guide Company.

Tanner, J. M. (1959). The measurement of body fat in man. *Proc. Nutr. Soc., 18*, 148-155.

Tanner, J. M., and Preece, M. A. (1989). *The physiology of human growth*. Cambridge, UK: Cambridge University Press

Taubman, W. (2004). *Krushchev: the man and his era*. New York, NY: W.W. Norton.

Taylor, A. (2006). *Bonar Law*. London, UK: Haus Publishing.

Taylor, H. L., Buskirk, E. R., and Henschel, A. (1955). Maximal oxygen intake as an objective measure of cardiorespiratory performance. *J. Appl. Physiol., 8*, 73-80.

Taylor, H. L., KLepetar, E., Keys, A., Parlin, W., Blackburn, H., and Puchner, T. (1962). Death rates among physically active employees of the railroad industry *Am. J. Publ. Health, 52,* 1697-1707.

Tissié, P. (1922). *L'éducation physique rationnelle*. Paris, France: Alcan

Tissot, J. (1904). Nouvelle méthode de mesure et d'inscription du débit et des mouvements respiratoires de l'homme et des animaux (new method of measuring and recording the tidal volume and respiratory movements of man and animals). *J. Physiol. Pathol. Gén. (Paris), 6*, 688-700.

Tittel, K., and Knuttgen, H. (1988). The development, activities and objectives of the International Federation of Sports Medicine. In A. Dirix, H. G. Knuttgen and K. Tittel (Eds.), *The Olympic Book of Sports Medicine*. Oxford, UK: Blackwell.

Trap, J., Barr, M., and Carlson, C. (1980). *Roller skating from start to finish*. Harmondsworth, England: Penguin Books.

Trevelyan, B., Smallman-Raynor, M., and Cliff, A. (2005). The spatial dynamics of poliomyelitis in the United States: From epidemic emergence to vaccine-induced retreat, 1910-1971. *Ann. Assoc. Am. Geogr., 95*, 269-293.

Trukhanovskiĭ, V. G. (1964). *Anthony Eden*. Moscow, Russia: Progress Publishers.

Tuttle, W. W. (1931). The use of the pulse-rate for rating physical efficiency. *Res. Quart., 2*, 5-17.

Ungerer, T. (1998). *Tomi: A childhood under the Nazis*. Boulder, CO: TomiCo.

Veblen, T. (1965). *The theory of the leisure class*. New York, NY: A.M. Kelley.

Vernon, J. The Ethics of Hunger and the Assembly of Society: The Techno-Politics of the School Meal in Britain. *Am. Hist. Rev., 110*, 693-725.

Vertinsky, P. (2007). Physique as destiny: William H. Sheldon, Barbara Honeyman Heath and the struggle for hegemony in the science of somatotyping. *Can. Bull. Med. Hist., 24*, 291-316.

von Pettenkofer, M., and Voit, C. Untersuchungen über den Stoffwechselverbrauch des normalen Menschen (Investigations on the metabolic consumption of normal men). *Z. Biol., 2*, 459-473.

von Laban, R. (1867). *Effort*. London, UK: Macdonald and Evans.

Waddington, I. (1996). The development of sports medicine. *Soc. Sport J., 13*, 176-196.

Wade, N. (1972). Anabolic steroids: Doctors denounce them but athletes aren't listening. *Science, 176*, 1399-1403.

Wasserman, K., and McIlroy, M. B. (1964). Detecting the threshold of anaerobic metabolism in cardiac patients during exercise. *Am. J. Cardiol., 14*, 844-852.

Welch, P. D. (1996). *History of American Physical Education and Sport* (2nd ed.). Springfield, IL: C.C. Thomas.

Wells, K. F., and Dillon, E. K. (1952). The sit and reach: a test of back and leg flexibility. *Res. Quart , 23*, 115-118.

West, J. T. (1973). Physical fitness, sport and the federal government 1909 to 1954. *Can. J. Hist. Sport Phys. Fitness, 4*, 26-42.

Wezler, K., and Böger, A. (1937). Ũber einem neuen Weg zur Bestimmung des absoluten Schlagvolumens des Herzens beim Menscheen auf Grund der Windkesseltheorie und seine experimentelle Prüfung (On a new way of estimating the absolute stroke volume of the heart in men on the basis of the Windkessel theory and its experimental proof). *Arch. exp. Path. Pharm., 184*, 482-505.

Wheeler, R. F. (1978). Organized Sport and Organized Labour: The Workers' Sports Movement. *J. Contemp. Hist., 13*, 191-210.

Whyte, A. G. (1926). *Stanley Baldwin: a biographical character study*. London, UK: Chapman & Hall.

Wicker, T. (2003). *Dwight D. Eisenhower.* Waterville, ME: Thorndike Press

Willgoose, C. E. (1961). *Evaluation in Health Education and Physical Education*. New York, NY: McGraw Hill.

Williams, J. (1973). Professor Paul Chailley-Bert (1890-1973) *Br. J. Sports Med., 7*, 12.

Williams, J. G. P. (1962). *Sports Medicine*. London, UK: Edward Arnold.

Williams, J. G. P. (1965). *Medical aspects of sport and physical fitness*. Oxford, UK: Pergamon Press.

Williams, N. (2009). The wise, for cure, on exercise depend": physical activity interventions in primary care in Wales. *Br. J. Sports Med., 43*, 106-108.

Woodland, L. (1980). *Dope: the use of drugs in sport*. Newton Abbot, Devon, UK: David & Charles.

Wordsworth, W. (1835). *A guide through the district of the lakes in the north of England with a description of the scenery, &c. for the use of tourists and residents, 5th ed.* Kendal, Westmoreland, UK: Hudson and Nicholson.

World Health Organisation. (2000). Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *WHO Tech. Rep. Ser., 894*, 1-253.

Wuest, D. A., and Bucher, C. A. (1995). *Foundations of Physical Education and Sport*. St. Louis, MO: Mosby.

Wyman, C. H. (1913). Thesis, YMCA International College, cited by J.H. McCurdy, the Physiology of Exercise, Philadelphia, PA: Lea & Febiger, 1828.

Zimmerman, E., Holst, C., and Sørensen, T. I. A. (2011). Morbidity, including fatal morbidity, throughout life in men entering adult life as obese. *PLoS One, 6 (4) e18546*.

Zuntz, N. (1889). *Untersuchungen über den Stoffwechsel des Pferdes bei Ruhe und Arbeit (Investigations on the metabolism of horses at rest and during exercise)*. Berlin, Germany: P. Parey.

Zuntz, N. (1899). Zwei Geräte für die Anwendung und Vermessung der menschlichen Arbeit (Two devices for the application and mesurement of human work). *Pflüg. Archiv. ges. Physiol., 78*, 372.

Zuntz, N., Loewy, A., Müller, F., and Caspari, W. (1906). *Höhenklima und Bergwanderungen (High altitudes and mountain walking)*. Berlin, Germany: Deutsches Verlagshaus.