

Health & Fitness Journal of Canada

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Volume 5

June 30, 2012

Number 2

NARRATIVE REVIEW

The developing understanding of Human Health and Fitness:

3. The Classical Era.

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Abstract

This article follows the development of interest in health and fitness, looking at contributions from the Minoan, Greek and Roman cultures. The Minoan era is best known for the institution of bull vaulting, but it also opened up sports for women, and served as an important bridge for the transmission of Egyptian knowledge to Greece. Ceramics suggest that their athletes had superb physiques, but the common people suffered from rickets, scurvy, a stunted stature and a short life expectancy. The most widely recognized contributions of the Greek period were the Hippocratic codification of health professionals and the establishment of inter-city Games such as the Olympiad. The latter competitions were initially amateur and patrician, but quickly became corrupted by the award of major prizes, with the modern problems of age classification, doping, "fixing" of contests and changes of citizenship. Another important feature of the Classical Era was a transition from Aesculapian mythology towards rational, evidence-based and even molecular medicine under Hippocrates, Pythagoras and Asclapiades. Calls were made for a balancing of the four body humours through (among other tactics) a matching of exercise to diet, and exercise came to be seen as a useful component of medical therapy. Gymnasia were built across Greece; these offered a new type of education, where academic instruction was leavened and made more effective by regular physical training. There was also a gradual recognition that moderate exercise had greater health value than the massive muscular development typical of heavyweight wrestlers. Both Sparta and Rome placed a strong emphasis upon sport as a means of enhancing fitness for military combat, but many in Rome decried the regimen of the gymnasium, considering it effete and an obstacle to effective martial training. Galen,

one of many Greek physicians migrating to Rome, brought the discipline of anatomy to the interpretation of ill health. The introduction of odometers, milestones, the observation of ventilation and accurate pulse counting allowed a monitoring of the intensity of physical training, and initially all male Roman citizens had to maintain adequate fitness for military service. However, the increasing wealth of the Roman Empire was marked by greater leisure; the construction of massive stadia, and frequent public holidays gave the public the option of attending brutal spectator events or relaxing at thermal baths. The resulting deterioration in physical condition and morale probably contributed to the subsequent conquest of the Roman Empire by stronger northern tribes.

**Health & Fitness Journal of Canada
2012;5(2):3-29.**

Keywords: Aesculapius, Galen, Greece, Gymnasia, Hippocrates, Military training, Minoa, Olympic Games, Physical Education, Pythagoras, Recreation, Rome, Spectator events, Sport, Thermal baths.

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Background

The first article in this series noted that the hunter-gatherer lifestyle predisposed people to a high level of physical activity and resulting physical fitness (Shephard, 2011). The second article pointed to developments in agriculture, particularly irrigation that allowed the development of quite large

city-states, with the establishment of a clear social hierarchy. The poor of necessity continued to engage in hard physical labour, but a social elite had the option of attending spectator sports events and enjoying sedentary board games (Shephard, 2012). The third segment in this historical account of our growing understanding of fitness and health looks at developments during the so-called classical era, covering the Minoan, Greek and Roman civilizations.

Written records date back to about the 8th Century BCE (Hall, 2006). However, many of the events described were chronicled centuries after they had happened, and sometimes it is difficult to separate myth from fact. Excellent translations of major classical texts are now available on-line. But until recently, the study of classical literature was a problem for many North Americans, because they lacked any instruction in Latin or Greek. During the past 3 or 4 decades, a few Canadian sports scholars, particularly Max Howell and Earle Ziegler, have shared their insights at international seminars on the history of sport and physical education (Boslooper, 1971; Howell and Palmer, 1969; Ziegler, 1972). Other Canadian sport historians have been attracted to the International Olympic Academy, a resource for Olympic participants, educators and postgraduate students. The campus of the Academy was built in 1967, on the river Aphaeus in the Peloponnesian Peninsula, in the “country” of Elis, and close to the site of the original Olympic Games.

The first Greek-speaking peoples were likely the Mycenaeans. They probably reached the Greek mainland between 1900 and 1600 BCE (Roebuck, 1966). Like their Middle-eastern contemporaries (Shephard, 2012), they were neolithic agriculturalists, sometimes

living in heavily fortified settlements with populations of up to 3000-4000 people. Early Bronze Age civilizations included the Minoan culture (in Crete, 2700 – 1450 BCE) and the Helladic era (on the Greek mainland, 2800 – 2100 BCE). During the period 500-448 BCE, Greek cities broke away from the Persian yolk, forming *poleis*, or city-states, each governing an area of 250-2500 km². Athens became the dominant *polis* with establishment of the *Delian League* (477 BCE), a military alliance of ships and soldiers from individual Greek city-states. Conflict between Athens and Sparta erupted around 458 BCE. The Peloponnesian wars continued intermittently for the next fifty years, with Sparta having the stronger land forces, but Athens the stronger navy. Sparta was the eventual victor (404 BCE), but before long it was crushed in its turn by the Thebans (371 BCE) and the Macedonians (346 BCE). The Hellenistic period began with the death of Alexander the Great (323 BCE) and continued until the Roman conquest in 148 BCE. Although Rome was the clear military victor, the Romans absorbed much of the Hellenistic culture. The period of Roman influence extended from 200 BCE to 476 CE; then physically stronger peoples from northern Europe conquered the Romans.

From the viewpoints of health and fitness, the most widely recognized innovations of Greek society were a codification of the health professions and establishment of the Olympic Games. Other important developments included the first steps in the transition from mythology and superstition towards evidence-based medicine, a recognition that many diseases reflected an adverse lifestyle rather than the whim of an angry god, the introduction of exercise and sport as components of medical therapy, the widespread establishment of schools

where academic teaching was leavened by regular physical training, and the acceptance of women into sport.

There was a strong emphasis upon sport as a means of enhancing fitness for military combat both in Greece and in Rome (McIntosh, 1971). In the view of Plato (360 BCE):

“about all gymnastic contests, ...only the warlike sort ... are to be practised and to have prizes of victory; and those which are not military are to be given up.”

During the Roman era, there was also a progressive recognition that the enormous bulk of the professional heavyweight wrestler was not necessarily the epitome of good health, and (in the declining years of this Empire) there was a massive growth in spectator events (probably seen as a method of social control).

Minoan Civilization

The Minoan civilization is important in that its location, on the island of Crete, provided a bridge, allowing the passage of ideas on health and fitness from Egypt and other Middle-eastern centres of learning to the Greek mainland.

Economy. The Minoans were a peaceful commercial people, heavily involved in trade with their neighbours. Merchandise included timber, copper, tin, silver and gold as well as the aromatic oils that were widely used in medicine, athletic massage and as perfumes (Roebuck, 1966; Shelmerdine, 1985). Their towns were prosperous, with paved roads. Even the poor lived in multi-room stone, wood, or mud-brick homes, often two or three stories tall, and a small leisured class occupied elaborate palaces

that also served as storehouses for surplus foods such as olive oil and wheat.

The land was cultivated by wooden ploughs, drawn by pairs of donkeys or oxen. Other tools were made from wood or bone, with leather strapping (Hood, 1971). Crops and produce included various grains, lettuce, celery, asparagus, carrots, pears, quince, and olives (Tzedakis and Martlew, 2000). Farmers also kept cattle, goats, pigs and bees. Surviving artifacts provide little evidence of a standing army or participation in military conflicts, although skulls from the period following the Mycenaean invasion sometimes show head wounds that were likely incurred in battle (Angel, 1973).

The Minoan religion was primarily matriarchal, with three goddesses (the Mistress of the Animals, a Snake Goddess, and the Goddess of Vegetation); perhaps for this reason, there was a relative equality of opportunity for men and women in their society.

The Minoan civilization ended around 1450 BCE, probably due to a severe earthquake, followed by a massive volcanic eruption of Mount Thera (Marinatos, 1939). Much of the Minoan culture was subsequently assimilated by the invading Mycenaean war-lords (Roebuck, 1966).

Health and fitness. Findings of gall stones and gout suggest some over-eating among wealthy Minoans, but the diet of the ordinary people was less adequate, with evidence of rickets and scurvy (Arnott, 1996). Metals that were smelted around Chrysokamino contained arsenic, and those working in the foundries would likely have developed heavy metal poisoning and/or silicosis. Trade with other Mediterranean countries is also

likely to have introduced epidemics of infectious disease.

As in other Middle-Eastern cultures (Shephard, 2012), illness was considered a manifestation of the displeasure of the gods (Longrigg, 1994). Attempts were made to exorcise evil spirits by incantations and prayers offered over ferments, gases, fluid and urine. Sometimes, votive sacrifices would be left at hill-top sanctuaries (Peatfield, 1990), with clay figurines demonstrating affected body parts such as a deformed hand or an edematous leg (Davaras, 1976; Warren, 1970). By the time of the Myceneans, a specific medical deity had been identified, the God of *Ahhiyawâ* (possibly analogous with *Paeon*, the patron of seer-doctors who sought to heal their patients with magical songs) (Horstmanshoff et al., 2004; Nilsson, 1967).

There was also a strong reliance upon herbal remedies. The chest ailments of metal workers were treated with camphorated oils, distilled from herbs such as laurel, sage, and lavender. Other medicinal plants identified in the Knossos cuneiform records include coriander, cumin, dittany, rue, saffron, rosemary, safflower, anise, verbena, Aleppo pine, myrtle and fig (Milani, 1986; Tzedakis and Martlew, 2000). Opium was known and used, at least as a soporific (Kritikos and Papadaski, 1967).

Some knowledge of public health is suggested by the clay pipes that provided water and sewage facilities to the upper classes (Reynoldson, 2003). However, the images of healthy and fit athletes displayed on the local ceramics may not reflect the health of the common people; overcrowding, poor nutrition and disease were likely prevalent among the lower classes of society (Arnott, 1996). One simple measure of social disparities is

provided by a comparison of average standing heights, 1.71-1.80 m for the male rulers, but at least 0.05 m less for the general male population. Vitamin deficiencies in the general population have been noted above. By the late Bronze age, the average life expectancy of Minoans was still only around 31 years (Arnott, 1996).

Sports and recreation. The most celebrated sport and/or religious ritual of the Minoans was bull leaping, as illustrated on a Fresco found in the palace at Knossos; this artwork probably dates from about 1450 BCE. A form of bull vaulting is still practiced in southwestern France, as the "Course Landaise." Vases, frescoes and seal stones suggest that other popular forms of sport and recreation, apparently pursued from quite a young age, included boxing (gloves were used for the first time in Minoan), wrestling, acrobatics, hunting, horse racing, dancing, swimming and (at least for soldiers) running distances of up to 60 stadia (about 11.4 km) in full armour (Howell and Palmer, 1969; Ziegler, 1972). The narrow waists, well-formed thighs and strong muscles depicted on Minoan pottery point to effective training programmes for the athletes. Plato (360 BCE) wrote many years later that the "*first of all in sports were the Cretans,*" who attended the gymnasium to perform "*daily exercises under the superintendence of masters.*"

Minoan competitors wore distinctive clothing, and in contrast with Greek athletes, nudity of participants was a rarity. Sports were performed to honour the snake goddess (Evans, 1921). There may have been a considerable number of spectators when events were held in the vicinity of the Minoan palaces. Perhaps because of some egalitarian traits in

Minoan society, most athletic activities were open to both men and women. Plato (360 BCE) made the following comments on female participation:

“those who are thirteen years of age and upwards until their marriage shall continue to share in contests if they are not more than twenty, and shall be compelled to run up to eighteen.”

“Women are not to be forced to compete by laws and ordinances; but if from previous training they have acquired the habit and are strong enough and like to take part, let them do so, girls as well as boys, and no blame to them.”

Greek Civilizations

Economy. The number and scale of temples and other public buildings in Ancient Greece point to the wealth of this society, brought about in part by foreign conquests and in part by slavery (in Athens, public and privately-owned slaves made up 80% of the total population). The average daily wage in classical Greece equated to 12 kg of wheat, several times higher than in most contemporary societies. However the soil around Athens was poor, and the local citizens relied upon trading, with most of their grain imported from dependent colonies. The daily lives of commoners were by no means easy. The poet Heriod (c. 700 BCE) and the historian Xenophon (c 430-354 BCE) paint a clear picture of rural life, with people working hard at the cultivation of olives, grapes, herbs and vegetables, using rather primitive tools such as wooden ploughs, hoes and mallets (Pomeroy, 1994; West, 1978). They were also kept busy herding sheep and goats, and harvesting timber both for winter heating and for the construction of *triremes*.

Under the constitution of Solon (c 638-558 BCE), Athenian society was divided on the basis of personal wealth (Aristotle., 350 BCE). An upper class of about 300 families, the *Pentacosiomedimni*, each owned property that produced at least 500 bushels (17,500 L) of wet or dry goods per year (Smith, 1889). They devoted their time to government, war, literature and philosophy. The *hippeis*, or knights were a second social class; they had a minimum annual income of 300 bushels, and could afford to maintain a war-horse for military service. Below them were the *Zeugitae* (with an annual income of 200-300 bushels). The *Thetes* comprised all other citizens, including foreigners who had decided that they could make a better living in Athens than in their home country, and men who had been freed from slavery because of the death of their owner, payment of ransom money by a friend or relative, or completion of their role as a *paidagogos* (below). Typical occupations of the *Thetes* were merchant, contractor, manufacturer, manager, tradesperson, artisan, and artist. Slaves occupied the lowest stratum of society; they were prisoners of war, victims of slave raids, and abandoned children (Jones, 1955).

Among Athenian women, the *hetaerae* were independently wealthy individuals, entertaining men as conversationalists, courtesans and prostitutes. A select few women also became philosophers, poets, surgeons and even chariot-racers. In addition to child-bearing, the responsibilities of ordinary women included spinning, weaving, baking bread, cooking, serving, cleaning, fetching water, and removing wastes. Female slaves performed many of the more menial tasks, at least in wealthy

households (Middleton, 2003; Pomeroy, 1975).

Spartan society was more egalitarian than that in Athens. All male Spartans who had completed their education were regarded as equals (*homoioi*) (David, 1981). Since the *homoioi* spent much of their time in military activities, people captured from other parts of Greece served as slaves and serfs to till the land (the *heilotes*) (Talbert, 1989). Foreigners who lived in a buffer zone around Sparta (the *perioeci*) could serve in the army and navy, but were not allowed to marry Spartan women (Lévy, 2003).

Health and fitness. Early Greek mythology speaks of Croton, the centaur with a knowledge of medicine [this mythical beast is still honoured on the cap-badge of the British Royal Army Veterinary Corps (Hausmann and Jöchle, 1988)], and of his pupils Aesculapius (the god of healing) and Achilles. Much of early medical practice took place on the battlefield. Thus, Euripylus begged Patroclus (MacPherson, 1773):

“draw this deadly dart, with lukewarm water wash the gore away, with healing balms the raging smart allay, such as sage Chiron, sire of pharmacy once taught Achilles” (Homer, Iliad, Book XI).

The transition from mythology to rational, evidence-based medicine began with Greek thinkers such as Pythagoras (570-495 BCE), Herodotus (5th Century BCE), Hippocrates (c460-370 BCE), and Asclepiades (126-68 BCE).

Aesculapian healing. In the time of Homer (9th century BCE), Greek healers continued the magical practices of surrounding societies. Many of their ideas were derived from Egypt, in part via the

Minoan civilization, and in part through the travels of scholars such as Pythagoras and Thales (c 624-546 BCE).

Imhotep was the Egyptian god of medicine (Shephard, 2012), and early Greek attempts at healing centred around a similar god *Aesculapius*. The latter was said to be a son of Apollo, snatched from the womb of his unfaithful earthly mistress. *Aesculapius* was assisted by a bevy of daughters: *Hygieia* ("Hygiene"), *Iaso* ("Medicine"), *Aceso* ("Healing"), *Aglæa* ("Healthy Glow"), and *Panacea* ("Universal Remedy"). *Hygieia* fed the magical non-venomous snakes that crawled the floors of the crowded temples of healing (*Aescelapia*). Some Greeks also ate snakes in a quest for medical knowledge and even immortality. The snake-entwined staff of Aesculapius remains a symbol of the medical profession in modern Canada (Hart, 2000). Much of *Aescelapian* healing was based on sedation and dream therapy, with the surreptitious administration of poppy seed and hemlock to the patients (Bettman, 1956). Sometimes, the fees paid for a cure were substantial; Phalysius of Naupactus paid 2000 *staters* (20-28 *drachma*, about a month's salary for a skilled worker) for the restoration of his sight (Pausanias, 1918).

Pythagoras. Pythagoras was primarily a mathematician, but he thought that certain numbers had magical properties, and he applied this concept to medical questions such as an appropriate period of quarantine (40 days) (Kingsley, 1995). His followers used wild musical harmonies in an attempt to purge the souls of those with psychological disorders. Pythagoras also had much to say about an appropriate diet (Cocchi, 1743). According to Aristoxenus (Diogenes Laertius, c520 BCE):

“he consented to the eating of all other animals, and only abstained from ploughing oxen and rams.”

Diogenes Laertius (404-323 BCE) claimed that Pythagoras was the first Greek sage to recommend a meat diet for athletes:

“so we learn from Favorinus in the third book of his Memorabilia--whereas in former times they had trained on dried figs, on butter, and even on wheat meal.”

However, the assertion of Aristoxenus seems at variance with the aversion of Pythagoras to killing living things (Sweet, 1987). Other historians believe that the Pythagoreans adopted a strictly plant-based diet (although being careful to exclude beans (Diogenes Laertius, c520 BCE)). It may have been Stymphalos, himself a former athlete, who introduced the meat diet during the 6th century BCE (Simopoulos, 2008).

Empedocles (490-430 BCE), a pupil of Pythagoras, attached great significance to the number four. He noted the four basic elements of matter: fire, earth, water and air, and suggested that these were represented in the body by blood (hot), phlegm (cold), black bile (moist) and yellow bile (dry). Disease thus resulted from an imbalance between these four humours (Bettman, 1956; Hicks, 1925), a concept that became prominent in Hippocratic medicine (below).

Herodicus. Herodicus was one of the *paedotribes* (see below), and reputedly was the teacher of Hippocrates. As an early advocate of therapeutic sports medicine, his patients were prescribed a brisk walk from Athens to Megara (a distance of some 42 km) at progressively

increasing speeds, followed by an oil and herb massage (Schreiber, 1884). He recommended maintaining health by a combination of strict diet and regular physical training, and he would have been in the forefront of the current fight against obesity, arguing that illness resulted from an imbalance between food intake and physical activity (Georgoulis et al., 2007).

Hippocrates. Hippocrates of Kos is often regarded as the father of western medicine. He was born into a family of physicians who claimed their descent from Aesculapius (Cactus Philological Group, 1996). Hippocrates (or one of his Pythagorean disciples) is best remembered for the Hippocratic Oath, a formal code of conduct for physicians and health-care workers (Edelstein, 1943). Egyptian physicians under the direction of the Pharaoh Ptolemy Soter (325-285 BCE) later collected the main ideas of Hippocrates and his followers as the *Corpus Hippocraticus* (Bettman, 1956). One important element in Hippocratic teaching, particularly relevant to those who have sought to maximize the performance of athletes in recent years, was the avoidance of harm to the patient (Edelstein, 1943):

“I will follow that system of regimen which, according to my ability and judgment, I consider for the benefit of my patients, and abstain from whatever is deleterious and mischievous.”

Hippocrates advocated a holistic approach to therapy, drawing an important distinction between medicine and religious superstition (Edelstein, 1967). He argued that disease was not the result of some ancestral curse, nor was it a divine punishment for some past sin;

rather, it was the end product of environment and personal lifestyle:

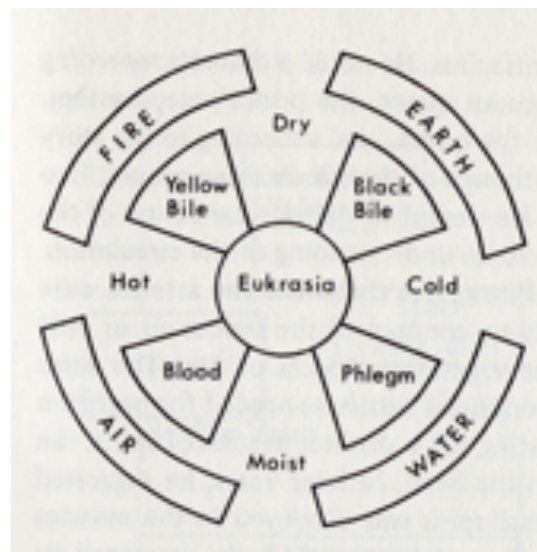
“if we call divine all things we do not understand, then divine things will be endless.”

Somewhat in contrast to Herodicus, much of Hippocratic treatment was passive. Hippocrates argued that given time, nature (*vis medicatrix naturae*) was able to effect healing, correcting the patient’s imbalance in the four basic *humora* (Edelstein, 1967; Garrison, 1966; Hart, 2001)(Figure 1). Rest and immobilization were thus common prescriptions (Margotta, 1968), although the Hippocratic bench was used to apply traction to broken bones and relieve pressure on injured areas. Sometimes, the doctor attempted to speed removal of the humour that was thought to be in over-supply (*materia peccans*) by such means as purges, blood-letting, and pepper-induced sneezing. However, Hippocrates did not totally abandon the idea of sport therapy (Kritikos et al., 2009), and his writings contain several favourable comments about exercise:

“exercise strengthens and inactivity wastes.” [On the Surgery, Hippocrates (Adams, 2007)]

“it can contribute much to the recovery of the sick, and to the preservation of health in the case of those who are well; and that it promotes the strength of those who use gymnastic exercises, and is useful to whatever one may wish to apply it “ [On regimen in acute diseases (Hippocrates, c360 BCE)]

Figure 1: Diagram illustrating the four body humours of Galenic medicine. A pupil of Pythagoras (Alcmaeon of Croton, 6th century, BCE, the individual who first distinguished arteries from veins) suggested that good health depended on the balance of various opposing qualities such as moist/dry; cold/hot; and acid/sweet). According to Empedocles (c495-435 BCE), matter was composed of four basic elements (air, fire, water, and earth). Hippocrates thought that all living things were composed simply of fire and water, but his son-in-law Polybus of Corinth (c400 BCE) proposed that good health (eukrasis) depended on a balance of four humours within the body: blood (a combination of fire and water), phlegm (a combination of earth and water), yellow bile (a combination of fire and air) and black bile (a combination of fire and earth).



As Heroditus had already suggested, exercise might also help to achieve a balance of the four vital humours, adjusting the relative amounts of food intake and physical exercise (Kritikos et al., 2009):

“to pinpoint for each body the proportion between nutrition and physical exercise, without an exaggeration towards a surplus or a shortage.”

“Food and physical exercise affect the human body in totally different ways, yet both contribute to health: physical exercise tends to ‘spend’ what already exists and the various kinds of food and drink to fill the gap that has been created.”

Hippocrates stressed the need for moderation and a “cool-down” post-exercise. In his view, some professional athletes exercised to excess, so that the balance point was passed (Kritikos et al., 2009):

“athletics is a bad occupation because it does not aim at man’s inner cultivation, so that he will become better, but simply (aims at) the athlete obtaining such a strength that he will be able to beat the opponent”

“exercises... should include little and short simple running and dual-direction running, walks in the shadow and wrestling in the dust, to avoid overheating as much as possible.” “walks after gymnastics result in the purification and the slimming of the body”

“while exercising, the well-being is deceptive, because, as it exceeds the normal boundaries, it is unstable, and the health of those who exercise does not improve, but it also deteriorates”

The general approach to treatment is well illustrated by the advice Hippocrates gave to Silenus, who complained of waking at night with indigestion (Smith, 1994):

...Silenus had spent a strenuous day at the gymnasium. He was tired and overheated when he ate the cheese.” “Thus, a surplus of fire had upset his humoral balance. To correct this, Hippocrates

advised Silenus to avoid strenuous exercises, or to cool off before eating.”

Asclapiades. Asclapiades of Bythnia (c124-40 BCE) carried the Greek medical tradition to Rome, drawing upon the views of Democritus (460-370 BCE) and of Epicurus (341-270 BCE) that the world was built from atoms. Asclapiades made the important distinction between acute and chronic illness. In his view, the first was caused by an obstruction of flow and the second by an excessive flux of atoms through pores in the body (Sarton, 1959; Yapijakis, 2009). Some historians have thus argued that Aescelapiades should be considered the father of molecular medicine. In his view, health could be restored by a wine diet, massage, such forms of exercise as walking, running and riding, emetics and bleeding; the wine diet and massage seem to have established the popularity of his medical practice in ancient Rome.

Fitness and physical training. The ideal of physical perfection, as promoted by physicians such as Herodicus, Hippocrates and Galen was deeply rooted in Greek civilization:

“strength and beauty are the gifts of Zeus...natural gifts imply the duty of developing them with God’s help.” [Pindar’s eleventh Olympic Ode (McIntosh, 1970)]

This same sentiment is echoed by the Apostle Paul in his first letter to the Corinthian Christians:

“know ye not that your body is the temple of the Holy Ghost?” (I Corinthians 6: 19)

Perfection of the body was seen as important to development of the mind; physical well-being was essential to mental well-being, and gymnastics and music were considered the most important of classroom topics. Thus Plato (384-322 BCE) (Plato, 360a BCE) had Socrates state:

“what shall be their education?gymnastic for the body, and music for the soul.”

Under the influence of Hippocrates, Greek athletes learned the hard lesson that victory in competition was gained not by making appropriate offerings to the gods, but rather by rigorous training (Appelboom et al., 1988). The wrestler Milo of Croton (6th century BCE), an associate of Pythagoras, a juvenile competitor and five-times Olympic victor, is reputed to have prepared himself for competition by carrying a young bull around a field each day from birth of the animal until it reached the age of four years (Harris, 1964; Masterson, 1976). However, the historian may have been given to some exaggeration, since he also suggested that Milo ate 10 kg of meat and 10 kg of bread per day, washing this down with 9 litres of wine!

There was some appreciation of the value of regular physical activity in slowing the aging process:

“it is disgraceful for a person to grow old in self-neglect before he knows what he would become by rendering himself well-formed and vigorous in body” [Xenophon: Memorabilia of Socrates, (Ainsworth, 1894)]

Athens. The initial instruction of Athenian children took place in *palaestrae*. In accord with Socratic

philosophy, there was recognition of the important linkages between physical and mental development (Forbes, 1929), a concept echoed in more recent trials such as the Trois Rivières regional study of required physical education for primary school students (Trudeau and Shephard, 2008). The dunce of Athens was the boy who could neither swim nor write.

Marco Vitruvius Pollio (c 80 BCE-20 BCE) provides a detailed description of the Athenian school. Facilities included indoor areas for the teaching of gymnastics, wrestling and boxing, with other rooms for changing, punch-bag practice, cold and hot bathing, application of oils and powders and space for academic study. The various buildings surrounded an open central court, used for the practice of running, jumping, discus and javelin throwing. When adulthood was reached (typically around 16 years), pupils were transferred from the *palaestra* to the adjacent *gymnasion* (Lynch, 1997), a centre not only for training participants in public games, but also for socializing and philosophic discussion. In many instances, there was also an adjacent stadium for public events. The classical tourist guidebook of Pausanias (2nd Century CE) suggests that each major city in Greece had its own *gymnasion* (Pausanias, 1918),

The word *gymnasion* itself implies a school for naked exercise (*gymnós* = naked) (Lucian, c160 CE). In the time of Homer (around 850 BCE), Greek athletes apparently followed the precedent of the Minoans and wore clothing when they were exercising. Explanations for the subsequent change of policy include a winner who lost his shorts en-route to the finish-line, a poorly coordinated runner who tripped over his clothing and killed himself, an attempt by coaches to alleviate heat stress during the summer

months and (most plausibly) aesthetic appreciation of a well-trained body as a tribute to the Gods (Harris, 1969, 1972; Ryan, 1974).

The staff of the *palaestrae* included *paidotribes* (somewhat analogous to the modern fitness trainer), *grammatistes* (who taught writing, arithmetic and literature) (Beck, 1964), *kitharistes* (who taught singing and the lyre), and the *paidagogos*, slave-guardians who supervised the lives and morals of the children between periods of formal instruction (Galatians 3: 24) (Young, 1987). Fees for the *palaestrae* were high, and although wealthy children attended until adulthood, the offspring of poorer citizens probably received no more than 3-4 years of instruction. Activities in both the *palaestra* and the *gymnasion* were supervised by the *paidotribes*; overseeing the *paidotribes* were the *gymnastes*, highly paid athletic exercise trainers who purported to understand not only the mechanics of a good performance, but also what this could do for the body [Galen, 129-217 CE, (Green, 1951; Sweet, 1987)]. Other staff included the *aleiptes* who anointed athletes' bodies with oil and performed muscle massages.

Sparta. In northern Greece, the Spartans valued fitness even more highly than the Athenians, viewing it mainly in the context of military prowess (Duckworth, 2001). Spartan society required all male children to enter special fitness programmes at the age of six. From then until adulthood, the government became responsible for the child's upbringing; a rigorous training regimen (the *agoge*) included measures designed to increase pain tolerance—sleeping on animal skins, eating a meagre diet, and bathing in mountain streams (Gordon, 1935). Success in this system

was a condition of attaining Spartan citizenship.

The *hoplon*, or military shield weighed about 10 kg. It was an integral part of Spartan infantry equipment. The historian Plutarch (c46-120 AD), writing long after the fall of Sparta (Babbitt, 1931), suggested that mothers gave their sons their first *hoplon* with the instruction that they should return:

"Either with this or upon this"

When asked why it was dishonorable to return without a shield and not without a helmet, Plutarch had the Spartan king Demaratos (510-491 BC) reply:

"Because the latter they put on for their own protection, but the shield for the common good of all."

Plutarch further highlighted the militant attitude of Spartan women, citing one who killed her deserting son with the declaration:

"He was not my offspring, for I did not bear one unworthy of Sparta."

After graduation, Spartan citizens continued to serve as *hoplites*, life-long shield-carrying soldiers (Hanson, 1989), leaving their slaves to tend their fields. According to the historian Herodotus (c484-425 BCE), a Persian scout observed the Spartan warriors undertaking calisthenics in order to prepare themselves for the Battle of Thermopylae (Rawlinson, 1942). Philostratus commented that even dancing was seen as useful practice in dodging a missile (Bowie and Elsner, 2008; McIntosh, 1971).

Spartan girls also underwent mandatory physical training in

designated female arenas. Activities such as wrestling, running, playing ball, throwing the javelin, swimming, riding horseback, and light combat were pursued with the primary goal of bearing healthy children (Pomeroy, 2002; Ziegler, 1972). As adults, the women eschewed make-up and jewelry. They were expected to maintain their physical condition, with slaves performing all household chores. Soon after birth, male children that appeared to be sickly were snatched from their mothers and thrown over a cliff.

Sport and recreation. Greek interest in sport centred around major athletic festivals, beginning as early as 1300 BCE. One legend tells of the Phaeacian Games, organized by King Alcinous; Odysseus, under the goading of Laodamus, picked up a discus and threw it beyond the mark of the Phaeacians (McIntosh, 1971). Other events such as chariot racing, boxing, wrestling and throwing the javelin feature in both the Iliad and the Odyssey (from around 1200 BCE). The games may have originated as an elaborate funeral ceremony for Pelops; certainly, funeral rites for Pelops were subsequently celebrated on the second day of the Games, and Zeus was honored on the third day (Drees, 1968; Guttman, 2004).

Strength and physical beauty were seen as the gifts of Zeus, and the athlete had the duty to develop these attributes:

“when it is a question of excellence, toil and expense strive to accomplish a deed that is shrouded in danger.” [Pindar’s Olympic Ode for Psauimis, (Svarlein, 1990)]

Olympic Games. The traditional date for the first Olympic Games was 776 BCE.

Initially, the event was local in scope, winners of the first 12 Games all being Eleans. However, competition later became open to all men of pure Hellenic descent (i.e., those born to free Greek parents) who had not incurred any personal disgrace. Women were excluded, and indeed the only female allowed to watch the festival was the high priestess of Hera. However, there does appear to have been a separate competition for women, associated with the festival of Hera (Harris, 1969).

Initially, the Olympic contest was a single-lap 200 m running match (the *stadion*). In 724 BCE, this was supplemented by the *diaulos* (a double-lap event of some 400 m) and the *dolichos* (an event of up to 24 laps, or about 4.8 km) (Guhl and Koner, 1876). The *pentathlon* (consisting of a triple jump, running, throwing a copper ingot, throwing a javelin and wrestling) was added in 708 BCE. There were a total of 293 successive Olympiads before eclipse of Greek civilization. Around 400 CE, the demise of the Olympic Games was hastened by the decision of Theodosius to replace Paganism by Christianity, and the temple of Zeus was burned in 408 CE (McIntosh, 1970).

Panathenaic Games. The Panathenaic games were held annually in Athens, as part of a larger religious festival (the *Panatheneae*), with the celebration being prolonged during Olympic years. The stadium for this event has hosted five of the modern Olympic Games. The Panathenaic Games began under Peisistratos (566 BCE). Some events, such as boxing, wrestling, *pankration* (a form of mixed martial arts (Schmitz, 1875)), *pentathlon*, and chariot racing were open to all-comers. Other activities were restricted to Athenians;

these included a torch race from Piraeus to the Acropolis, mock infantry and cavalry battles, the *apobatai* (a chariot race where the driver jumped from his vehicle, ran alongside it and then jumped back in), and the *euandrion* (a beauty contest for the participants) (Young, 2004).

Other Greek Games. Other Greek celebrations included the Pythian, Isthmian and Nemean Games. The Pythian Games were held in honour of Apollo, celebrating his legendary slaying of the python. These contests began around 582 BCE, and continued until the 4th century CE, taking place during the third August of the 4-year period between successive Olympic Games (Grote, 1857, 1905; Sweet, 1987). They were held either at the Delphic shrine on Mount Parnassus, or on the Crisaeian plain immediately below it, and they were open to all Greeks (in contrast, the Olympic Games were open only to aristocrats). Pythian events included foot and chariot races and (in contrast to the Olympic celebrations) music and poetry.

The Isthmian Games (dating from 581 BCE) honoured Poseidon. They were held in the Corinthian isthmus every two years, and beginning in 228 BCE, Roman competitors were also accepted. The Nemean Games (beginning around 573 BCE) celebrated Juno; they also were held every two years. Features of the Nemean Games were horse races over distances of 4.2-8.4 km, and the hoplitodromos, a two-lap *diaulos* run in full *hoplite* uniform. Traditional prizes were a pine branch at Isthmus, and a celery sprig at Nemea (Fennell, 1899; Pausanias, 1918).

Age and sex categorization. Separate classes of competition were organized for *paidēs* (boys, aged 12-18

years) and *andres* (men). Given the absence of birth certificates, age verification was as problematic as in some modern competitions; classification depended largely on secondary sex characteristics. The category of *ageneioi* (adolescents aged 17-19 years, found in some Games, although not in the Olympics) refers literally to those who were beardless. The boys threw a discus that was smaller than the standard size, ran only a half-length of the *stadion* and received smaller rewards (see below) (Golden, 1990, 1998; Guhl and Koner, 1876).

The foot race was regarded as the most appropriate type of competition for female athletes, and distances were shortened by one sixth relative to their male peers (Guhl and Koner, 1876). This handicap, interestingly, approximates their disadvantage in terms of maximal aerobic power (Shephard and Åstrand, 2000), although the basis for the Greek decision was the shorter average stride length of the women.

Athletic injuries. The “heavy” sports that were prominent in Greek athletics (wrestling, boxing *pankration* and *apobatai*) caused frequent injuries (Nomikos et al., 2008), and from the nature of the lesions described in the Hippocratic treatises (dislocations and fractures), a substantial part of Hippocrates’ practice must have been devoted to sports injuries (Masterson, 1976). Wrestling frequently led to spinal dislocations (Geroulanos and Bridler, 1998), and in the words of Galen (König, 2005) produced:

“men 'lame and wrinkled and eyes askance”

Boxing (*pygmachia*) was introduced into the Olympics of 668 BCE. Contests continued until one of the fighters either became unconscious or refused further fight. Statues of athletes frequently display the boxer's "cauliflower ear," although ear-guards were introduced during the 4th century BCE (Hyde, 1923). Some contestants such as Melanomas prided themselves on winning without seriously hurting their opponents (Constantoyannis and Partheni, 2004). But unfortunately, there was no prosecution of an athlete who killed an opponent (Yunis, 2005), and deaths were not uncommon. Thus, Agathos Daimon died during an Olympic boxing match at the age of 35 years (Finley and Pleket, 2005; Sweet, 1987). During the Olympic Games of 564 BCE, a *Pankration* opponent had apparently ceded to Arrachion, a famous athlete, and then suddenly sprang at him, strangling him; the contest was awarded post-humously to Arrachion (Chaudon et al., 1773). There are also records of at least two fatal chest injuries (Menenakos et al., 2005), although because they were reported centuries later, the details have been disputed (Brophy, 1978). An incident during the Nemean Games, around 400 BCE, is described by both Pausanias and the cleric Eusebius (Menenakos et al., 2005); the boxers had bound their hands with cattle skin, but their fingers remained bare, so that their tips pierced the opponent's chest wall (Taylor, 1824):

"this man struck his opponent a single blow, opened up his side, then thrust his hand inside and seized his internal organs."

Pheidippides. Brief comment must be made on the death of Pheidippides, the original "marathon man." This is sometimes portrayed as a possible hazard

of normal marathon running. The historical legend, although disputed (Lovett, 1997), is very different. The scene was set by a battle against the Persians, in August or September 490 BCE. The Athenian army had dispatched Phidippides, a professional runner, to Sparta in a desperate plea for military support. However, according to Herodotus (Godley, 1920; Olson et al., 2011), their messenger returned with the disappointing news that the Spartans would delay sending reinforcements until they had completed the Karneian celebration of the full moon:

"they could not lead out the army on an expedition on the ninth day, they said, when the circle of the Moon was not yet full. And so they waited for the full Moon."

Pheidippides completed the rugged, mountainous two-way trip of 480 km in about three days. He then marched with the small army of Athenians to the plain of Marathon, and fought the Persians in full armour, before running a further 42 km to Athens to convey the news of victory (coupled with a warning about approaching Persian ships). He burst into the Assembly crying "*Nenikéamen*" ('We have won'), before collapsing and dying. The Bassler hypothesis that distance running provides immunity against fatal coronary atherosclerosis (Bassler, 1977) is now disproven (Noakes et al., 1977). But assuming the legend of Pheidippides to be true, other reasons for his demise can be suggested. The runner packed an extraordinary volume of physical activity into four days; he undertook most of this effort in the heat of the Mediterranean summer, and death was probably caused by a combination of previous exhausting exercise, heat stress, and high blood catecholamine levels. Typical afternoon

temperatures on the final run from Marathon to Athens would likely have led to cancellation of a marathon run in Canada (Shephard, 1976). Dry-bulb values probably averaged around 32° C, possibly rising to 38° C as the runner approached Athens.

Amateurism. The ancient Olympic Games are commonly lauded for their emphasis on amateurism, with the aristocratic victors receiving no more than a laurel wreath. However, the word *athlon* means “prize,” and as on the modern sports field, the concept of amateurism was soon abandoned; indeed, some of the later Athenian competitors were rewarded very richly (Finley and Pleket, 2005). Possibly in an attempt to democratize the Games and promote *eunomia* (good order), Solon (638-558 BCE) proclaimed a reward of 500 *drachma* (about a year’s salary for the highest of the four social classes of that period) for every Athenian who won an Olympic prize, and 100 *drachma* for an Isthmaic victory (Grote, 1857, 1905; Kyle, 1993, 2007). This reward was supplemented by free meals for life and premium seats in the theatre. Moreover, other city-states were required to provide their competitors with equivalent rewards in the event that they were winners.

There were also specific prize games, where the rewards were much larger. Records from the Panathenaic Games of the 5th Century BCE suggest that the male winner of the *Stade* later received 100 or more amphorae of oil (a total of about 3,600 litres), with a cash value of 1200 *drachma*. Even greater sums were awarded to the winner of the prestigious chariot races (Sweet, 1987; Young, 2004). Cities competed in terms of the magnitude of the prizes that they

awarded, with some reaching 6000 *drachma*. One professional boxer, pankriatist and runner (Theagenes of Thasos) claimed to have won at least 1300 prizes (Findling, 2004).

Finally, herbs, wine, hallucinogens, animal hearts and testes were ingested in attempts to enhance performance and gain the coveted prizes (Bowers, 1998). There are also reports of athletes “throwing” contests after receiving a substantial bribe, and of competitors such as the Cretan-born runner Sotades who opted to become a naturalized Ephesian in return for a substantial cash incentive.

Roman Civilization

Economy. Rome began its history with a society where all males were considered as citizens and equals, but like Greece (and indeed, modern Canadian society), wealth brought substantial social stratification and corresponding differences in health and fitness needs. Finally, the richest class (the *senators*, about 1.5% of the population) controlled some 20% of the nation’s wealth. Below them were the *curiae*, middle-class households with at least 25 acres of land, serving as office-holders and tax-collectors (another 10% of the population, and controlling a fifth of the National income) (Schiedel and Friesen, 2009). Below them again were the *plebs*, small property holders, tradesmen or artisans, and the *colons*, lower-class tenants.

The approximate price of goods and services is known from the edict of Diocletian, promulgated in 301 CE. Some of the wealthiest Romans were in the army, with annual earnings of 7800-12.5000 denarii/year (the modern equivalent of \$165,000-300,000 Cdn, if measured in terms of the price of food); moreover, this base pay was

supplemented by a grain allowance of 30 *modii* (about 240 litres). In contrast, the poorest citizens fed mostly on grain, and even their survival rations depended on State subsidies (Frank and Johnson, 1933; Graser, 1940). Slaves played an important economic role, particularly as sources of labour for agriculture and mining.

Health and nutrition. Roman notions of health initially derived from both Alexandria and Greece. Many Greek physicians had migrated to Rome, although they were denounced by Cato the elder (230-149 BCE) as greedy charlatans. In Cato's view (*De Agri Cultura*), most ailments could be cured by a liberal administration of cabbage water! However, beginning with Asclepiades (above), Greek physicians gained acceptance among the Roman nobility, and in 46 BCE Caesar granted Roman citizenship to all medical practitioners.

Much of Roman medicine was dedicated to the army. Unlike other contemporary nations (who usually left injured common soldiers to their fate), the Romans assigned 1-4 surgeons to support each cohort of 420 soldiers (Bettman, 1956), with rehabilitation centres (*valetudinaria*) in each of the main Roman Provinces. There was also a strong emphasis on public health, with the construction of extensive aqueducts to provide clean water, and rigid laws to guard the purity of food products.

The most prominent physician of the Roman era was of Greek birth, Claudius Galenus (c 130-200 CE) (Kudlien and Durling, 1991; Sarton, 1954). His family was wealthy, and his medical studies began at the prestigious *Aesculapium* in Pergamon. He then travelled widely to other centres of learning, including Alexandria, before becoming team physician to a group of gladiators in the

city of Pergamon. Subsequently, he was summoned to Rome by Marcus Aurelius and was in great demand as a personal physician to several of the Roman emperors (Vivian, 1973). In contrast to most of his predecessors, Galen had gained a sound knowledge of anatomy by dint of dissecting a hippopotamus, an elephant, a monkey, a pig and a man who had drowned. He placed considerable value upon observation and reasoning, and his views were held in great reverence for many centuries. Indeed, as late as 1559 CE, the British College of Physicians summoned a Dr. John Geynes to appear before them (Pelling and White, 2003):

"because he had been accustomed to declare in public that Galen had erred: ... But since he refused to come 'sensibly, he was constrained by the sheriffs of London ... to appear or else be committed to jail."

Galen maintained many of the concepts of health typical of his earlier Greek compatriots, in particular insisting on the need to balance the four humours of the body (blood, yellow bile, black bile, and phlegm, above) as the road to health. He may have glimpsed the idea of artificial ventilation, since in one study he used a bellows to inflate the lungs of a dead animal (Baker, 1971; May, 1968). His concepts of physiology (Figure 2) also reflect these basic concepts.

Galen saw an appropriate and individually tailored nutritional plan as one way of balancing the body humours, and (contrary to the Pythagoreans) he recommended beans as a means of filling out the frames of the gladiators (Grant, 2000; Wiedemann and Wiedemann, 2002). He also lauded the merits of barley soup (Grant, 2000), but warned that if someone who exercises should live off

vegetables and barley juice, the whole body will soon be in a sorry state and waste away (Grant, 2000). Those who wrestled and boxed for a whole day also needed pork. Nevertheless, he criticized athletes who “*overloaded themselves with flesh and blood,*” (Galen, c180 CE) and he recognized the dangers of ingesting a plethora of food, as exemplified by Milo (who was reputed to have eaten a whole heifer in a single day) (Barbé, 1878):

“a swollen belly does not prepare an agile mind” (Galen, V: 874).

Fitness and training. The overall physical fitness of the Roman people was greatest during the period of conquest and expansion, when all Roman citizens between the ages of 17 and 60 were subject to the military draft. The training plan for the Roman army was essentially practical. Seneca (c 4 BCE- 65 CE) commended weight training, high and long jumping, and certain forms of dance; indeed:

“any short and simple exercises which tire the body rapidly and so save time.”

Other components of military training included running, marching, and discus and javelin throwing (Grant, 1964).

Attitudes to Greek sport. Although the schools of Athens recognized the concept “*Mens sana in corpore sano,*” the actual phrase dates from the end of the first century CE, and it is what the Roman poet Juvenal’s suggested people should desire in life (Satire X, l. 356). General Fulvius Nobilior organized a Greek Athletic Festival in Rome in 186 BCE, and Caesar Augustus (63 BCE- 14 CE) authorized the restoration of the temple

of Zeus, with construction of Greek-staffed gymnasia in many Roman cities.

However, the average Roman regarded the practices of the Greek *gymnasion* as an effeminate substitute for adequate martial training. Cicero quotes the Roman poet Ennius (239- 169 BCE) as suggesting (Bishop, 1970; Gardiner, 2002; McIntosh, 1993) that:

“to strip naked among one’s fellow citizens was the beginning of vice.”

Most Romans saw the elaborate regimen of the *gymnasion* with its strict regulation of diet as hindering preparation for active service. The satirist Lucianus (125-180 CE) (Ziegler, 1988) complained:

“you will see an army enlisted from the Greek gymnasium listless because of their palaestrae course and hardly able to bear arms.”

and in “De Liberis Educandis,” Plutarch commented (Babbitt, 1927):

“a slenderly built soldier accustomed to military exercises forces his way through the masses of fleshy athletes.”

Views of Galen. Galen disparaged the professional athlete (Ryan, 1974; Smith, 1979):

“When athletes miss their goal, they are disgraced; when they attain it, they are not yet above the brutes.” (Exhortation to the study of the arts)

“Athletes live a life quite contrary to the principles of hygiene, and I regard their mode of living as a regime more favourable to illness than to health... when they give up their profession, they fall into a

condition more parlous still; as a fact, some die shortly afterwards; others live for some little time, but do not arrive at old age." (a citation of Galen from Hippocrates Nutriment 34: 9:110)

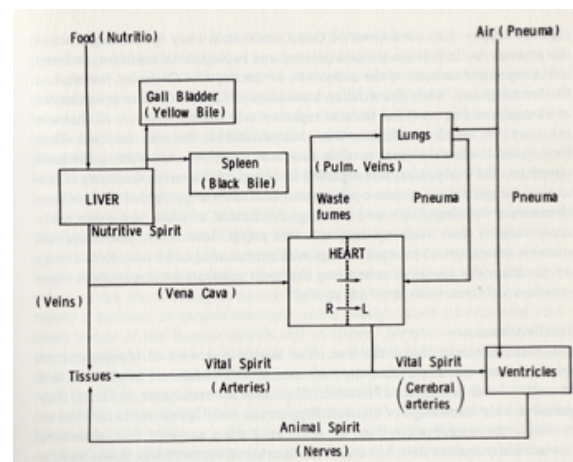
"The best gymnastics is that which not only exercises the body but delights the spirit" [Galen: Exercises with the small ball, (McIntosh, 1993)]

Galen was perhaps the first to draw the important distinction between exercise (which he saw as including running, shadow fighting, wrestling, jumping, throwing a discus, games with a small or a large ball, and leaping with weights, followed by massage), and the vigorous activities of daily living (digging, ploughing, pruning, reaping, riding, fighting, hunting and travelling) (Mattern, 2008). Health Canada and the Coalition for Active Living have followed Galen's lead in recent years, recognizing the contribution that active living can make to population health.

Galen's advocacy of moderate physical training can be seen in at least three of his works: *"On Health," "Whether health is the concern of medicine or gymnastics"* and *"Exercises with the small ball."* The last probably refers to a game somewhat akin to handball, played in a walled court or *sphaeristerium*. Galen preferred such activity to more dangerous and fiercely competitive sports such as wrestling and *pankration*, and he recommended exercise with the small ball or *harpastum* for the treatment of many ailments (Green, 1951):

"it exercises every part of the body, takes up little time, and costs nothing."

Figure 2: Sketch illustrating Galen's teleological explanation of human physiology (*De usu partum corporis humani; Uses of the human body parts*). Food (*nutritio*) was conveyed by special ducts to the liver. Here, vital heat converted it into blood (*nutritive spirits*). Excessive food was transferred to the gall bladder, where it formed yellow bile) and to the spleen (where it formed black bile). Some of the nutritive spirits were conveyed to peripheral tissues by an ebb and flow motion in the veins, and some passed via the vena cava to the right ventricle. From there, it passed through microscopic pores in the inter-ventricular septum to reach the left side of the heart, where it was warmed by the innate heat of this organ. It then mixed with inhaled air (*pneuma*) in the lungs, forming vital spirits. Respiration was needed to cool the fire in the left ventricle. The vital spirits were conveyed to the brain via the cerebral arteries, and after penetrating the cribriform plate, they were transformed into vital spirits. The vital spirits in turn travelled through the nerves, inducing a swelling and thus a contraction of the skeletal muscles. The pumping action of the heart also allowed excessive vapours and waste fumes to pass via the pulmonary veins, back to the lungs.



Caesar is said to have been an excellent ball player, and wealthy Romans frequently included a *sphaeristerium* when designing their "dream villa," much as a wealthy Canadian of today might set aside an exercise room in his or her basement. However, unless slaves were in

plenteous supply, it is unlikely that a walled court “cost nothing.” Moreover, even this exercise could sometimes become very vigorous, with the use of “*many wrestling holds*” against the opponent.

Views of Plato. In Book 3 of his “Republic,” Plato (360a BCE), although himself an amateur wrestler, described the professional athlete scornfully:

“the habit of body such as they have is but a sleepy thing, and perilous to health.”

For Plato, sport had value only when it was severed from the prospect of financial gain. He used the word *ascesis* to denote physical training, which should include attention to diet and endurance training. As we shall see in a subsequent article, this concept of asceticism developed further in the monasteries of the Middle Ages.

Views of other philosophers. Aristotle (384-322 BCE) argued that:

“The best habit is one which comes midway between the athletic and the valetudinarian, some amount of exertion must therefore go to its making. But the exertion must not be violent or specialized, as is the case with the athlete.” [Aristotle: *Politics* (Mouratidis et al., 1998)]

The Greek sophist Philostratus (c172-250 CE) continued to heap derision on traditional athletes who focussed simply on the development of extreme strength in his work “*Gymnasticus*.” Such training upset the balance of the bodily humours: doctors over-stuffed the athletes, failed to develop their endurance and did not enforce sufficiently rigorous training (Konig, 2008).

Oribasius (4th century CE), one of Galen’s pupils, believed that exercise should be sufficient to leave a person exhausted, but he also agreed that exercise had to be carefully supervised to avoid adverse reactions (Grant, 1997).

Quantitating training. Perhaps because many of the Romans believed in moderate exercise, one of their important contributions was the quantitation of training sessions through the use of odometers, study of respiration and accurate pulse counting.

Much of the physical activity required by the Roman military comprised long marches along stone-paved highways, and an odometer was thus developed to allow the placing of precisely measured milestones (Sleeswyk, 1981). The instrument was described by Vitruvius, about 27 BCE (Book X of *de Architectura*, Chapter 9), although it may have been invented by Archimedes of Syracuse [287-212 BCE]. More recently, Canadian cardiologists have used car odometers in a similar fashion, setting precise walking distances, for patients undertaking unsupervised rehabilitation following myocardial infarction (Kavanagh, 1976).

Galen ante-dated the late Bob Goode (Goode et al., 1998) in suggesting that an individual’s increase in respiration could be a useful criterion when setting an appropriate intensity of exercise during training sessions. He recommended not exercising until the “first digestion” of food had been completed. The ideal regimen should also include a warm-up and a warm-down, the latter followed by massage and the drinking of adequate fluids. In his *Treatise to Thrasyvoulos*, Galen further argued that excessive exercise against opponents could produce what he regarded as an unhealthy condition, a highly specialized athlete

who had difficulty with ordinary activities such as digging, mowing or rowing (Sweet, 1987).

The water clock or *clepsydra* was known in China, Babylon and Egypt from 4000 BCE, but it was greatly perfected by the Greeks and Romans; this enabled physicians and trainers to make accurate measurements of heart rate (Landeis, 1979). Herophilus (335-280 BCE) seems the first physician to have used a *clepsydra* for this purpose.

Sport and recreation. *Caestus boxing.* As the Roman era continued, boxing developed in two directions - as a recreational pursuit of the nobility, and as a form of gladiatorial combat. The poems of Horace and of Ovid suggest the popularity of wrestling and discus throwing among the wealthy. Gladiatorial opponents fought to the death, wearing a *caestus*, a glove that was reinforced with metal spikes to increase the extent of injuries. Despite the efforts of Tiberius (42 BCE - 37 CE) and Constantine (272-337 CE), *Caestus* boxing became increasingly bloody until in 393 CE such contests, along with other Olympic events, were banned by the decrees of Theodosius (347-395 CE) (Grindle, 1892).

Spectator Sports. According to the historian Suetonius (c 69-130 CE), during the rule of Nero (37-68 CE) sport increasingly took the form of Etruscan-imported spectator events (Champlin, 2005) - four-horse chariot racing, mock sea battles and fights with wild animals-what Juvenal (Satire X) saw as a means of buying popular support ("*panem et circenses*, bread and circuses"), and more recently Peter McIntosh characterized as a form of social control (McIntosh, 1993).

One spectacle boasted 63 leopards and 40 bears and elephants.

Even sports such as running, throwing and jumping became the domain of a guild of professional performers. Many large stadia and amphitheatres were built to allow the staging of such spectacles throughout the Roman Empire. The Colosseum in Rome, begun under the emperor Vespasian in 72 CE, accommodated 50,000 spectators, and in 103 CE, the emperor Trajan (53-117 CE) rebuilt the nearby Circus Maximus. The latter had previously been a simple wooden structure, but it had been destroyed by fire. In its place, Trajan constructed a massive marble chariot-racing stadium that measured 600 x 150 m and seated at least 150,000 people (Humphrey, 1985). Often, the entire chariot course was sprinkled with a mineral such as a green carbonate of copper (*chrysocola*) to indicate the Emperor's support of a particular team. By 354 CE, there were also 200 public holidays per year, of which 175 were devoted to "Games" of this type (McIntosh, 1971).

Other recreational facilities. Other recreational facilities available to the general population were the *thermae* and the smaller *balnae*, or public baths. The bath built by Trajan measured 280 x 210 m (McIntosh, 1971), and the Diocletian bath was said to accommodate as many as 6000 bathers at any one time. In addition to bathing facilities, the *balnae* included courts for ball games, discus throwing and exercises with weights, plus libraries and restaurants. A wealthy senator hoping to become a Tribune sometimes thought it good politics to arrange a day of free public admission to the local *balna* to celebrate his birthday. Frontinus (40-103 CE), a famous Water Commissioner,

reported that there were 856 *balnae* in Rome alone (Evans, 1994). After exercising, the bathers either relaxed or were massaged in a *tepidarium*, and then progressed to a yet warmer *caldarium*, finishing with a brief spell in the *laconicum*, the hottest of the baths.

As Christianity became established, blue laws prohibited visits to the baths on Sundays (Aaland, 2005; Yegul, 1992).

Impact upon fitness. Fitness levels declined as wealthy Romans became sated with pleasure and sedentary entertainments; attendance at gladiator battles and chariot races came to assume a higher priority than the maintenance of physical condition. The lavish lifestyle eventually took its toll of physical decay, and the Roman civilization fell to physically superior Barbarian tribes from Northern Europe in 476 CE (Harris, 1972).

Conclusions

Conclusions about health and fitness in the Classical world can be based not only on artifacts such as statues and ceramics, but also on a copious literature. However, many of the written accounts were completed centuries after the events described, and it often remains hard to dissociate reality from myth. The Minoan culture of Crete was important in that it provided a bridge for the transmission of Egyptian and Middle-eastern concepts of health and fitness to mainland Greece. It was lauded for the development of superbly conditioned athletes, both men and women, and apparently this training was undertaken without the pressure of some impending military conflict. Greek society brought major changes to medicine through the teachings of Hippocrates and his followers. The Hippocratic code served to transform

charlatan magicians into highly respected and ethical professionals. Medical knowledge showed a slow but progressive transition from the mythology of Aesculapius towards rational, evidence-based and even molecular medicine under Hippocrates, Pythagoras and Ascelapiades. Therapy focused on the Greek understanding of the nature of matter, with a search for balance among the four body humours (blood, phlegm, yellow and black bile), an approach that probably owed something to the Chinese concepts of Ying and Yang (Shephard, 2012). Tactics included not only such drastic remedies as purgatives, emetics and blood-letting, but also a matching of exercise to diet, so that exercise became a significant and integral component of medical therapy.

The establishment of inter-city Games such as the Olympiad is widely praised, particularly for its amateur if patrician status. Development of the athlete's body became seen either as a goal in itself, or as a tribute to Zeus. However, this noble goal was quickly corrupted by the award of major prizes, with issues of age-classification, doping, the "fixing" of contests, and sudden changes in citizenship. Gymnasia for the preparation of athletes were built across Greece, and these offered for the first time an education where regular physical training helped the process of academic learning. Boxing and wrestling were popular sports, and some contestants in these disciplines seem to have developed a formidable musculature. However, there was a gradual recognition that moderate exercise had greater health value than such massive muscular development.

Sparta and Rome placed a strong emphasis upon sport as a means of enhancing fitness for military combat, and many in Rome thought the *gymnasion* an

effete institution, an obstacle to effective martial training. In the early days of the Roman Empire, all citizens were expected to maintain military preparedness. The introduction of odometers, milestones, observations of ventilation and accurate pulse counting allowed training and military operations to be set at an appropriate level of effort. However, the increasing wealth of the Roman Empire allowed growing leisure, not only for the wealthy, but also for ordinary citizens. Spectator sport was seen as a method of social control, and a combination of the construction of massive stadia, and frequent public holidays permitted a large fraction of the population to attend brutal contests between gladiators and wild animals. There were also widespread opportunities for relaxation at public thermal baths. Such trends probably contributed to a deterioration in physical condition of the Roman people, and thus their conquest by stronger northern tribes.

Author's Qualifications

The author's qualifications are: Roy J. Shephard M.D., Ph.D., LL.D., D.P.E., F.A.C.S.M.

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