The Athlete’s Clock

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LEARNING OBJECTIVES FOR THE ATHLETE'S CLOCK

After completing this course participants will be able to:

1. Explain why the author thinks the photo of Roger Bannister crossing the finish line is the “greatest sports photo ever.”

2. Understand what strategy a runner should employ for success in a long distance run.

3. Explain why the human brain might act to regulate or limit an athlete’s exercise pace.

4. Explain what a brain governor is and why it might regulate the intensity or duration of endurance aerobic exercise.

5. Explain how the brain subconsciously limits the amount of exercise an athlete can safely perform.

6. Explain the idea that a brain governor might set an athlete’s pace at the start of a distance race.

7. Explain why the brain governor might fail to prevent damage to an athlete.

8. Identify why athletes and coaches advocate a steady pace in distance events.

9. Identify which pacing module is considered the least successful for producing an athlete’s optimal performance.

10. Explain why the scientific studies on pacing strategies have not resolved the issue of optimal pacing.

11. Explain what the role of the automatic motor oscillator is in distance runners.
12. Identify how distance runners primarily change their speed.

13. Identify what part of the brain influences movement timing.

14. Explain the term entrainment as it relates to runner’s breathing and stride rhythm.

15. Explain why humans can’t achieve the running speed of other mammals.

16. Identify the phases of a short, all out spring.

17. Explain why increasing stride length and not just increasing stride frequency is important in increasing overall running velocity for sprinters.

18. Identify the type of muscle fibers sprinters have a higher percentage of than non-athletes.

19. Identify what factor can affect a sprinter’s running velocity other than fiber type.

20. Explain how sprinters will be able to improve their time without the use of artificial enhancements.

21. Explain what is meant by the term circadian rhythms.

22. Identify the science that studies biological rhythms.

23. Identify the common type of biological rhythms in humans.

24. Identify what is thought to be the master biological pacemaker in mammals.

25. Identify the two defining characteristics of all biological rhythms.

26. Explain what, according to the author, the importance of biological rhythms might be to an athlete’s performance.

27. Identify what area of the body normally regulates core body temperature.


29. Explain what is meant by the term jet lag.
Test for *The Athlete's Clock*. Choose the BEST answer for each question.

1. Which of the following is the question presented throughout the chapters in the book?
   a. Can or should the athlete consciously dictate or willfully strategize their sport performance over time?
   b. Is the athlete’s sport performance under the conscious control of their Central Nervous Systems?
   c. Is the athlete’s sport performance the result of the decision making and guidance of their coach?
   d. Is athletic performance under the conscious control of human beings or under the control of the forces of nature?

2. The author calls the photograph of Roger Bannister crossing the finish line, “the greatest sports photo ever” because it was a photo of
   a. A medical student, not an athlete, winning the race.
   b. A runner achieving the four minute mile for the first time.
   c. A runner using a scientific approach to pacing strategies for the first time.

3. Runners, cyclists and swimmers are at a disadvantage compared to sports like tennis or basketball for choosing strategies for performance success because
   a. They never know what the condition of the track or water will be.
   b. They can only choose to either go faster, go slower or maintain constant velocity throughout the race.
   c. They can only train to maintain their maximal speed for a specific amount of time, not for various distances.
   d. They can only develop a successful strategy after they are able to measure the ability of their competitors (after the race has started.)
4. In order to achieve success in a distance race, which of the following is true?
   
   a. The runner should start the race at maximal effort in order to set the pace for the other runners.
   
   b. The runner should start the race at a very relaxed pace in order to conserve energy and be exhausted at the end of the race.
   
   c. The runner should start the race at a speed than can be sustained and adjusted as needed during the race, providing the greatest average-muscle work per time.
   
   d. The runner should start the race at a very moderate pace and at the midpoint of the race, increase their pace to maximal effort.

5. The use of a numerical scale by athletes to subjectively report their feelings of exercise stress or level of exercise effort is called
   
   a. Rating of labored breathing
   
   b. Heart rate perception
   
   c. Rating of perceived exertion
   
   d. Difficulty scale

6. According to research physiologists, the primary cue used by athletes to sense their level of effort is which of the following?
   
   a. Physiologists are not sure exactly how an athlete senses their level of effort.
   
   b. Rate and depth of breathing is used by most athletes
   
   c. Buildup of blood lactate levels.
   
   d. Increase in heart rate

7. If the athlete doesn’t control their exercise pace based on how they feel, their pacing may be controlled by
   
   a. Visual cues such as placement of mile markers
   
   b. Psychological mechanisms such as knowledge of time
   
   c. The brain acting to regulate motor activity to keep the body from exercising beyond the limits of safety.
   
   d. The athlete’s anticipation of an average speed based on previous events.
8. As a protective mechanism, the brain subconsciously limits the amount of exercise that an athlete can perform by
   a. Creating agonizing, miserable feelings of fatigue, making it intolerable to the athlete to keep going.
   b. Increasing the strength of muscle contractions until muscle cramps occur making too painful to continue.
   c. Causing a failure of homeostatic control
   d. Causing the body to collapse due to erratic heart rhythms from signals from the Central Nervous System.

9. Rather than an athlete’s physiological or physical state regulating exercise capacity, the intensity or duration of endurance aerobic exercise is limited by
   a. A brain supervisor
   b. A brain governor
   c. A CNS regulator
   d. The athletes genetic profile

10. The idea that the unconscious brain governor is able to set an appropriate pace for an athlete’s optimal performance at the start of a distance race is based on the premise that
   a. The central nervous system has anticipatory powers based on an athlete’s level of training.
   b. The brain is able to set an athlete’s rate of muscular effort in advance of any sensory input based on previous experience.
   c. The brain sets the athlete’s velocity at the start of a race based on psychological cues rather than physical cues.
   d. The brain knows how much muscular effort an athlete is able to safely expend based on the athlete’s age.
11. When the brain governor fails to prevent damage to an athlete, it is likely due to
   a. The athlete’s ability push beyond the limits of fatigue and discomfort
   b. The athlete having a preexisting condition, such as heart muscle abnormalities.
   c. The athlete having a predisposing condition, such as the use of medication or ergogenic aids
   d. Both b and c are correct.

12. When setting the pace for a race, coaches and athletes have advocated even steady pacing in distance events because
   a. Steady pacing uses energy more economically.
   b. It doesn’t increase the build up of lactic acid.
   c. It keeps the body temperature at an even level without increases or decreases.
   d. It prevents dehydration.

13. Starting a race at a slow pace and then completing the second half of the race at a slightly faster pace is called a
   a. Positive split
   b. Negative split
   c. Fast split
   d. Steady split

14. Which pacing module is considered the least successful for optimal performance?
   a. Steady pace throughout the race.
   b. Relaxed start with a strong finish.
   c. Start fast but finish slow.
   d. All three are equally successful.
15. The _____ has been used by some athletes to guide pacing strategies for distance running.
   a. U shaped pattern.
   b. 5 percent rule.
   c. 2 percent rule.
   d. 9 second rule.

16. Which of the following statements regarding scientific studies on pacing strategies is true?
   a. There is a lot of scientific research regarding optimal pacing that proves a steady pace is the most efficient strategy.
   b. The majority of the scientific studies on pacing were performed in the real world of distance racing and not in a laboratory.
   c. The studies that have been completed on pacing strategies have had conflicting results and are not helpful in defining optimal pacing.
   d. Optimal pacing is sport specific and varies from one distance sport to another.

17. The author cites examples of techniques used by former athletes. One of the examples was Paavo Nurmi, who focused entirely on the _____ and ran with a _____ in his hand.
   a. Time of day of the race; towel
   b. Clock; stop watch
   c. Speed of his opponents; clock
   d. Ability to maintain the lead; watch

18. Competitive athletes will often push past the pain and fatigue they feel, but they should be especially careful about paying attention to how their body feels in _____.
   a. Hot, humid environments
   b. Cold, dry environments
   c. Cold, wet environments
   d. Moderate, wet environments
19. Separate from the brain governor, our bodies also possess a mechanism that
   a. Acts as an intrinsic controller of muscular activity and keeps a steady tempo of neuromuscular activation.
   b. Reserves muscle energy for increases in speed as needed during a race.
   c. Gives runners an unconscious sense of rhythm when running.
   d. Provides an intrinsic time monitor that increases pace at the point in a race that will optimize performance.

20. The primary role of the automatic motor oscillator in distance runners is to
   a. Help runners increase their velocity by increasing both stride frequency and stride length simultaneously to maximize the capability of the runner.
   b. Decide which is the right combination of stride frequency and stride length to attain a desired velocity.
   c. Respond to the runner's own manipulation of their stride frequency in accordance with runner's strategy for best performance.
   d. Prevent the runner from over exerting or over stressing their muscles and causing possible damage or injury.

21. According to research findings, for distance runners, changes in speed were achieved primarily through
   a. Increasing stride frequency.
   b. Increasing both stride frequency and stride length (especially in events ranging from 3,000 meters to a marathon.)
   c. Increasing stride length.
   d. Decreasing stride length and increasing stride frequency.
22. What is the purpose of the motor oscillator keeping the stride frequency the same tempo at different running speeds?
   a. Maintaining a constant tempo helps the runner get into a rhythm that helps protect them from possibly tripping when increasing stride frequency
   b. Keeping a constant tempo helps lessen landing impact
   c. Maintaining stride frequency minimizes expenditure of metabolic energy and decreases the risk of overuse injury
   d. It helps the runner strategize the best way to optimize his or her performance.

23. Why do cyclists have a preferred cadence that is higher than a lower energy-efficient cadence?
   a. The only way to increase speed on a cycle is to increase the cadence.
   b. Pedaling at a higher cadence minimizes muscle strain and creates less force per revolution
   c. A faster cadence is more efficient for climbing hills
   d. A faster pedal rate creates a more comfortable environment when riding in heat and humidity.

24. The official scientific name for the unconscious timing mechanisms that govern motor performance (what the author calls a central motor oscillator) is
   a. Central pacemaker governor
   b. Central performance generator
   c. Control pattern generator
   d. Central pattern generator
25. Which of the following statements regarding the CPG is true?
   a. The CPG is one central controller located in the central nervous system.
   b. The CPG is several control centers that are dispersed throughout the central nervous system.
   c. The CPG is two control centers, one that coordinates and synchronizes the exact sequence of muscular innervations over time that permits locomotion and one that precisely regulates the tempo of the entire system.
   d. The CPG is a motor center which signals muscle contraction and controls purposeful motor activity.

26. The difference between CPGs and brain motor centers is that
   a. Humans use the CPG's to consciously control the rhythm and tempo of purposeful motor activity, but the brain motor center is a subconscious control
   b. Brain motor centers are in the cerebral cortex and CPGs are in the nerve fibers that control muscle contraction.
   c. CPGs subconsciously control the rhythm and tempo of purposeful muscle activity, but the brain motor centers can be willfully and consciously controlled.
   d. CPGs exist throughout the animal kingdom, but motor control areas are unique to human beings.

27. Which of the following statements is true regarding CPGs and the evolutionary process?
   a. CPGs in cats and in monkeys are basically the same with little control from higher brain centers.
   b. From some of the research done on monkeys, the persistence of locomotor patterns after spinal cord transactions has been shown.
   c. Research has revealed a lot of information about the existence, location and function of CPGs in humans.
   d. Evidence suggests a decrease in the independent nature of spinal cord CPGs in human beings as compared to lower animals.
28. Movement timing appears to be influenced by the ____ since patients with disease in this area have difficulty timing muscle activation during rapid limb movements.
   a. Hypothalamus
   b. Cerebellum
   c. Spinal cord
   d. Brain stem

29. In humans, as well as many other animals, it has been observed that for a certain number of strides there is a breath. In other words, breathing is often coupled with stride rhythm during locomotion. This is called _____.
   a. Entertainment of breathing
   b. Entrainment
   c. Ventilation stride rhythm
   d. Breathing and striding link

30. According to the author, which of the following statements regarding breathing and striding is true?
   a. Entrainment, using a 2-2 rhythm (two steps during inhalation and two steps during exhalation) definitely improves the performance of a distance runner.
   b. Higher brain centers in the runner should determine breathing pattern in order to minimize the work of the respiratory muscles.
   c. Neither professors of exercise physiology nor distance runners can agree on whether runners should breathe naturally without concentrating on a certain pattern, or whether they should use entrainment to improve their performance.
   d. Entrainment should never be used by distance runners since it is neither efficient nor beneficial in improving performance.
31. Force over a distance is called _____, and _____ is the rate at which the work gets done.
   a. Work; power
   b. Watts; speed
   c. Foot-pounds; power
   d. Work; horsepower

32. Power is expressed in terms of _____, named for James Watt, who developed the first _____.
   a. Watts; generator
   b. Watts; practical steam engine
   c. Watts; combustion engine
   d. Horsepower; generator

33. Why does the author compare human athletes to machines?
   a. Both humans and machines have to be fed fuel that can be converted to energy.
   b. Both humans and machines have different functions when they work. For example different machines do different jobs; athletes have different sports they participate in.
   c. Like machines, when human athletes exercise they burn fuel with oxygen to convert chemical energy into muscular activity, creating power.
   d. Machines, like humans, must have oxygen to function over long time periods.

34. According to the book, the world’s fastest man sprinted down a 100-meter track in _____ seconds.
   a. 0:26.28
   b. 0:09.58
   c. 0:11.49
   d. 40 mp
35. Which of the following statements regarding running speed and mammals is true?
   a. Mammals achieve top running speeds related to specific adaptations that equip them for high running velocity.
   b. Bigger animals are faster than smaller ones, therefore the larger the athlete is, the faster they can sprint.
   c. Humans don’t have the muscular capacity that certain other mammals possess and can’t produce the force necessary to sprint as fast as a mammal such as a greyhound.
   d. Humans possess a brain governor not possessed by other mammals that controls how fast a sprinter can run in order to protect the runner from injury.

36. A short all out sprint has distinct phases, which are the starting block phase, acceleration phase, _____ and _____.
   a. Peak velocity phase; finish line velocity decrease phase
   b. Finish line velocity decrease phase, starting block lag phase
   c. Constant speed phase; deceleration phase
   d. Stride frequency phase; stride length phase

37. In a race, a false start has been defined as
   a. A start more than 0.171 seconds after the gun
   b. A start less than 0.1 seconds after the gun
   c. A start less than 0.185 seconds after the gun
   d. A start less than 0.160 seconds after the gun

38. Overall, male sprinters have faster sprinting times than females by about _____.
   a. 10 percent
   b. 20 percent
   c. 15 percent
   d. 7 percent
39. The fact that on average male sprinters have faster sprinting times than female sprinters has been attributed to

a. The males longer stride length and their ability to generate greater ground forces.

b. Women are more flexible than men and this affects their elastic recoil forces.

c. Males have greater leg-muscle mass.

d. All of the above may be involved in why males sprinters are faster than female sprinters.

40. Coaching sprinters to increase their stride frequency without an increase in stride length will not affect their overall running velocity because

a. If a sprinter increases their rate of striding but do not provide an increase in muscle force to lengthen their stride, stride length will shorten and overall running velocity will not be increased.

b. Increasing stride frequency only, without an increase in stride length, will increase the requirements for force production per step which does not increase velocity.

c. Some research has shown that sprinters with the greater stride length had higher velocities than those who focused only on increasing stride frequency.

d. Increasing sprinting velocity by increasing stride length requires more development of strength and power than increasing stride frequency in the short term.

41. Sprinters tend to possess a higher percentage of what type of muscle fibers in their leg muscles than do non-athletes?

a. Type I fibers

b. Slow-twitch, Type II fibers

c. Type I fast-twitch fibers

d. Fast-twitch Type II fibers
42. As well as muscle fiber type, what other factor can affect a sprinter’s running velocity?
   a. A strong, high arch in the feet.
   b. The elasticity of leg muscles and their connecting tendons.
   c. The most current training trends using weight training.
   d. Advances made in the design of running shoes.

43. Why are Type II fibers more adept at the kind of work required for sprinting that Type I fibers?
   a. They possess a greater metabolic capacity for anaerobic metabolism.
   b. They generate high muscular force over brief periods.
   c. They can contract at a velocity that is twice as fast as that of slow-twitch fibers.
   d. All of the above are correct answers.

44. According to the author, if it is accepted that there is an ultimate limit below which no human will ever be able to run 100 meters, how will sprinters continue to improve without artificial enhancements?
   a. Ultimate training techniques will be developed that will allow humans to push past any biological limits set for performance.
   b. Genetic selection will produce sprinters capable of overcoming any biological limitations.
   c. Runners can continue to break records by adding decimal points to their running times so records can be broken even if a lower limit exists.
   d. Changes in track surfaces will be developed that will allow athletes to improve their speed.
45. All living things, including both animals and plants, possess clocks that govern phasic increases and decreases in cell function that cycle with chronological time. These patterns are called ______ and have a bearing on athletic performance.
   a. Physiological rhythms
   b. Circadian rhythms
   c. Sleep cycles
   d. Wake cycles

46. As far as sports and athletic performance goes, why could circadian rhythms be a factor?
   a. The clocks that dictate circadian rhythms govern phasic changes in physiological functions that have an important bearing on motor performance.
   b. If an athlete has to travel out of his/her normal time zone for a competition, the circadian rhythm can be affected (particularly sleep patterns) and result in a poor performance by the athlete.
   c. Several famous athletes has credited their poor performance in a competition to what has been termed “jet lag” brought on by an interruption in their biological rhythms.
   d. Circadian rhythms do not play a role in athletic performance.

47. The science of the study of biological rhythms is called ______.
   a. Molecular genetics
   b. Chronobiology
   c. Anthropology
   d. Neuroscience

48. Most biological rhythms in humans are
   a. Diurnal
   b. Circatidal
   c. Circalunar
   d. Nocturnal
49. The master biological pacemaker in mammals is/are
   a. The central gene clocks
   b. Serum glucocorticord levels
   c. Suprachiasmatic nucleus
   d. Ribonucleic acid

50. The two defining characteristics of all biological rhythms are
   a. Biological functions vary with an intrinsic periodicity in a constant environment. These intrinsic rhythms are considered to be genetically controlled and tend to be quite precise.
   b. The intrinsic periodicity can be altered by extrinsic sensory input (most commonly the light-dark cycle in a chronological, astronomical day.)
   c. Biological rhythms always follow an intrinsic clock and never respond to any extrinsic stimuli in an organism’s environment.
   d. Both a and b are characteristics

51. Which of the following statements is most relevant as to why biological rhythms might be important to an athlete’s performance?
   a. An athlete could plan their competition schedules during times when their individual biological rhythms are at their peak.
   b. Becoming familiar with their performance related intrinsic biological rhythms would help an athlete to become less dependent on training and diet for success.
   c. Teams and coaches could schedule competitions during times when most athlete’s expected temporal peaks in function and performance.
   d. According to the author, there are questions regarding patterns of physiological and performance markers that need to be answered before recognizing the importance of phasic changes to an athlete’s physiological function and sports performance
52. What area of the body normally regulates core body temperature?
   a. Nerve centers in the spinal cord
   b. Hypothalamic centers in the brain
   c. Hypothalamic centers in the spinal cord
   d. A CNS governor

53. Regarding core temperature, most people are warmest around ____ and coolest around ____.
   a. 1:00 p.m.; 9:00 p.m.
   b. 6:00 p.m.; 4:00 a.m.
   c. 9:00 a.m.; 6:00 p.m.
   d. 2:30 p.m.; 12:00 a.m.

54. Which of the following is NOT true regarding the importance of core temperature in athletic performance?
   a. Velocity in nerve conduction increases by 2.4 meters per second for each rise in body temperature of 1 degree C.
   b. Enzymatic activity in metabolic processes is accelerated as temperature increases
   c. A rise in total body temperature improves performance in sustained exercise.
   d. Flexibility and muscle and tendon contractile function may be improved by elevations in body temperature.

55. The change in core body temperature reflects the combined effects of at least one internal variable and two extrinsic variables. The two extrinsic variables are
   a. A person’s sleep cycle and wake cycle.
   b. The increases in metabolic processes that result when a person performs physical and mental tasks.
   c. A biological rhythm driven by a person’s SCN.
   d. Both a and c are the extrinsic variables.
56. There are studies that indicate that peak strength is between ______ and that this corresponds to ______.
   a. 9:00 and 10:00 a.m.; lowest point of core temperature
   b. 5:00 and 7:00 p.m.; peak in core temperature
   c. 5:00 and 7:00 p.m.; lowest point in core temperature
   d. 9:00 and 10:00 a.m.; peak in core temperature

57. Other research has found that for muscle strength:
   a. The rate of strength decline with repeated contractions was observed in the evening.
   b. There is no correspondence between strength and peak core temperature.
   c. There is minimal difference in strength between morning or afternoon hours.
   d. Time of day is irrelevant to strength values so circadian rhythms have no impact on muscle contraction.

58. In regards to maximal aerobic power, a person’s oxygen uptake at rest is lowest at _____ and peaks _____.
   a. 5:00 a.m.; around midday
   b. 4:00 p.m.; in the late afternoon and early evening
   c. 4:00 a.m.; in the late afternoon and early evening
   d. 11:00 p.m.; around noon

59. Cyclical patterns of levels of cortisol and growth hormone
   a. Peak in the early afternoon
   b. Peak at 8:00 a.m.
   c. Peak at 8:00 p.m.
   d. Peak during the sleep cycle
60. When do circadian rhythms of cognitive processes tend to peak?
   a. Around mid-afternoon.
   b. In general, earlier in the day than those of physiological variables.
   c. Short-term memory peaks in the early evening.
   d. Long-term memory peaks in the early morning.

61. The impairment of both physical and mental performance that results from jet lag has been termed _____.
   a. Sleep deprivation
   b. Mental fatigue
   c. Circadian adversity
   d. Diurnal interruption

62. Which of the following statements regarding the effects of jet lag is true?
   a. Jet lag symptoms are worse when a person flies from east to west.
   b. The more time zones an athlete crosses, the worse they will feel when they arrive at their destination.
   c. Generally, males experience more jet lag symptoms than females.
   d. Extroverts or night people have a harder time adapting to changes in biological rhythms.

63. Melatonin is secreted by the ____ gland and is highest in the body in _____.
   a. Adrenal; daylight hours
   b. Pituitary gland; the dark of night
   c. Pineal gland; daylight hours
   d. Pineal gland; the dark of night
64. Melatonin has what type of effect on the body?
   a. It has a hypothermic effect and lowers body temperature.
   b. It has a hyperthermic effect and lowers body temperature.
   c. It has a hypothermic effect and increases body temperature.
   d. It has a hyperthermic effect and increases body temperature.

65. Which of the following is the best definition of the term scalar expectancy theory?
   a. An internal clock in the human brain that provides us with a sense of present or working time. This acute perception of time governs our daily activities and decisions.
   b. Our expectancy that, using past experiences, similar situations will always occur within a similar time frame.
   c. Our ability to recognize that an occurrence or experience is outside the realm of what we perceive should be of normal duration.
   d. Our ability to perceive our environment in both spatial and temporal realms that is necessary for our survival.

66. Why is an acute perception of time important to athletes?
   a. Athletes need to be aware of how much time they have spent and how much time they have left in a sports competition.
   b. Athletes must be able to identify a visual duration and match it to a motor activity.
   c. Athletes must be able to use intrinsic timekeeping mechanisms in order to make deliberate, conscious decisions about their motor activities.
   d. When an athlete is playing a particular sport or involved in competition, it is important for that athlete to be able to recall a memory of a previous time to use as a guide for current motor responses.
67. In baseball, professional players can only track a pitched ball to within 5.5 to 6 feet of home plate, so players jump their vision ahead and then let the ball catch up to the focal point. This practice of putting the eye ahead of the ball is called _____.
   a. Façade point
   b. Anticipatory vision
   c. Saccade
   d. Jump vision

68. Researchers consider athletes experts at visuotemporal processing. In determining why athletes possess these timing abilities, all of the following factors have been considered EXCEPT
   a. Reaction time
   b. Running speed
   c. Coincidental timing
   d. Anticipation

69. Which of the following statements regarding athletes and reaction time is true?
   a. Researchers have found a much shorter reaction time between athletes and untrained subjects when testing basic reaction times.
   b. The shorter reaction times of trained athletes are innate.
   c. Athletes have superior reaction times in tasks that are specific to their sport.
   d. Neither basic reaction time nor choice reaction times are trainable.

70. Baseball players tend to reach their peak pitching and hitting capabilities at _____, while track and field athletes peak at _____.
   a. 28 or 29 years of age; their mid 20s
   b. 30 or 31 years of age; their late teens and early 20s
   c. 24 years of age; their mid 20s
   d. 20 or 21 years of age; 18 or 19 years of age
71. When training young athletes, researchers at Florida State University determined that to be successful and improve skill and performance, practice activities should be what they labeled _____.
   a. Performance aspect training
   b. Repeat activity training
   c. Deliberate practice training
   d. Coach-guided training

72. There is the popular notion that to make an athlete a champion, it requires
   a. That children start training for a specific sport by 4 years of age.
   b. 10 years and 10,000 hours of the right kind of practice.
   c. Structured coaching by the time a child is in their early teens.
   d. The right combination of genes and intense practice.

73. Which sports would require early specialization because performance must peak in the early teen years?
   a. Tennis and pole vault
   b. Speed skating and basketball
   c. Short distance running and basketball
   d. Figure skating and gymnastics

74. The book quotes Tudor Bompa, who stated that he believed that
   a. Specialized sport involvement for young children is necessary for developing elite athletes.
   b. Multilateral sport involvement for young children is important for their overall healthy athletic development.
   c. It is important for young children to develop a variety of fundamental skills to help them become general athletes before specializing in training for one sport.
   d. Both b and c are correct answers.
75. In attempting to identify sports talent in children, one approach that was characteristic of Eastern European countries and recently China was the _____, while in the United States and westernized countries the approach used is _____.

a. Weeding out approach; the scientific approach
b. Demonstrated performance from a large pool of young athletes; early age screening based motor development and physical characteristics.
c. Scientific approach based on motor skills and physical characteristics; weeding out the best performance from a large pool of young athletes
d. Demonstrated performance which lets the cream rise to the top; selection based on physical characteristics associated with a specific sport.

76. What are the two types of aging identified in the book?

a. Biological aging and psychological aging
b. Genetic aging and environmental aging
c. Primary aging and secondary aging
d. Chronological aging and biological aging

77. The increase in the natural life span of human beings in developed nations is due to

a. Delays in primary aging as humans have evolved.
b. New treatments and medicines that delay deterioration of cellular integrity and function.
c. Better nutrition during the developmental years of children and young adults.
d. Better, improved health care, better nutrition and improvements in sanitation.

78. Which of the following statements regarding physical activity and aging is true?

a. Athletes who maintain high levels of sport activity through their adult life will see benefits that limit their secondary aging.
b. High levels of physical activity help limit the effects of primary aging.
c. Physical activity has no impact on health risk factors or aging.
d. Too much physical activity has been shown to have a detrimental effect on both categories of aging.
79. What two characteristic changes occur as humans age?
   a. A decline in the level of daily physical activity and loss of body fat.
   b. A decline in the level of daily physical activity and increase of lean body mass.
   c. An increase in the level of daily activity and increase of lean body mass.
   d. A decline in the level of daily physical activity and loss of lean body mass.

80. The term for the progressive loss of skeletal muscle as humans age is _____, and amounts to _____.
   a. Biomarkers; 5% per year after age 40
   b. Sarcopenia; 5% per year after age 40
   c. Sarcopenia; 10% per decade after age 40
   d. Biomarker; 10% per decade