History of Physical Activity

How much do we really need?

From an evolutionary perspective what is more normal? Someone who pushes their body to do nonessential physical activity or someone who prefers to avoid unnecessary exertion? A common assertion by gym–bros and fitness enthusiasts is that civilization and modern society — and its associated lifestyles — have reduced our natural physical abilities. They usually then point to select individuals from less westernized populations who appear to be able to scale mountains, run ultramarathons, and perform seemingly superhuman feats without training as evidence that if only people were to set aside modern society that they too would acquire such abilities. Setting aside the problematic cultural perspective inherent in such statements; is physical activity the evolutionary expectation?

Topics: Myth of the Early Athletic Human — Physical Activity Level — Great Apes — Inactivity Mismatch Hypothesis — Neolithic Agricultural Revolution — Industrial Revolution

Myth of the Athletic Early Human — Assertion that civilization/modern society and the associated lifestyle has reduced our natural physical abilities such that if we were to give up modern lifestyles we would be endowed with substantially greater athletic abilities.

Truthiness — A belief or assertation that something is true because of intuition, perceptions, or a desire for it to be true; without regard to evidence.

Assertions regarding the physical capabilities of early humans are typically based upon the observation of hunter-gatherer, subsistence farmers, and non-industrial peoples who seemingly complete superhuman feats without the need for training. For instance, the Tarahumara in Mexico are renown for long–distance running abilities, Sherpa in Nepal are renown for their mountain climbing and altitude resistance, and the Bajau in South-East Asia are renown for their free–diving abilities. The **Myth of the Athletic Early Human** relies upon the fallacy of **Truthiness** to gloss over that these specific examples represent extreme situations that are not representative of most populations.

Reliance upon some of these select populations as examples is particularly problematic as aspects of their physical capabilities reflect alterations to optimize survival in the harsh environments in which they live. For instance, there appear to be population–level differences between some of these groups and appropriate comparison populations within industrialized societies (e.g., greater capillary density in Sherpa populations, enlarged spleens within Bajau populations). So either as pre-existing capabilities that enabled success within their environmental niche or as adaptations that have propagated across generations to enhance success within that niche; an individual who has grown up in the U.S. is unlikely to obtain similar capabilities as individuals within these populations if they gave up their modern lifestyle.

The other major issue is that within these populations, such abilities are still considered unique and extraordinary. Take for instance observations that Tarahumara athletes can exhibit energy expenditures exceeding 10,000 kcal during a 24–period. It is not that all Tarahumara people can accomplish such feats, rather only a few select individuals within the population exhibit such capabilities. Frequency analysis suggests that while the emergence of these specialized abilities appears to occur slightly more frequently in such populations than in typical western societies; this is likely a reflection on cultural need/opportunity. There are simply more athletic endeavors which an individual in a typical western society can choose to specialize in and the need to specialize does not align with imperatives for survival.

Finally, such myths falsely embrace the idea that these populations complete such feats without training. The daily existence of hunter–gatherer, subsistence farmers, and non-industrial peoples requires engaging in the kinds of physical labor and psychological challenges that provides such training. This represents a different perspective on training than that commonly found within western societies. They don't have to take time away from their work/school to engage in exercises to develop their abilities and prepare for an event, because their daily existence is itself the training. It is common for Tarahumara children to average ten miles a day of walking across rugged terrain. Thus, it should not come as a surprise that when asked to complete a 10 mile course, Tarahumara children regularly outperform appropriate peer–comparison populations. This is fundamentally no different from children growing up in any other population that has a societal need to engage in an activity. Their societal need cultivates a greater ability to engage in the activity as compared to other populations without such a societal need.

Physical Activity Level (PAL) — Total energy expenditure expressed as a multiple of Basal Metabolic Rate

To better understand what an evolutionarily normal level of physical activity might be, it is helpful to utilize a more standard measure of physical activity that has the advantage of being unbiased by differences in body size. From an energetic perspective however, body size is actually less relevant than metabolic rate. **Physical Activity Level** (PAL) refers to the ratio of how much energy you expend in a twenty-four-hour period (basal metabolic rate, thermic effects of food processing, and physical activity), relative to the amount of energy you would use to sustain your body if you never left your bed (basal metabolic rate). So this formula is conceptually similar to the energy balance equation.

The World Health Organization provides some framework for classification of physical activity levels. PALs below 1.4 are considered to be extremely inactive. PALs between 1.4 and 1.69 are considered to be sedentary. PALs between 1.7 and 1.99 are considered to be moderately active. PALs between 2.0 to 2.4 are considered to be vigorously active. PALs greater than 2.4 are considered extremely active. So using this concept, it is possible to also calculate the physical activity related energy expenditure necessary to obtain a particular classification of physical activity level.

> So assuming a basal metabolic rate of 1600 kcal and a habitual caloric intake of 2000 kcal, we can consider what the physical activity level (PAL) might be for different energy expenditures:
> **No physical activity**
>
> $$PAL = \frac{(BMR + TEF + PA)}{BMR} = \frac{(1600 + 200 + 0)}{1600} = 1.1$$
>
> **500 kcal of physical activity**
>
> $$PAL = \frac{(BMR + TEF + PA)}{BMR} = \frac{(1600 + 200 + 500)}{1600} = 1.4$$
>
> **800 kcal of physical activity**
>
> $$PAL = \frac{(BMR + TEF + PA)}{BMR} = \frac{(1600 + 200 + 800)}{1600} = 1.6$$

An individual with a metabolic rate of 1600 kcals, consuming 2000 kcals of food would have to expend 920 kcals of energy through physical activity for a PAL at the lower level of moderate activity. Using this framework we can then compare physical activity across various populations. Construction workers exhibit PALs of around 1.8. Chimpanzees exhibit PALs of around 1.5. Research on the few remaining hunter-gatherer societies still present have observed PALs of around 1.85; whereas subsistence farmers exhibit PALs of around 2.0. As most non–primate mammals exhibit PALs greater than 3, it appears that humans and other primates are particularly averse to unnecessary physical activity when compared to other mammals. Ultimately, within the context of primates **an evolutionarily normal level of physical activity is as little as possible to survive**.

But it is not quite that simple. Chimpanzees, bonobos, gorillas, and orangutans — other members of the taxonomic family of primates referred to as **great apes** that also include humans — do not experience the same health–related issues associated with low levels of physical activity that humans do. Non–human great apes do not seem to develop obesity–related diseases, diabetes, high blood pressure, coronary artery disease, or heart diseases. Yet they sleep for approximately ten hours and engage in ten to twelve hours of time sedentary or in very light levels of activity (e.g., grooming, eating). And their patterns of activity result in climbing/walking less than three miles per day. How do we rectify the idea that modern humans are only slightly less active than hunter–gatherer populations and more active than non–human great apes; with the evidence that modern humans have disproportionately greater prevalence of these diseases/disorders that influence our health and wellbeing?

The dominant modern perspective points to a critical period coinciding with the early origins of hunting and gathering. Specifically, changes in pelvic anatomy to permit fully upright bipedal locomotion (two legged movement) patterns reduced energetic needs, allowing for individuals to forage across a much larger area and thrive in habitats with lesser food densities. From an energetic perspective, there is substantial evidence that mammalian quadruped (four legged) locomotion patterns at maximum speed require half the energy expenditure of human bipedalism.

So in comparison with other mammals, humans exhibit lower maximal speeds and can only sustain this maximal speed for a short duration. However, under more typical walking/jogging patterns of locomotion the pattern reverses. Human bipedalism requires only half the energy expenditure as compared with mammalian quadruped locomotion patterns at typical locomotion speeds. Thus, research in the areas of anthropology and evolutionary biology suggest that shifting

locomotion patterns towards bipedalism may have specifically biased selection towards enhancing aspects of endurance.

Compared to other primates and quadriped mammals, humans posses a number of adaptations for endurance activity including greater stride length (through long legs and small feet), greater heat dissipation (sweat glands, reduced body hair, body shape), and metabolic adaptations (increased vascularization, increased mitochondrial concentrations). As the behavioral bias to avoid excess activity aligns with selection to enhance efficiency (i.e., endurance), these adaptations did not overwrite this tendency towards sedentary behavior. Further, evidence indicates that while these adaptations enhanced our energy efficiency; hunter–gatherer populations and non–human great apes exhibit similar levels of energy expenditure while foraging for food. The advantage of this endurance is actually in being able to acquire more energy at a faster rate. But ultimately, unlike non–human great apes, by acquiring physiologic adaptations to enhance endurance, **humans have acquired a dependency on physical activity**.

Inactivity Mismatch Hypothesis — Human physiology is adapted for more consistent muscle activity throughout the day associated with a combination of both physical activity and non-ambulatory time spent in active rest postures.

The other predominate way that hunter–gatherer populations and non–human great apes differ from modern humans is in how we engage in sedentary behavior. Adults in the US and UK sit an average of nine to thirteen hours per day. Those individuals who spend more time sitting at work also tend to spend more time sitting outside of work, compared to those who have more active jobs. Such time spent sitting is not much different from the nine to ten hours that modern hunter–gatherers, subsistence farmers, and preindustrialized societies have been observed to spend sitting; nor the ten to twelve hours non–human great apes spend in sedentary or in very light levels of activity. But, energetically sitting with your back against a back rest only requires 4% more energy than laying down.

Anthropological evidence tells us that the typical resting stances adopted by Humans from the time of Homo Eructus/Neanderthals up until the Middle Ages in Europe (late 15th century) were sitting without a back rest or squatting. Chairs with back support were uncommon and only available to the rich and prestigious until the Industrial Revolution. Assessment of modern hunter-gatherers, subsistence farmers, and preindustrialized societies indicate that while 49% of time spent in sedentary behavior was in a sitting position with legs out in front,

40% of time spent was in a deep squat, and 11% of the time was spent kneeling. Critically, sitting behaviors were rarely longer than 45 minutes in total duration. So while we may have a strong biological drive to avoid unnecessary energy expenditure, we appear to also have a need to move.

The health risks associated with these prolonged periods of sedentary time – more than 45 minutes at a time – are commonly attributed to three main issues. First, **time spent sitting is time spent not doing other things**. Physiologically, if the goal is to be energy efficient and facilitate recovery from exertion, sleep is far more beneficial. At the same time every hour spent sitting is an hour spent not moving. Second, **long periods of inactivity reduces the uptake of sugar and fat from the bloodstream**. During and briefly following even short duration physical activities, the body increases the uptake of sugar and fat from the blood stream. This metabolic response to activity combats the intrinsic bias to store excess energy within adipose tissue reducing excess accumulation. Finally, **long periods of inactivity triggers an inflammatory response**. Sedentary behavior is associated with elevated levels of cytokines resulting in chronic low-grade inflammation which results in damage to tissues in the arteries, muscles, liver, and brain. Although physical activity can itself induce an inflammatory response, after the cessation of the activity there is a release of cytokine inhibitors and anti-inflammatory cytokines reducing such chronic low-grade inflammation. So not only are we moving less than we may be biologically programmed to expect, but we also sit for far greater periods of time.

Neolithic Agricultural Revolution (10,000 – 8,000 B.C.)

— Transition in human history from small, nomadic bands of hunter-gatherers to larger, agricultural settlements. Period defined by agricultural developments including animal and plant domestication, and the invention of the plow.

Human physiologic systems and characteristics are biased to be highly energy efficient — doing as little physical activity as possible, while also being adapted to have greater efficiency when we do need to move. At the same time, the negative impacts of sedentary behavior make clear that **human physiology uses physical activity as an important regulatory stimulus**. The issue thus is that for much of human history we did not have a chance to avoid being physical active. Some have pointed to the Neolithic Agricultural Revolution as a critical transition period when there began to be a mismatch between the physiological attributes and characteristics optimized for long–duration movement and the opportunity to avoid activity. Although such assertions are commonly criticized given the increased

physical activity levels exhibited by subsistence farmers in comparison to hunter–gatherers; it was at this point in human history that there began to be **opportunity for some within a community to engage in less physical activity** — often at the expense of others increasing their physical activity levels.

Following this period in human history, there is substantial evidence that there was general awareness that being physically active was beneficial for health and wellbeing. In ancient China and India, collections of philosophies emphasized movement practices as a way of promoting longevity, avoiding dysfunction, and promoting better control of the mind and emotions — serving as our earliest evidence of the medical specialty that would go on to become sports medicine. Across eastern and western cultures, prominent Chinese and Indian philosophers as well as philosophers like Plato, Socrates, Confucius encouraged activity to improve mental health. During the fifteen to seventeenth centuries educators and philosophers encouraged activity within the middle and upper classes as a means of teaching values and character. The very fact that such evidence exists should tell us that some portion of these populations exhibited lower levels of physical activity and that there was impetus to try to increase physical activity in these individuals.

However, the most prominent detail in historical records is that from the times of pharaonic Egypt, through the classical civilizations of Greece and Rome, ancient China and India, through renaissance age, and national periods of Europe/colonial period of America; engaging in physical activity was recognized as an important behavior to specifically improve combat skills. The use of physical activity to specifically incur benefits in skills and attributes aligns with the concept of exercise. Further, this concept of exercise — engaging in physical activity to specifically incur adaptations in health and skills — appears to be a uniquely human behavior as no other animal appears to engage in such training. It is believed that the concept of exercise became a human behavior following the Neolithic Agricultural Revolution; however, as such training would presumably facilitate hunting and gathering lifestyles there is debate regarding the extent to which such behavior may have predated this period. Interestingly, however, historical record indicates that nearly every generation has expressed concern about the youth being less active, less fit, and less healthy.

Industrial Revolution (1760 – 1840) — Transition in human history from an agricultural economy to one based upon industrial manufacturing. Period defined by large–scale mechanized agriculture, the growth of factory production, and the widespread utilization of the steam engine.

Compellingly, the Industrial Revolution appears to be a critical point in the widespread emergence of cardiovascular disease, cancer, and diabetes. Prior to the industrial revolution, there does not appear to be substantial evidence that such diseases were prevalent as the most common causes of death were infectious diseases such as influenza, polio, and rubella. The industrial revolution brought about prominent cultural changes that occurred as labor–intensive jobs were replaced by mechanized processes. Again, this represents a turning point in human history where the was **opportunity for a larger portion of the population within a community to engage in less physical activity** — at the expense of increasing the physical activity level of a smaller number of individuals. At the same time, medical advancements began to combat infectious diseases. Thus, from a population perspective, a larger portion of the population could survive infection as well as avoid physical activity; enabling the emergence of the critical threats to health and wellbeing that we now face.

Additional Resources:

Lieberman, D. E. (2015). Is exercise really medicine? An evolutionary perspective. Current sports medicine reports, 14(4), 313-319. http://dx.doi.org/10.1249/JSR.0000000000000168

Myth of the Athletic Early Human

Assertion that civilization/modern society and the associated lifestyle has *reduced* our natural physical abilities such that if we were to give up modern lifestyles we would be endowed with substantially greater athletic abilities.

- Based upon the observation that hunter-gatherer, subsistence farmers, and non-industrial people exhibit the ability to complete seemingly superhuman feats without the need for training (running ultramarathon- like distances, scaling mountains with heavy loads, etc.).
- Ignores that these physical capabilities reflect alterations to optimize survival in the harsh environments in which they live.

Myth of the Athletic Early Human

- This myth relies upon the fallacy of Truthiness to gloss over that the specific examples represent extreme situations that are not representative of most populations.
  - Truthiness – a belief or assertion that something is true because of intuition, perceptions, or a desire for it to be true; without regard to evidence.
- Within these "more natural" populations, such abilities are still considered unique and extraordinary.

Myth of the Athletic Early Human

Ignores population level differences

- An individual who has grown up in the U.S. is unlikely to obtain similar capabilities as an individual within these populations if they gave up their modern lifestyle and moved to the woods.
  - Pre-existing capabilities that allowed the population to survive in these environments.
  - Environmental adaptations that have propagated across generations to enhance success in the environment.

Myth of the Athletic Early Human

The emergence of these specialized abilities occurs slightly more frequently in these populations than in typical western societies.

- Largely attributed to greater cultural need for such specialized abilities as well as the opportunity to engage in such activities.
  - When need aligns with survival, there is a stronger drive to perform.
- In typical western societies, there is a larger number of potential activities that an individual could choose to engage in.
  - Activities are rarely needed for survival.

Myth of the Athletic Early Human

Not going to "the gym" to prepare for an event is not the same thing as not training.

- The daily existence of hunter–gatherer, subsistence farmers, and non-industrial peoples requires engaging in the kinds of physical labor and psychological challenges that provides such training.
  - This simply reflects a different perspective of what it means to train.
  - Their daily existence is itself the training, as the activities they regularly do align with the requirements of the event/activity.

Alignment between Life and Event

Societal need cultivates a greater ability to engage in the activity as compared to other populations without such a societal need.

Daily Existence	Activity
Tarahumara children average 10 miles a day of walking/running across rugged terrain.	10 mile cross-country race.
Scandinavian children learn to cross-country ski very early in life and use it frequently as a means of transportation.	Cross-country skiing

What is an evolutionarily normal Level of Physical Activity

Physical Activity Level (PAL)

Total energy expenditure expressed as a multiple of Basal Metabolic Rate

- Provides a way of accounting for differences in body size by expressing physical activity relative to metabolic rate.
- This ratio has the advantage of being unbiased by differences in body size.

$$PAL = \frac{(BMR + TEF + PA)}{BMR}$$

World Health Organization Physical Activity Framework

Classification	Physical Activity Level
Extremely Inactive	Below 1.4
Sedentary	1.4 to 1.69
Moderately Active	1.7 to 1.99
Vigorously Active	2.0 to 2.4
Extremely Active	Above 2.4

Assuming a metabolic rate of 1600 kcal and a habitual caloric intake of 2000 kcal.

$$PAL = \frac{(BMR + TEF + PA)}{BMR} \qquad PA = (BMR * PAL) - BMR - TEF$$

Moderately Active (PAL of 1.7)	**Vigorously Active (PAL of 2.0)**	**Extremely Active (PAL of 2.41)**
$PA = (1600 * PAL) - 1600 - 200$	$PA = (1600 * PAL) - 1600 - 200$	$PA = (1600 * PAL) - 1600 - 200$
$PA = (1600 * 1.7) - 1600 - 200$	$PA = (1600 * 2.0) - 1600 - 200$	$PA = (1600 * 2.41) - 1600 - 200$
$PA = 920\ kcal$	$PA = 1400\ kcal$	$PA = 2056\ kcal$

What is an evolutionarily normal Level of Physical Activity

Physical Activity Level (PAL)

Total energy expenditure expressed as a multiple of Basal Metabolic Rate

- PAL around 1.8 - Construction workers
- PAL around 1.85 - Hunter-gatherer societies
- PAL around 2.0 - Subsistence farmers
- PAL around 1.5 – Chimpanzees
- PAL > 3.0 – Most non-primate mammals

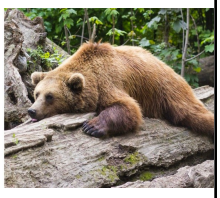
What is an evolutionarily normal Level of Physical Activity

Bias towards engaging in as little activity as possible to survive.

Great Apes

Theory of Effort Minimization

There is a dominant behavioral tendency to minimize energy expenditure and maximize energy intake.



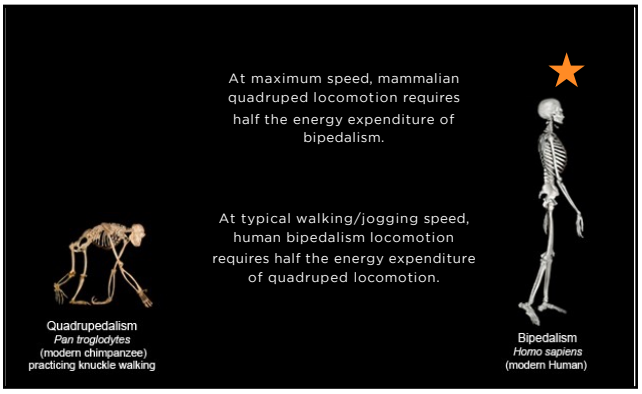
What is an evolutionarily normal Level of Physical Activity

- Humans appear to be the only members of the Great Apes that experience health related issues associated with low levels of physical activity.
- Non-human great apes do not seem to develop obesity-related diseases, diabetes, high blood pressure, coronary artery disease, or heart diseases in the wild.
  - Sleep for approximately ten hours a day
  - Engage in ten to twelve hours of time sedentary or in very light levels of activity (e.g., grooming, eating).
  - Patterns of activity result in climbing/walking less than three miles per day.

Why is it that Humans are Sensitive to a lack of Activity

Biased selection towards enhancing endurance (efficiency).

- Changes in pelvic anatomy to permit fully upright bipedal locomotion (two-legged movement) patterns reduced energetic needs.
  - Individuals could then forage across a much larger area and thrive in habitats with lesser food densities.
  - Coincided with early origins of hunting and gathering.



Why is it that Humans are Sensitive to a lack of Activity

Biased selection towards enhancing endurance (efficiency).

- Human physiology has adapted to support endurance activity.
  - Greater stride length (long legs & smaller feet)
  - Greater heat disputation (sweat glands, reduced body hair, body shape)
  - Metabolic adaptations (increased vascularization and mitochondrial concentrations).
  - Use of activity to help regulate physiological systems.

What is an evolutionarily normal Level of Physical Activity

Bias towards engaging in as little activity as possible to survive.

Great Apes

Bias towards engaging in as little activity as possible to survive.

+

Bias towards enhanced efficiency (i.e., endurance).

Humans

Why is it that Humans are Sensitive to a lack of Activity

Biased selection towards enhancing endurance (efficiency).

- This enhanced endurance enabled acquiring food at a faster rate with similar levels of energy expenditure.
  - Expending more energy would oppose the underlying Great Ape bias to avoid unnecessary activity.

Why is it that Humans are Sensitive to a lack of Activity

Modern approach towards sedentary behavior.

- Great Apes engage in ten to twelve hours of time sedentary or in very light levels of activity (e.g., grooming, eating).
- Modern hunter-gatherers, subsistence farmers, and preindustrialized societies sit for 9 to 10 hours per day.
- Adults in the US and UK sit 9 to 13 hours per day.
- Sitting with your back against a back rest requires only 4% more energy than laying down.

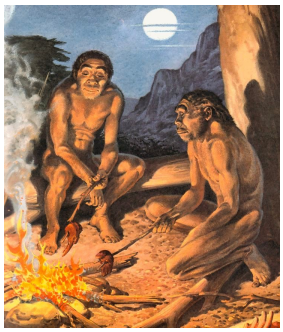
Why is it that Humans are Sensitive to a lack of Activity

Until the Middle Ages in Europe (late 15th century) the typical resting stance was sitting without a backrest or squatting.

- Chairs with back support were uncommon and only available to the rich and prestigious until the Industrial Revolution.
- Assessment of modern hunter-gatherers, subsistence farmers, and preindustrialized societies indicate that time spent sedentary was:
  - Sitting 49% of the time with legs out in front
  - Squatting 40% of the time
  - Kneeling 11% of the time
  - Sitting behaviors were rarely longer than 45 minutes in total duration.

Inactivity Mismatch Hypothesis

Human physiology is adapted for more consistent muscle activity throughout the day associated with a combination of both physical activity and non-ambulatory time spent in active rest postures.



Health-related Concerns About Sitting

The health risks associated with these prolonged periods of sedentary time – more than 45 minutes at a time – are commonly attributed to three main issues.

Time spent sitting is time spent not doing other things.

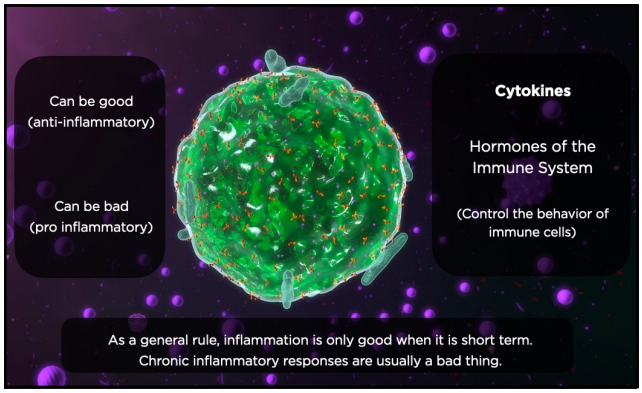
- Physiologically, if the goal is to be energy efficient and facilitate recovery from exertion, sleep is far more beneficial.
- Every hour spent sitting is an hour spent not moving.

Health-related Concerns About Sitting

The health risks associated with these prolonged periods of sedentary time – more than 45 minutes at a time – are commonly attributed to three main issues.

Long periods of inactivity reduces the uptake of sugar and fat from the bloodstream.

- During and briefly following even short duration physical activities, the body increases the update of sugar and fat from the blood stream.
- This metabolic response to activity combats the intrinsic bias to store excess energy within adipose tissue, thereby reducing excess accumulation.



Health-related Concerns About Sitting

The health risks associated with these prolonged periods of sedentary time – more than 45 minutes at a time – are commonly attributed to three main issues.

Long periods of inactivity triggers an inflammatory response.

- Sedentary behavior is associated with elevated levels of cytokines resulting in low-grade inflammation which results in damage to tissues in the arteries, muscles, liver, and brain.
- While physical activity can induce an inflammatory response, after the activity stops there is a release of cytokine inhibitors and anti-inflammatory cytokines.
  - This reduces chronic low-grade inflammation.

Neolithic Agricultural Revolution

(10,000 - 8,000 B.C.)

Transition in human history from small, nomadic bands of hunter-gatherers to larger, agricultural settlements. Period defined by agricultural developments including animal and plant domestication, and the invention of the plow.

Neolithic Agricultural

Revolution

A critical transition period when there began to be a **mismatch** between the **physiological attributes and characteristics optimized for long-duration movement** and **the opportunity to avoid activity.**

- For much of human history we did not have a chance to avoid being physical active.
- Subsistence farmers do exhibit increased physical activity levels in comparison to hunter-gatherers.
  - Subsistence farming allows some members of the community to in engage in less physical activity.

Relationship between Physical Activity

Health and Wellness

History of writing regarding the influence of physical activity on health and wellness.

- Collections of philosophies from ancient China and India emphasized movement practices as a way of promoting longevity, avoiding dysfunction, and promoting better control of the mind and emotions.
- Across eastern and western cultures, prominent Chinese and Indian philosophers as well as philosophers like Plato, Socrates, Confucius encouraged activity to improve mental health.

Relationship between Physical Activity

Health and Wellness

History of writing regarding the influence of physical activity on health and wellness.

- During the fifteen to seventeenth centuries educators and philosophers encouraged activity within the middle and upper classes as a means of teaching values and character.

- Pharaonic Egypt
- Classical Civilizations of Greece and Rome
- Ancient China and India
- The Renaissance Age
- National periods of Europe
- Colonial period of America

For as long as written records have existed, engaging in physical activity has been used to specifically improve combat skills.

(Exercise)

- Pharaonic Egypt
- Classical Civilizations of Greece and Rome
- Ancient China and India
- The Renaissance Age
- National periods of Europe
- Colonial period of America

Bias towards enhanced efficiency (i.e., endurance).

Need to move.

Engagement in Exercise.

Humans

The Emergence of

Exercise Behaviors

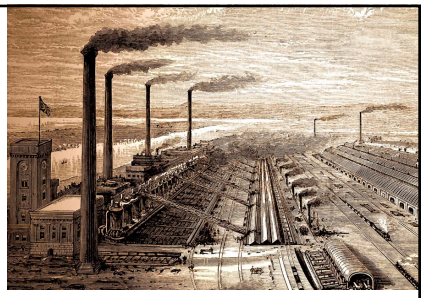
Acquired behavior of engaging in one activity for the specific purpose of improving performance on another activity.

- The concept of exercise is thought to have become a human behavior following the Neolithic Agricultural Revolution.
- However, as such training would presumably facilitate hunting and gathering lifestyles there is debate regarding the extent to which such behavior may have predated this period.
- Historical record indicates that nearly every generation has expressed concern about the youth being less active, less fit, and less healthy.

Industrial Revolution

(1760 - 1840)

~225 years ago



Transition in human history from an agricultural economy to one based upon industrial manufacturing. Period defined by large-scale mechanized agriculture, the growth of factory production, and the widespread utilization of the steam engine.

(First) Industrial

Revolution

A critical point in the widespread emergence of cardiovascular disease, cancer, and diabetes.

- Prior to the industrial revolution, the most common causes of death were infectious diseases such as influenza, polio, and rubella.
- The industrial revolution brought about prominent cultural changes that occurred as labor-intensive jobs were replaced by mechanized processes.
  - This represents a turning point in human history where the was opportunity for a larger portion of the population within a community to engage in less physical activity.

History of Physical Activity Worksheet

1. The idea that civilization and modern society and the associated lifestyle has reduced our natural physical abilities is known as the?

2. A belief or assertion that something is true because of intuition, perceptions, or a desire; without regard to evidence is known as the?

3. A common characteristic of all members of the Great Apes is what bias towards physical activity?

4. Calculate the Physical Activity Level for the following cases (rounded to one decimal place).

Case	Metabolic rate (kcal)	Caloric Intake (kcal)	Physical Activity Expenditure (kcal)	Physical Activity Level (PAL)
Case 1	1820	2500	250	
Case 2	2690	1870	500	
Case 3	1130	1400	800	
Case 4	1545	1900	900	
Case 5	3200	3600	1100	

5. What cases would have a physical activity level classification as being Moderately Active?

6. Calculate the amount of physical activity expenditure that would be necessary to be considered as having a moderately active physical activity level for the following cases (rounded to one the nearest integer/whole number).

Case	Metabolic rate (kcal)	Caloric Intake (kcal)	Physical Activity Expenditure (kcal)
Case 1	1980	2730	
Case 2	1600	2000	
Case 3	3150	4200	
Case 4	1580	1780	
Case 5	2190	2500	

7. Calculate the amount of physical activity expenditure that would be necessary to be considered as having a vigorously active physical activity level for the following cases (rounded to one the nearest integer/whole number).

Case	Metabolic rate (kcal)	Caloric Intake (kcal)	Physical Activity Expenditure (kcal)
Case 1	2355	2570	
Case 2	1734	2100	
Case 3	1669	4200	
Case 4	2900	3500	
Case 5	1768	1980	

8. What are the benefits of bipedal locomotion?

9. The idea that human physiology is adapted for more consistent muscle activity throughout the day associated with a combination of both physical activity and non-ambulatory time spent in active rest postures is known as the:

10. What are the three main reasons humans appear sensitive to prolonged periods of sedentary time?

11. When considering cytokines and inflammation, what is the general rule regarding inflammation?

12. When did knowledge of the importance of physical activity for health emerge?

13. What period in history represents a critical transition period when there became a mismatch between physiological attributes optimized for endurance and the opportunity to avoid activity?

14. The concept of exercise is thought to have become a human behavior following what period in history?

15. What period in history represents a critical point in the widespread emergence of cardiovascular disease, cancer, and diabetes?