The Modern Olympics & Post-Modern Athletics: A Clash in Values

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Abstract: While the overwhelming majority of professions do not regulate the use of performance enhancements, athletics has become a lightning rod. Analysis of the current policies regulating athletic enhancements reveals that drawing the line on what is permitted is an ethically and politically arbitrary process, and sport governing bodies hold athletes to a different standard. The World Anti-Doping Agency uses “the spirit of sport” as criteria for banning enhancements while recent findings in genomics reveals the spirit of being human is to take advantage of what is available for survival. These contradictions question the reasoning and validity of the current regulations of athletic enhancements.

1. Introduction

In 776 BCE, the ancient Greek concept of the Olympics consisted of one event, a race approximately 200m in the nude which honored deities. The Romans later took over Greece, and in 393 AD, Roman Emperor Theodosius proclaimed Christianity the religion of the Roman Empire. He perceived the Olympic Games as a pagan festival and subsequently banned them.

The International Olympic Committee (IOC) revived the Olympics in 1894, bringing the games back to Athens in 1896. The main architect Baron Pierre de Coubertin contributed the Olympic motto Citius — Altius — Fortius. Every four years the best athletes in the world have the opportunity to train and achieve the necessary qualifying standards and make their countries summer or winter Olympic teams. As the Olympic motto states, the athletes that perform faster, higher, and stronger than the other athletes, and these ends are symbolically rewarded with coveted Olympic medals.

Historically, competitive athletes have used whatever is available at the time to gain an extra edge in competition. Prior to biotechnology, athletes experimented with a number of exotic methods including eating live bees [1] and cocoa leaves [2] to increase stamina. In the late 1800s, cyclists used nitroglycerin which is used by physicians to stimulate the heart after heart attacks to improve breathing.[3]
After the revival of The Modern Olympics, athletes continued to seek innovative methods to improve performance. Thomas Hicks, the winner of the 1904 Olympic marathon, drank brandy and strychnine during the race.[4] In the 1930s, athletes began using amphetamines instead of strychnine to increase stamina. In the early 1900s, several Tour de France cyclists ate bull testicles in order to boost their testosterone levels and increase muscle mass.[5]

The Olympic Movement didn’t anticipate the future advances in biotechnology. At the 1954 World Weightlifting Championships in Vienna, American physician John Ziegler discovered the use of anabolic steroids by Soviet athletes. These synthetic male hormones derived from testosterone enabled Soviet athletes to dominate power lifting competitions. Following the systematic use of male hormones in the Soviet Union and the death of two cyclists from using amphetamines in the 1960s, the International Olympic Committee (IOC) developed its first list of prohibited substances and drug tests for the 1968 Mexico Olympics.

At the 1988 Seoul Olympics, Ben Johnson sprinted to a world record in the 100m and winning the gold medal. A former skinny kid from Jamaica, he moved to Canada in 1976 and transformed into an intimidating mass of muscles. Three days later, the IOC stripped him of the medal for taking Stanozolol, a synthetic anabolic steroid taken orally.

In the early 1980s, Amgen genetically engineered a synthetic version of erythropoietin called Epogen more commonly known as EPO to increase the oxygen carrying capacity in anemia, cancer and dialysis patients. Erythropoietin is produced naturally in the kidneys then released into the blood stream where it binds with receptors in the bone marrow to produce red blood cells and hemoglobin. After successful clinical trials for EPO; some cyclists, distance runners, and triathletes began injecting EPO to boost their endurance.

At the 1998 Tour de France widespread doping took place. Doping officials caught a trainer with the French cycling team Festina with vials of EPO, steroids, and syringes in a team car; and asked the team to leave the event. After more raids, six other teams and a number of individual riders dropped out as more banned substances were found.

In response to these high profile international incidents, at the World Conference on Doping in Sport Conference in 1999 the IOC created the World Anti-Doping Agency (WADA) as an independent foundation to create and enforce performance enhancement policies. According to former President of WADA, Dick Pound, sports need rules and athletes need to respect the rules as well as their opponents.[6] WADA’s Prohibited List reflects Pound’s sentiments with numerous pages listing categories of banned substances and methods.
WADA considers a substance or method for inclusion on the prohibited list if it is a masking agent or meets two of three criteria. Article 4.3 of the WADA World Anti-Doping Code states these criteria are they violate the spirit of sport, are performance enhancing, or have health risks to athletes.[7]

Article 4.3 also discloses that WADA developed these three criteria based on the following reasoning. The potential to enhance performance alone is not a satisfactory enough since physical training, red meat, carbohydrate loading, and training at altitude enhance performance. Requiring all three criteria is also not acceptable as WADA believes the use of a gene transfer technology for sports enhancement should be prohibited as contrary to the spirit of sport even if it is not harmful.

2. Drawing the Line
WADA currently has four major categories of banned performing enhancing substances and methods including anabolic agents and hormones, enhancement of oxygen transfer, stimulants and beta-blockers, and gene doping. [8] In this section, I analyze the regulatory policies of these four major categories.

Determining health risks is a fairly straight forward process determined by the medical community. In the case of protecting athletes from health risks, paternalism is appropriate. Unsupervised usage of performance enhancing substances and methods has led to harmful side effects including death.

- Unsupervised male hormone and steroid usage has caused numerous side effects ranging from behavioral problems, altered masculine traits, to fatality. In the US, laws controlling narcotics and The Anabolic Steroid Control Act of 1990 criminalized their non-medicinal use.
- EPO can cause the over production of red blood cells, thickening the blood to the point where the blood has to be thinned or result in clogged blood vessels that can lead to a stroke or heart attack.
- The unsupervised use of cognitive enhancements can lead to psychological and physical dependence. Athlete usage of amphetamines has led to a number of deaths.
- In clinical trials, gene therapy to correct genetic abnormalities has a history ranging from positive results to multiple problems including death. A number of Rhesus monkeys used as test subjects successfully receiving the erythropoietin gene had red blood counts so high they required blood thinners to prevent heart failure. Pleiotropy is also a risk. If you alter a gene, because of alternative splicing, this may have an effect on other traits. Gene doping is the use of this medical treatment for enhancement purposes.

However, drawing the line on the various means to the desired ends of enhancement is a less definitive process. According to Thomas Murray, a bio-ethicist with of the Hastings Center, all lines drawn are arbitrary. But, he asks
rhetorically, if a runner wears running shoes with roller blades, do they deserve to win? [9] If the answer is no, then not all enhancements are the same. So, how do WADA and the governing bodies of each sport draw the line on enhancements?

a) Strength Athletes Playing Cat and Mouse

From 1968-1988, East Germany operated a state sponsored system of providing performance enhancing drugs to thousands of athletes. East German women began dominating swimming events and later developed side effects to male hormones. John Ziegler later helped develop the anabolic steroid Dianabol that does not have the side effects of testosterone.

At the 2000 Sydney Olympics, doping officials caught a Chinese swimmer with vials of hGH. Human growth hormone (hGH) a naturally occurring hormone produced by the pituitary gland that accelerates protein synthesis. Its role is to stimulate the liver to secrete insulin like growth factor (IGF-1) which plays a role in muscle growth. In the 1980s, the Cohen-Boyer patent for genetic engineering launched the biotech industry in Silicon Valley. Genentech genetically engineered hGH as a treatment for dwarfism, muscle wasting in AIDs patients and the elderly, and as a therapy for hormonal imbalances. Some baseball and football players, bodybuilders, and sprinters have used hGH to provide muscle mass, extra strength, trim body fat, and for faster muscle repair when recovering from injuries.

Detecting illegal doping isn’t always a simple process. In a game of a cat and mouse, synthetic chemist Patrick Arnold deliberately designed a drug to evade testing. Using the anabolic steroid gestrinone purchased from China off a website, Arnold created a steroid that disintegrates during lab testing when the urine sample is heated. In 2003, Don Catlin of WADA’s Analytical Lab at UCLA anonymously received a used syringe for injecting steroids, later determined to be sent from track coach Trevor Graham. The lab was able to establish the samples molecular fingerprint and replicate it. It turned out to be tetrahydrogestrinone (THG), a designer steroid known as “the clear” that athletes obtained through Victor Conte Jr. of BALCO, a supplement distributor located near San Francisco. WADA has subsequently devised a test to detect THG.

BALCO became the subject of a federal investigation, resulting in an indictment of its executives and the banning of track athletes from professional competition for a minimum of two years. Following the money trail led to investigating American sprinter and Olympic Gold Medalist Marion Jones who was once considered a role model to young athletes. She was imprisoned for six months for perjury in the BALCO investigation and subsequently admitted to lying about taking THG from 2000-2001 and also using EPO and hGH. The IOC also took back her five medals from the 2000 Sydney Olympics.

The FDA has since approved Sermorelin, an over the counter drug therapy to treat children with stunted growth. Sermorelin stimulates the pituitary gland to
increase the production of human growth hormone which increases the production of IGF-1 by the liver resulting in increased muscle growth. The therapy will also reverse the effects of aging and it can provide a strength supplement to athletes that is difficult to detect.

Although WADA bans the use of strength enhancements via male hormone supplements, surgery that accomplishes the same goal is legal. An increasingly popular and approved procedure among high school, collegiate, and professional baseball pitchers is Tommy John surgery. This procedure is named after Tommy John, a Los Angeles Dodgers pitcher, who underwent an experimental surgery in 1974 to replace an overused ligament in his elbow with a tendon from another part of his body. “This surgical procedure has become controversial since some pitchers are over exaggerating their symptoms in order to have the surgery.” [10] This is because the surgery is intended to repair muscles, but athletes have more strength after the surgery which will increase the pitcher’s velocity, similar to the use of steroids.

b) Endurance Athletes Sleeping Their Way to the Top
At the 1968 Olympics, Kip Keino defeated the American favorite Jim Ryan in the 1500m. Held in Mexico City at altitude, the effects of altitude on performance of endurance athletes especially the Kenyan athletes received attention from the press and other athletes.

In response, Finnish athletes used blood doping in the 1970s to increase their endurance capabilities. Then referred to as blood packing, blood was drawn usually by a team physician, spun in a centrifuge, and then concentrated red blood cells were replaced in the athlete after their body had already replaced those that were withdrawn. Because no foreign substances were involved, in 1985 WADA’s rules were revised to ban any artificial altering of blood. In addition to blood doping to boost endurance, Finnish endurance athletes began living in dormitories with the percentage of oxygen reduced from 21 to 15 percent to increase the production of red blood cells.

In response to Finnish and African success, many of the top American marathoners began living and training at altitude for several months before a competition to obtain extra oxygen carrying capabilities. In order for Americans to remain competitive at the world class level, Nike sponsored the Oregon Project. Based on living high and training low, runners lived in a house located in Portland with deoxygenated air pumped in to rooms simulating 9,000-12,000 feet altitude. The runners living in the house have the benefit of living high and training at low elevation with more oxygen available allowing more intense workouts.

Top athletes including women’s marathon world record holder Paula Radcliffe, Lance Armstrong, and David Beckham have purchased their own altitude tents directly from Hypoxico and Colorado Altitude Training. These closet size tents
which sell for roughly $5,000-$7,000 fit over their beds and dilute the air with nitrogen reducing the amount of available oxygen.

In 2000, the IOC banned the use of hypoxic tents at the Olympic village in Sydney. The WADA considered placing hypoxic tents on the 2007 List of Prohibited Substances and Methods on the grounds they have the potential for performance enhancing and they violate the spirit of sport. Because hypoxic tents involve the passive use of technology which operates independent of any effort of the athlete, the benefits are not an extension of athlete’s natural talents.

Reacting to the IOC investigation into banning hypoxic tents, Paula Radcliffe responded, “I don’t really agree with the IOC investigation into it. All the altitude tent does is stimulates the body to cope with conditions that can be found naturally. If you say an altitude tent is unfair, you have to ban people living at altitude.”[11]

The Duke Center for Sports Law & Policy issued a position paper arguing such a determination is arbitrary and that passive use fails as a rule. Athletes using ultrasound electronic stimulation to muscles and joints, massage equipment, and ice and heat treatments which stimulate blood circulation and the healing process, which are also passive, are not considered in violation of the spirit of sport.[12] Currently, WADA allows the use of hypoxic tents during training.

c) *Shopping for a Sharkskin Suit*

Contrary to the Modern Olympic Movement’s goals, statistics indicate that it’s not always the hardest working athlete that wins. According to Jon Entine, choosing one’s parents is more important than choosing a coach.[13] Although WADA banned gene doping in 2003, a hot topic among athletes, journalists, and WADA officials is when athletes will experiment with gene doping, the banned use of gene therapy for athletic enhancement.

Comparing human genomes, researchers are attempting to pinpoint the genes and genetic variations contributing to diseases phenotypes as well as physical traits, including athletic ability. Researchers developing gene therapies for diseases have also created potential athletic enhancements. Researchers have compiled a list of 269 genes linked to physical performance including 214 autosomal genes, 7 on the X chromosome, and 18 mitochondrial genes.[14]

Scientists have discovered several genes that contribute to muscle mass. As we age, muscles produce *IGF-1* which is used in patients to recover from injury by speeding up DNA repair so injuries heal faster. Lee Sweeney, a physiologist at the University of Pennsylvania, found that inserting the insulin-like growth factor gene (*IGF-1*) into the muscles of mice prevented muscle deterioration from aging and muscular dystrophy. Injecting the *IGF-1* gene into mice produces 15-30 percent more muscle mass than typically found in sedentary mice.[15]
Researchers have also discovered mice lacking the myostatin gene tend to develop huge muscles. By knocking out the gene, mice developed two to three times more muscle than would occur naturally. Although myostatin inhibitors were developed to combat muscular dystrophy, athletes will also benefit from their increased muscle development, interference with fat deposition giving a leaner physique, and faster recovery from injuries.

Jim Wilson of the University of Pennsylvania has successfully injected the erythropoietin gene into Rhesus monkeys. Soon after, a number of coaches inquired about the potential use of the therapy on athletes. Anticipating that some athletes may roll the dice presumably with EPO and strength genes, WADA has invested millions of dollars in grants to researchers to develop tests to catch these athletes. Detecting gene doping for muscle mass presents a challenge to since it currently requires subjecting athletes to invasive muscle biopsies. Richard Snyder of the University of Florida is developing a test that will detect evidence of gene doping in bodily fluids.[16]

Although athletes are unable to choose their parents, biotechnology has provided several approved interventions to increase the odds of selecting a desired phenotype. These include pre-implantation genetic diagnosis (PGD), artificial insemination, egg donation, and even apparel imitating adaptive traits.

In the process referred to as in vitro fertilization (IVF), egg and sperm are mixed in a lab hopefully producing an embryo. PGD is typically used to prevent transmitting inherited diseases to children. When embryos reach the eight cell stage, they show signs of gene expression. A physician can remove a single cell from an embryo which is usually from 3-5 days old to analyze its genes to detect abnormalities. If the embryo is healthy, the physician will introduce the embryo into a womb. PGD is also used to select abnormal traits as is the case with a deaf couple that selected an embryo for a deaf child.

The PGD process is legal in the United States and is frequently used for gender selection. As more genes are identified for specific skills, parents will have a greater probability of selecting specific traits for their children. Although a main argument against positive eugenics is that selecting traits lacks consent of future generations. However, this argument is based on the premise that in traditional breeding we choose the genes we are born with. The IOC has not specifically addressed if an embryo is selected for athletic ability, the so-called designer baby issue.

The sale of human organs, tissues, and embryos is illegal; but, it is legal is for donors to receive compensation for the inconveniences of time, travel, and discomfort. In contrast, human sperm and eggs are a commodity in the United States. Nobel Prize recipients have sold their sperm. Advertisements are placed in college newspapers for bright female college students to help pay their tuition by selling their eggs. The American Society for Reproductive Medicine
recommends limiting compensation to $5000 to egg donors. Females with high SAT scores and models with certain physical features are offered from $10,000 - $100,000 for their eggs.

Sociologist Troy Duster notes, “In the late 1900s, with the increasing use of sperm banks and in vitro fertilization, many prospective parents articulated explicit eugenic agendas. Parents openly ordered up what they thought would be preferred genes of race, height, intelligence, or musical ability. There has not been a substantial eugenic concern generated by this development.”[17]

What if scientists had the ability to inject genes to give athletes better vision or give swimmers more water repellant skin and their bodies a more hydrodynamic profile, or runners a more aerodynamic profile? Since gene doping is banned, athletes have taken different routes to acquire these traits and gain an extra edge in competition. Since sport federations are lenient towards surgeries that improve athletic performance, golfer Tiger Woods had Lasik surgery to correct his vision. With 20/10 vision after the surgery, Wood’s performance improved.

Competitive runners wear the lightest and most aerodynamic clothing on the market. Synthetic running gear including Coolmax running shorts, singlets, and socks wick away water and provide less wind resistance than cotton clothing. American sprinter Marion Jones once competed wearing the aerodynamic Nike windsock, a one piece suit covering her limbs and head.

Similarly, swimmers want the most hydrodynamic profile. Although no operation is available to make our skin more hydrodynamic, swimmers can shave their body hair and wear caps. In addition, a number of manufacturers have responded with performance enhancing swimsuits.

In 2008, Speedo created the LZR Racer swimsuit. Using computational fluid dynamics, Speedo created panels that compress the body providing a hydrodynamic shape requiring less energy and less oxygen from the swimmer. Testing in a NASA wind tunnel reveals the LZR Racer has significantly less drag than other suits. Besides being lightweight and water repellent, its panels are ultrasonically woven making them seamless which further reduce friction in the water.

The high tech suit requires twenty minutes changing time because it retains the shape of the human body. The lengthy changing time is worthwhile to the athletes. Since the debut of the Speedo LZR and similar suits from other brands at the 2008 Olympic trials, an unprecedented number of world record times were set with 43 of those set at the 2009 Summer World Championships in Rome.[18]

Federation Internationale de Natation (FINA), the international governing body for swimming, approved the suit, although the performance enhancing qualities provided by the LZR Racer swimsuit are not the result of hard work by an athlete.
FINA has subsequently banned the use of the Speedo LZR Racer hydrodynamic full body suits as well as other brands effective January 1, 2010. The top professional swimmers now must race against these world records without the benefit of the full body swimsuits that the record holders were able to legally use at the time.

d) Work Hard, Not Smart
Maximizing athletic performance requires mental as well as physical components which contribute to what sport psychologists refer to as flow. After the 1986 Olympics, the IOC banned beta-blockers, medication prescribed to patients for anti-tremor and anti-anxiety, when they discovered that usage by marksmen improved pistol shooting scores. Similarly, the IOC banned narcotics, cannabinoids, large quantities of caffeine, and stimulants for some Olympic events due to their boosting effects.

Discoveries in epigenetics over the last decade have implications for the medical community through epigenetic therapies and also for performance enhancement. Research reveals that our environment and even diet alter our gene expression by turning genes on and off. DNA is packaged around bundles of proteins called histones. Methyl donors can alter these chromatin proteins and also silence genes via enzymes that bind methyl groups onto DNA. Researchers are just beginning to understand the epigenome, the hot spots in the human genome that are affected by on and off switches that regulate our genes.

A medical application of epigenetics is to provide an alternative to regular EPO injections. In 2002, Oxford Biomedica began developing Repoxygen to provide the controlled release of erythropoietin. Repoxygen switches the erythropoietin gene on in response to low oxygen levels and then off when the oxygen level is raised. Although intended for anemia patients, this gene therapy injected directly into muscles rather than the kidneys will also benefit endurance athletes. Similarly, Roche Pharmaceuticals developed Continuous Erythropoiesis Receptor Activator (CERA) for dialysis patients that help the kidneys produce a sustained release of erythropoietin.

An application for performance enhancement is the discovery that cognitive development begins earlier than we ever imagined. Researchers Randy Jirtle and Robert Waterland have shown that what our mothers and grandmothers ate can boost intelligence and provide an advantage in life by making children better in school, jobs, and athletic events.[19] Vitamin B9 or folic acid is a methyl donor and is crucial in neural tube formation in an embryo that later becomes the spinal cord and brain.

Practices to increase inner strength are routinely used as part of professional athletic and Olympic training. Sport psychologists prescribe therapies such as visualization, stress reduction, and self talk. Using high-tech gadgets, former elite runner and now coach for endurance runners Alberto Salazar monitors runner’s
blood chemistry and brainwaves to provide biofeedback in order to achieve peak performance.[20]

In other professions, it is the norm to use mood and intelligence enhancements. Edgar Allan Poe died at 40 years of age after a life of alcohol and opiate abuse. Although these drugs boosted his creativity, he is regarded as a great writer. School systems throughout the United States routinely chose his writings as part of their curriculums.

A University of Maryland study estimates that 18 percent of college students have taken attention deficit disorder medications such as Ritalin, Adderall, or Modafinil without a prescription to help with studying. These cognitive enhancers are more potent than caffeine, but less potent than amphetamines. They stimulate proteins in the brain increasing dopamine levels and boost memory.[21] It is probable that a similar percentage of students taking the SATs or in music competitions take similar medications in order to perform better.

Thousands of reporters make the trip to the Olympics representing their publishers. When they need an extra edge, coffee and Red Bull are their best friends. Modern journalists also depend on the internet, especially Google for data mining and spell check software for editing. In biological terms, reporting is the result of an extended phenotype. In the competitive field of journalism, if reporters were not allowed to use Google for data mining, writing a marketable product would become almost impossible. Pulitzer Prize Committees, the publisher, and readers are concerned with the quality of the product, not if it is derived from a natural or enhanced state.

I imagine each of the Nobel Prize winners whose work helped develop the scientific discoveries that were instrumental in producing athletic enhancements or the technologies that labs use to catch the athletes were equally performance enhanced. It’s unlikely that the Nobel Laureates were not tested for performance enhancement.

While athletes are subjugated to working hard, not smart by utilizing what is available in developing their talents based on the WADA Anti-Doping Code; who objects to a surgeon taking medication to prevent trembling before performing surgery or their child’s school bus driver taking medications to drive more safely? Even The United States Department of Defense has investigated the use of cognitive enhancements to create super soldiers. Given the regular use of mood and intelligence enhancements in other professions, the current policy to ban performance enhancements holds athletes to a different standard.

3. The Great Leap Backwards
WADA’s 2003 version of the World Anti Doping Code includes a section titled Fundamental Rationale for the World Anti Doping Code. It states that the goal of the Modern Olympic Movement, comprised of athletes and federations
representing each sport and country, is to preserve the Olympic spirit which includes values such as respect for rules, dedication, and community. [22]

In the early 1800s, Jean Baptiste Pierre Lamarck proposed two laws to explain inheritance and adaptations. First, the inheritance of acquired traits through environmental cues that creates germ line changes in humans that are transmittable to offspring, and second the use and disuse theory. In 1887, August Weismann proposed the germ plasm contained in human chromosomes is isolated from somatic cells providing a barrier from environmental influences. Evelyn Fox Keller notes, “When Weismann’s concept was incorporated into Mendelian genetics, geneticists succeeded in purging Lamarckism from science.” [23] Although the scientific community has disputed Lamarckian inheritance in humans for over a century, recent findings in genomics have caused a resurgence in Lamarckism through cultural inheritance.

Evolutionary geneticist Spencer Wells describes our DNA as the greatest of all history books. As part of a five year study which began in 2005 called the Human Genographic Project, Wells and other specialists from the fields of linguistics, climatology, anthropology, and archaeology became detectives to provide a more complete picture of our past by attempting to decode that history book. [24] What is coded is the story of human history, migrations, and evolution.

Roughly 50,000 years ago, early modern humans migrated out of southeast Africa in response to environmental changes. Unlike most plants and animals which have a narrow environmental range in which they can survive, our species has proceeded to inhabit almost every portion of the earth. In order to adapt humans developed innovative survival techniques. Jared Diamond refers to this development of our increased intelligence and brain size as The Great Leap Forward.

The migrations subsequently led to tremendous genetic diversity. Genomics researcher Craig Venter estimates a 99.5 percent similarity in human DNA. Among the 0.5 percent differences are roughly 10,000,000 single nucleotide polymorphisms (SNPs) which are nucleotide variations that make humans and populations unique. The distribution of polymorphisms across populations also reflects our human history.

Your ancestors are an important factor for success in some sports. Athletes from several ethnic backgrounds dominate in specific events. Chinese athletes possess quick reaction time and neuromotor skills. Representing numerous countries, they sweep the ping pong medals. Athletes with West African ancestry have a high percentage of fast twitch muscles and hold the fastest times and win virtually all 100m-400m running events.

In contrast, athletes with East African ancestry inherit a high percentage of slow twitch muscle fibers that are thin and metabolize fuel in a manner that is
conducive to distance running. East Africans living at medium altitude possess greater oxygen carrying capabilities. Living near the equator, their height to surface area ratio is maximized to dissipate heat which is also useful for distance running.[25]

Organisms can modify their environment creating the selection pressures to which they are exposed. For example, bird’s nests and spider’s webs are the result of the organism’s own niche construction. A group of Oxford University researchers observed that beavers and humans manipulate their environment considerably more than any other species. A beaver’s dam modifies many selection pressures in the beaver environment, some of which are likely to affect the fitness of genes that are expressed in quite different traits, such as their teeth, tails, feeding behavior, and susceptibility to predation, diseases, and social systems.[26]

Approximately 14,000 years ago, global warming occurred at the end of the Pleistocene Ice Age. This period was followed by The Stone Age which is characterized by humans manufacturing tools. Genomics researchers have linked positive selection to adaptations to lifestyle changes during the Late Pleistocene and Holocene. Positive selection favors the fixation of an allele that increases fitness. Finding uninterrupted DNA segments is strong evidence of a recent adaptation. Using 1.6 million SNPs, researchers have found approximately 1800 genes are the result of recent selection.[27]

Researchers discovered these nucleotide variations are sometimes found in blocks called haplotypes. Haplotypes that are long and common are signs of selection. These haplotypes are SNPs that travel together and are unique to individuals and populations. Using the HapMap, a database of known haplotypes, University of Wisconsin Anthropologist John Hawks estimates that in the past 5,000 years, positive selection has occurred at a rate roughly 100 times higher than any other period of human evolution.[28] These adaptations coincided with a cultural revolution spurred by greater human intelligence and characterized by the use of tools.[29]

Roughly 10,000-12,000 years ago hunter-gathers began to practice agriculture and domesticated farm animals. This led to increased population density and greater exposure to animal pathogens increasing the spread of infectious diseases. Several hundred thousand susceptible people are necessary to sustain endemic diseases such as small pox, typhoid, yellow fever, measles and tuberculosis.[30] Comparing the recent changes in genomes, measles and small pox coincided with the domestication of farm animals.

Agriculture also changed our susceptibility to diseases. In West Africa, the frequency of the allele of sickle cell anemia increased due to the effects of yam cultivation. Similarly, East Africans cleared the rain forest creating more standing water which increased the breeding grounds for malaria carrying mosquitoes.[31]
Humans exposed to malaria evolve traits that for resistance such as sickle cell. The mutation that causes sickle cell, an anemic blood disorder, is caused by one nucleotide found frequently with those of African ancestry.

Researchers have also found evidence of strong selection in the lactase gene coinciding with the domestication of cattle 5,000-10,000 years ago in parts of Africa. Humans do not naturally produce lactase, the enzyme produced in the small intestines to digest lactose or milk sugar, after nursing. Cattle domestication led to mutations disabling the molecular switch that turns off the production of lactase. Those with the mutation are able to drink milk their whole life, while others are lactose intolerant.

Our ancestor’s lifestyles have led to adaptive mutations that contributed to the unique human populations that inhabit the earth today. Genetic variations in organisms result not only from their environments, but from culture and the use of technologies changing the evolutionary process via Lamarckian and cultural inheritance.

Modern humans are not pastoral; rather use cutting edge technology to create smart environments. Temperature controlled smart offices, boats, homes, and cars not only make our lives more comfortable, but also enable us to occupy a broader range of ecological niches. Human ingenuity has led to clothing for various climates. Modern athletes wear smart clothing to wick away water.

Technology creates a masking effect by suppressing environmental pressures. Rather than developing specialized beaks similar to Darwin’s finches, humans develop tools to alter food sources and refrigerators to preserve food. In humans, the sizes of our jaws, mouth muscles, and teeth have reduced as a result of technology.

Rather than developing venom or fangs, humans utilize technology to create sophisticated weapons. Rather than succumbing to plagues, humans build hospitals and create vaccines in hopes of eradicating them. Humans will not develop wings; rather build helicopters, Air Force One, and the Space Shuttle. Humans will not develop gills; rather build diving tanks and submarines.

The Kenyan running tribes, the Kikuyu and Kalenjin, have adapted to modern technology through Westernization, modernization, and globalization. The Maasai tribe dominated running events in tribal competitions during the 1950s under British occupation.[31] They have not used running as a means to modernization, because money is less important in a cattle based economy.

In spite of pressure from the Kenyan government to modernize, the Maasai tribe in Kenya is slow to adopt education and acquire modern technologies in their culture. As one of the few remaining pastoral ethnic groups, severe droughts and
bovine diseases could lead to their extinction. By refusing to blend their culture with modern technology, the consequences are potentially disastrous.

These findings have created a scientific revolution by changing the concept of a gene and a cultural revolution in terms of the way we see ourselves as humans. The spirit of being human is to take advantage of whatever is available to survive, whereas the Olympic Movement’s ideal athletes have talents that result from drive, effort, training, and perseverance.

4. Democracy in the Cyborgification Process
Performance enhancement remains a divisive public policy issue. Some advocate governing bodies should regulate how humans live. In contrast, transhumanists prefer autonomy. Athletes will continue to use performance enhancements via innovative substances and methods, and acquire the necessary traits to compete in the world of professional athletics.

Some scholars have used the argument that performance enhancements provide the opportunity of leveling the playing field in athletics. I do not agree with the premise of this argument because it is based on the notion that we have an entitlement to a phenotype.

I do not rebut arguments for banning performance enhancements. This is because I am not questioning WADA’s right to ban performance enhancements at the Olympic events, rather their reasoning and alienation to those who prefer autonomy. I am opposed to a global entity legislating values such as what humans can do with their own bodies since this is contrary to my beliefs which advocate less government intervention in our lives. This type of governance sets a precedent and may influence broader regulation for physical, cognitive, and mood enhancements in other aspects of our lives.

Debating the strengths and weaknesses of the multiple arguments for and against performance enhancements is not the purpose of this article. For more discussion of these arguments, see the work of Andy Miah, Jon Entine, Julian Savulescu, and Nick Bostrom.

I propose a policy option used in other human endeavors, holding separate events. However, in order for enhanced athletes to receive legal status in the Olympics, it will require a more accurate and accepted worldview of what it actually means to be human.

Shortly before the 2004 Olympics in Athens, Leon Kass, the former head of the President’s Council on Bioethics said, “I want to be sure when I cheer that I’m cheering for the athlete and not their chemist.”[33] In this article, I argue when we cheer at the Olympics, we are cheering not only for the athlete’s medical staff, parents and grandparents; but their ancestor’s environment, culture, and the technologies, however primitive, that have directed their evolution. In my

If sport federations legalized athletic enhancements, physician consultation with athletes would minimize health risks. Because the Anabolic Steroid Control Act of 1990 criminalized the non-medicinal use of steroids in the United States, some American athletes purchase these banned substances on the black market from companies such as BALCO and may administer the drugs themselves.

Historically, athletes have fought for equality in the Olympics. Disabled athletes were forced to fight for their right to compete, and the IOC now holds the Paralympics. At one time, sport regulatory bodies thought women were too frail to compete in the marathon event. As a result of pressure from women’s rights groups, the IOC held the first ever women’s Olympic Marathon event at the 1984 Summer Games in Los Angeles. Annually, thousands of women run in competitive marathons and participate in charity marathon events. Without restrictions on athletic enhancements, organizers can hold a separate set of events for enhanced competitors.

In other types of competitions such as beauty pageants, officials have held separate events for enhanced contestants. In China, the Miss Artificial Beauty contest is exclusively for women, including transsexuals, who have had cosmetic surgery. All contestants must provide a doctor’s certificate to prove that they have had surgical alterations. According to Paula Shugart, the President of the Miss Universe Organization, her organization allows padding and surgical enhancements to make the Miss Universe Pageant a reflection of the world we currently live in.

**Author’s Note**
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