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On 5th August 2017, under the floodlights of London's Olympic stadium, America's Justin Gatlin beat Jamaica's Usain Bolt to win the IAAF World Championship one-hundred metre gold medal title.

This brought the entire world to a stop; for a split-second, as people realised what they had witnessed, there was silence, not a soul daring to utter a word. It was then, however, that the storm began. The cause? Gatlin's doping history. Now imagine if the storm hadn't broken. Imagine, say, if doping in athletics never became as full-scale as it is today. Would the science behind sport be affected? Yes. Would sport be harmed? No. But how could this be achieved by taking something small enough to fit in a pocket back in time?

Well, first we must look at Justin Gatlin's doping history. In 2001, at an age of just 19 years, Gatlin was banned form athletics for taking an amphetamine; however, he argued back, stating that he'd been taking the amphetamine since childhood to counter his attention deficit disorder. As a result of this, there is still controversy as to whether Gatlin should have been banned for simply taking medication that he'd used his entire life. However, it is what came next that paved the way for the world's reaction to his win in London. In August 2006, Gatlin announced to the US media that he had tested positive for a banned testosterone, and consequently received an eight-year ban from athletics, narrowly avoiding a lifetime ban because of his cooperation with the doping authorities; after a hearing in 2007, though, the ban was cut to just four years.

But how can a few tablets give somebody an advantage so great that it is deemed unfair and illegal? Let's start with amphetamines, which "are stimulants which act on the central nervous system to delay fatigue and increase alertness."[1] To place this in context, athletes use banned amphetamines to train harder, to build endurance and muscle and to consequently be faster. However, illegal amphetamines trafficked on the streets are harmful: "for users who engage in high-frequency and high-speed injecting, there are likely to be problematic health, social and financial consequences, including acute psychotic-like episodes accompanied by violence, the development of dependence, difficult withdrawal symptoms with agitation and depression, and stress on relationships."[2] Amphetamines are used as a treatment for attention deficit disorder as they increase the levels of dopamine (3,4-dihydroxyphenethylamine) in the brain, an organic substance that is a neurotransmitter in the brain and is essential in a number of roles in humans and other animals, most notably attention and movement. Once again, we arrive at the controversy surrounding Gatlin's first ban; he had been taking medical amphetamines since he was a child to counter his attention deficit disorder, so was it right to humiliate him in front of the world?

Regardless of your opinion, the second ban is arguably even more disputed. Testosterone is both an anabolic steroid and a male sex hormone, and a synthetic form is illegally taken by some athletes to help them recover more rapidly from training and build bulk muscle, allowing them to "train harder, run or bicycle more quickly, jump higher, swim faster, hit a baseball farther, recover sooner, and, let's not forget, increased sex drive and combativeness. Certainly, the idea that taking doses of the hormone gives competitors an unfair advantage is behind the brouhaha over Floyd Landis, the 2006 Tour de France winner who French officials say tested positive for elevated testosterone on the day of his remarkable comeback during Stage 17."[3] ""Steroids are not going to take someone without athletic ability and turn them into a star athlete, or teach you how to swing a bat and connect with the ball," said Douglas A. Granger, the director of the

[1] http://www.teachpe.com/drugs/amphetamines.php
[2] http://amphetamines.com/effects/why-do-athletes-take-illegal-amphetamines/
[3] http://www.nytimes.com/2006/08/10/fashion/10Fitness.html

behavioural endocrinology laboratory at Pennsylvania State University. “But if you have a certain athletic presence, testosterone could take you to the next level.””[4] The controversy surrounding Gatlin’s second ban comes from his coach at the time, Trevor Graham, who claimed that Gatlin, along with eight of his other athletes, had been sabotaged by a massage therapist who rubbed their legs with testosterone cream without their knowledge. Although the therapist later denied the claim, the doubt was placed into people’s minds as to whether Gatlin himself played any part in the ‘doping’, and so the justice in the four-year ban he served is questionable.

Now before I explain further, I must ask you, where do you stand on this matter? Are you with a vast majority of the world, viewing Gatlin as a cheat? Or do you believe that he has served his harsh, underserved bans and is now a new, reformed athlete? Of course, the huge media influence across the globe has exacerbated things, more negatively in my opinion, with news readers on numerous channels not even doing so much as pausing before uttering the words “two-time cheat Gatlin”. Kelly Sotherton, former bronze-medal heptathlete and writing for *The Telegraph*, pretty much sums up the world’s emotions: “There is no denying it – like almost everyone inside the London Stadium on Saturday night, I wanted Usain Bolt to win. And if not Bolt then Christian Coleman (silver medallist, a young American athlete). I know we make Justin Gatlin out to be the pantomime villain, but that’s because he is everything we don’t want the sport to be.”[5] If Gatlin is a villain then, according to the media, Usain Bolt is most definitely a hero; the fastest man in existence, everything from his iconic pose to his showmanship in the midst of pressure is embedded in the mind of the world, and society has collectively welcomed his kindred spirit into its heart. Justin Gatlin, however, is the antithesis, which was demonstrated in the aftermath of the race on August 5th, where he was booed by the sixty thousand-strong stadium, to which he responded with an aggressive finger to his lips. Even Lord Sebastian Coe, President of the IAAF, has stated: "I'm not eulogistic that someone who has served two bans has walked off with one of our glittering prizes.”[6] However, no matter which side of the fence your allegiances lie, there is no doubt about the fact that what happened that day exacerbated the schism within sport and how it is perceived by the world.

But could this schism have been averted from the start? What if, say, the world was aware of the effect of drugs earlier? Surely, if this were the case, ‘doping’ would be eradicated much earlier, and we would now be in a world where athletics and indeed sport as a whole was free of the unfair advantage gained through drug-taking? The World Anti-Doping Agency, founded in November 1999 after the Festina affair at the 1998 Tour de France, has made it their “mission to lead a collaborative worldwide movement for doping-free sport”. It is WADA that monitor and test athletes at both the Olympic Games and IAAF World Championships, with individual national agencies responsible for testing athletes at domestic events. The two most common methods for drug testing (and most successful) are via urine samples and blood samples, although urine samples are favoured as traces of the drug remains in the urine longer than in the blood, often for about five days.

Samples of urine then undergo mass spectrometry, a process by which the atomic mass of atoms or molecules is determined, and essentially reveals the structure of the compound being tested. The machine used, called a mass spectrometer, firstly ionises the atoms in the compound, and then these are accelerated to give them equal kinetic energy; a magnetic field then deflects them according to their mass, and upon reaching the detection point a spectrum is

[4] http://www.nytimes.com/2006/08/10/fashion/10Fitness.html
[5] http://www.telegraph.co.uk/athletics/2017/08/06/joined-booing-justin-gatlin/
[6] https://www.standard.co.uk/sport/other-sports/sebastian-coe-justin-gatlin-drug-storm-a-wakeup-call-for-athletics-a3605696.html

drawn, detailing the molecular masses of the particles that are detected. If, therefore, an athlete has taken a performance-enhancing drug, the mass spectrometry of the urine sample will reveal the type of drug, and the athlete will be dealt with accordingly.

The first mass spectrometer was invented by F.W. Aston in 1919, shortly after the First World War had ended, so this is when I would go back in time to. But what would I take? If I took something extremely modern, I would struggle to make people believe my tale, and it would likely need modern battery power, so would just run out and become useless. Belief, in my opinion, is the key here; if I were able to demonstrate to the post-war world something unheard of, they would find it difficult to find fault in my ways. So, again, what would I take?

A testosterone supplement pill, the type that are banned by WADA. Why? Because steroids first appeared in sport in the early 1950s by American athletes, after Soviet weightlifters were suspected by the world of using substances to win gold medals. Testosterone became widely used throughout American sport, partly due to the advance in muscle bulk, and partly due to the increased sexual drive it produced, which was prominent in the years after the Second World War.

The first Olympic athlete to test positive for the use of performance-enhancing drugs was Swedish pentathlete Hans-Gunnar Liljenwall at the 1968 Olympics in Mexico City, and it could be strongly argued that this shed light on the concept of 'doping'. But if the world was aware earlier of the effects of doping upon the human body, surely greater measures would be taken, and the concept of doping would be all but eradicated in the present day and the future. Certainly, the hurricane that broke out when cyclist Lance Armstrong admitted in 2012 that he had taken banned substances in all seven of his Tour de France victories would have been prevented.

So I'd take a testosterone pill back to America in 1919, after the invention of the mass spectrometer. The world would of course be aware of testosterone from the body, which would reinforce my position as I explain the effects of testosterone supplement pills. Then, however, I would take the pill, and then after a sufficient time has passed, provide a urine sample to be analysed. The resulting spectrum would reveal the compound of the pill, and would put the key, belief, into the minds of the scientists surrounding me. The world would soon be aware of the effect of doping, at a much earlier stage, which would arguably encourage strict monitoring at sporting events, perhaps beginning at the Antwerp Olympics in 1920.

What effect would this have on the world? Well, for starters, the storm created by Justin Gatlin on the 5th August 2017 would be non-existent, as drug monitoring in sport would be greatly increased during the 20th century, and would expel any unfair advantage from sport itself. The vast funding given annually to the World Anti-Doping Agency and other drug agencies around the world can be given instead to those intent on finding new breakthroughs in drug-discovery, such as finding strategies for neurodegenerative diseases like Alzheimer's. And of course, those who lose their lives to drug addiction, whether in sport or not, can avoid this.

To conclude, I would take a testosterone pill back to 1919 America, and demonstrate to them how the newly invented mass spectrometer can be used to counter doping in sport. If this were to happen, it is likely that doping would be eradicated by the late twentieth-century, and so sport would be a fair playing field once again. Ultimately, the storm created by Justin Gatlin's victory would be avoided, and who knows, maybe a different light would shine on the history of sport?