Genetic Doping: WADA we do about the Future of 'Cheating' in Sport?

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ABSTRACT

Due to developments in science and biotechnology, the concept of 'gene doping' is emerging as the number one threat to fair play in sport. This procedure, which involves the manipulation of one's natural genetic characteristics in order to enhance athletic ability, has been banned by the World Anti-Doping Agency (WADA) since 2003. Given the irreversible and potentially undetectable nature of this nascent form of enhancement, it is clear that gene doping poses one of the toughest challenges that anti-doping authorities have yet to face.

By adopting an inter-disciplinary approach to the issue that focuses on the scientific, legal, practical and ethical issues associated with this pre-emptive prohibition of gene doping, this article arrives at a somewhat inflammatory and provocative conclusion: it might be time for sport's stakeholders to consider allowing – and regulating to a safe level – the use of genetic modification in sport. The future of cheating in sport is upon us, and the time to act is now.

Keywords: Genetic Modification, Enhancement, Anti-Doping, Doping Regulation, Sports Law

1 Introduction

"We used to think that our fate was in our stars, but now we know that, in large measure, our fate is in our genes." - James Watson[1]

Human nature dictates that whenever there is fierce competition, there is also likely to be attempts to gain an edge over one's opponent. The storied history of doping in sport is a prime example of this phenomenon. What started more than 2000 years ago in the Ancient Greek Olympics eventually progressed into more modern times when the use of substances such as alcohol, cocaine and amphetamines spilled into sport during the first half of the twentieth century.[2] Since then, more sophisticated forms of doping – such as blood doping – have been used by athletes in an attempt to gain an unscrupulous advantage.[3] The next chapter in the development of drug use in sport is likely to be gene doping,[4] a procedure which Custer describes as the injection of 'synthetic genes into muscle cells, where they become indistinguishable from the receiver's DNA.'[5] In his opening address at the Banbury Conference in 2002, the then World Anti-Doping Agency (WADA) President Richard Pound warned the sporting community that the prospect of genetic enhancement 'will probably make drugs like [steroids] look like the dark ages.'[6] In light of this, the International Olympic

[1] Former director at the National Centre for Human Genome, and co-discoverer of the structure of DNA (alongside Francis Crick) in 1953.
[2] Mottram 2015, pp. 21-3; Matthews 2005, pp. 137-44.
[3] Dimeo 2007, p. 130.
[4] See Jack Anderson, The Future? Gene-Edited Athletes, eSports and the End of Contact Sport, 10 May 2018, https://www.irishexaminer.com/archives/2018/0510/sport/the-future-gene-edited-athletes-esports-and-the-end-of-contact-sport-470454.html (Accessed 15 November 2018), noting that gene doping is a '21st-century means of cheating in sport.'
[5] Custer 2007, p. 185.
[6] Pound's introductory comments at the Banbury Workshop are helpfully printed in Schneider and Friedmann 2006, pp. 66-72.

Committee (IOC) added gene doping to its Prohibited List in 2003.[7] This article seeks to highlight the conglomeration of scientific, legal, practical and ethical issues associated with this pre-emptive prohibition of gene doping in order to arrive at a somewhat provocative conclusion: it might be time for sport's stakeholders to consider allowing – and regulating to a safe level – the use of genetic modification in sport.

With this in mind, Part 2 begins with a medical assessment of the issue that examines both the fundamental science behind gene doping and the oft-cited claims that it is not yet a feasible technique to use in sport. The corresponding points concerning the detectability of genetic manipulation and its potential health risks for athletes are also explored in further detail. Part 3 focuses on the practical and legal implications of prohibiting gene doping. Here, the analysis turns to the rather tenuous and largely unworkable distinction between genetic therapy for treatment and genetic therapy for enhancement. The interrelated difficulties that WADA might have in sanctioning genetically modified athletes are also discussed at this stage. Thereafter, Part 4 considers the potential social and ethical ramifications of permitting gene doping. Two key points of analysis are identified in this section. Firstly, the intertwined relationship between sport and society is canvassed in the context of genetics in an attempt to probe the public's response to the issue. Secondly, the ethical implications that genetic technology might have for the 'level playing field' in sport is also debated. The article concludes by looking at how genetically modified athletes might be accommodated in sport and offering some tentative proposals for reform.

[7] McCrory 2003, p. 192; International Olympic Committee (2002) WADA and IOC Publish New List of Banned Substances and Methods, https://www.olympic.org/news/wada-and-ioc-publish-new-list-of-banned-substances-and-methods-1 (Accessed 16 November 2018). From 2004 onwards, WADA assumed responsibility for publishing and updating the Prohibited List in sport.

2 A Medical Overview of Gene Doping

2.1 What is Gene Doping?

According to Munthe, there are two predominant types of genetic enhancement; somatic cell modification and germ-line modification.[8] The former, which has been described as 'realistic enough to be taken seriously',[9] is primarily concerned with modified genes that are inserted into the cells of the body and do not pass down to offspring.[10] In contrast, the latter produces genetic changes that pass down to future generations through alteration of an early embryo.[11] Given that germ-line modification has recently been labelled a distant 'science fiction',[12] this article predominantly focuses on somatic genetic modification.[13] It is also worth noting at this juncture that WADA does not adopt this basic distinction between the two types of gene doping, instead preferring to use the all-encompassing definition of the 'use of normal or genetically modified cells.'[14] If WADA is serious about acting pre-emptively in regards to discussing gene doping, it is recommended that this distinction is recognised, particularly as both types of modification arguably give rise to different ethical and scientific issues. This

[8] Munthe 2000.
[9] van Hilvoorde et al. 2007, p. 186; Aschwanden 2000.
[10] National Human Genome Research Institute, Somatic cells, https://www.genome.gov/glossary/index.cfm?id=186 (Accessed 1 August 2018).
[11] Wright 2006, p. 334.
[12] Harridge and Velloso 2009, p. 378.
[13] Sporadic references to germ-line modification are made where appropriate (such as in Chapter 3.2).
[14] World Anti-Doping Agency (2018) Prohibited List, https://www.wada-ama.org/en/resources/science-medicine/prohibited-list-documents, section M3 (Accessed 17 August 2018).

point is perhaps reflected in the fact that, while somatic modification is regulated in many countries, germ-line modification is universally forbidden.[15]

The fact that somatic cell modification is permitted is perhaps also why so many studies have been conducted to examine what genes may be candidates for doping. After conducting experiments with so-called 'Schwarzenegger mice', Sweeney identified the gene for IGF-1 as one potential target to increase strength and muscle growth in humans.[16] This muscle hypertrophy could also be caused by inactivating the myostatin gene since this could lead to reduced body fat, an attractive benefit to most athletes.[17] On the other hand, Schjerling suggests that endurance may also be enhanced by manipulating the erythropoietin (EPO) gene to boost both red blood cell production and the amount of oxygen in the blood.[18] The same athletic benefit might also be obtained from modifying other proteins such as VEGF,[19] ACE[20] and PPAR-d.[21] What is interesting here is the various ways in which different genetic manipulations might affect different sports. For example, whilst IGF-1 might be used to specifically target a cricketer's arm or a golfer's shoulder, it may be relatively useless in a sport such as long-distance running (where EPO gene doping is arguably more fruitful). Other sports, such as soccer and boxing,[22] may find that a combination of numerous manipulations would improve their performance. Consequently, whilst genetic modification will undoubtedly affect *all* sports in some manner, it is likely to have a greater impact upon some sports more than others. Snooker, for instance, is perhaps on the periphery of the gene

[15] Polcz and Lewis 2016, p. 415; Battery et al. 2011, p. 494.
[16] Barton-Davies et al. 1998; Lee et al. 2004.
[17] See generally Schuelke et al. 2004.
[18] Schjerling 2005, pp. 23-4; Lippi and Guidi 2004.
[19] Schjerling 2005, pp. 25-6.
[20] Jones et al. 2002.
[21] van der Gronde et al. 2013, p. 678.
[22] Boxing provides a particularly interesting case study because scientific evidence has suggested that manipulation of the DREAM gene could lead to the ability to feel less pain caused by injury. See Cheng and Penninger 2003.

doping debate. Therefore, in the future it may be that certain sporting federations will be more willing to commit more time and resources to the issue than others.

Aside from the issue of what genes may be targeted, it is also helpful to assess *how* such doping could occur. A brief perusal of the scientific literature suggests that there are three possible techniques that athletes might use to gene dope.[23] The first of these, commonly referred to as the *in vivo* method, is the direct injection of DNA into the target muscle.[24] Although it is perhaps the simplest (and cheapest!) option,[25] van der Gronde notes that it is also the least efficient due to its 'poor controllability of integration and expression.'[26] The second approach is *ex vivo* transfer. This entails the genetic modification of cells *outside* of the body before being reinserted back into the athlete's bone marrow.[27] The advantage of this method is that it allows greater control over the expression of the gene, as evidenced by its use to treat severe combined immunodeficiencies.[28] The main drawback with this approach is its complexity and the increased costs associated with the 'specialised laboratories' required for this procedure.[29] Nevertheless, regardless of the technique used, Wells observes that both methods will require the use of a vector.[30] Reiss and Straughan illustrate that a vector is an 'organism that carries genetic material from one species to another.'[31] The commonest form of vector is a viral vector (either in the guise of a retrovirus or adenovirus),[32] presumably because the effects of the gene therapy on the patient last

[23] See Unal and Unal 2004, p. 358.
[24] Haisma and de Hon 2006, pp. 259-60.
[25] Wells 2008, p. 624.
[26] van der Gronde et al. 2013, p. 671.
[27] Ho 1998, p. 212; Azzazy 2005, p. 961.
[28] Hacein-Bey-Abina et al. 2002.
[29] Wells 2008, p. 624.
[30] Wells 2009, p. 169.
[31] Reiss and Straughan 1996, p. 37.
[32] Artioli et al. 2007, p. 350.

longer when using this system of delivery.[33] A non-viral vector – such as synthetic plasmid DNA[34] - is also another possibility but, as with the *in vivo* method, the efficiency of such a technique is questionable.[35] Both approaches do, however, carry the risk of inducing 'incorrect gene regulation' and 'new genetic defects'.[36] The implications of genetic modification for athletes' health is explored shortly.

The third and final method of genetic manipulation is an altogether more contemporary one which focuses on the use of CRISPR-Cas9, a gene-editing technology that uses a 'molecular scissors' approach to make cuts and changes in DNA sequences.[37] Polcz and Lewis argue that this procedure brings the possibility of gene doping even closer to reality because 'it is much cheaper, more accurate, and more technologically straightforward than earlier technologies'.[38] Given that the first clinical trials of CRISPR-Cas9 only began in late-2016,[39] WADA needs to be aware that the field of genetic therapy is a rapidly developing one, so a sound understanding of the science behind gene doping is an essential foundation block for creating effective anti-doping policy. In this light, whilst WADA should be applauded for recently funding over $2 million on research projects related to gene doping,[40] it is telling that, during 2015, WADA had an annual budget less than that of Wayne Rooney's salary.[41] If we are serious about combatting the genetic modification of athletes, the various

[33] Fischetto and Bermon 2013, p. 968; Sinn et al. 2005.
[34] Gatzidou et al. 2009, p. 42.
[35] Wang et al. 2013.
[36] Friedmann and Hoffman 2009, p. 246 (noting the reports of patients who developed cancer because of the retrovirus insertions).
[37] Heinz and Mashreghi 2017; Jocelyn Kaiser, CRISPR Helps Heal Mice with Muscular Dystrophy, 31 December 2015, http://www.sciencemag.org/news/2015/12/crispr-helps-heal-mice-muscular-dystrophy (Accessed 4 October 2018).
[38] Polcz and Lewis 2018, p. 9.
[39] Ginn et al. 2018, p. 4.
[40] Steiner 2011, p. 88.
[41] ESPN, WADA Wants Funding to Keep Pace with Rooney-style Wage Rises, 24 July 2015, http://www.espn.co.uk/olympics/story/_/id/13310936/wayne-rooney-earns-much-world-anti-doping-agency-annual-budget-which-struggling-catch-drugs-cheats-due-lack-funds (Accessed 11th September 2018).

stakeholders in sport may need to reassess the allocation of their resources to ensure that WADA has the tools to effectively 'fight' doping. As Murray potently concludes: 'with better funding, much more could be done.'[42]

2.2 A Medical Reality?

However, such funding is perhaps unlikely to arrive any time soon due to the prevailing attitude amongst some commentators that gene doping is a 'waste of resources' because it is 'in the same ballpark as the babbling nonsense talked about a baldness cure.'[43] As McKanna and Toriello maintain, the nascent nature of genetic modification perhaps suggests that the issue is generating an inordinate amount of discussion.[44] However, this viewpoint can be rejected from three different perspectives. From the short-term perspective, there have been claims that gene doping is already occurring.[45] Before the 2006 Winter Olympics, for instance, it was reported that German coach Thomas Springstein had inquired via email about the possibility of obtaining Repoxygen, a substance used in genetic therapy to treat anaemic patients.[46] Whilst WADA should be careful not to descend into a moral panic by implementing rash anti-doping policies on the back of a potentially baseless assumption (its use for gene doping was never proven), such allegations suggest that we must remain vigilant and open to the *possibility* that genetic modification is, or will be shortly, occurring. This is reinforced by

[42] Murray 2017, p. 465.
[43] Miah 2005, p. 43 (citing David Powell, Spectre of Gene Doping Raises its Head as Athletes see Possibilities (2001) The Times, London).
[44] McKanna and Toriello 2010. See also Murray 2009a, p. 143 (stating that the 'imminence of genetic enhancement appears to be greatly exaggerated').
[45] See, for example, Friedmann et al. 2010, p. 647 (discussing the allegations that a Chinese genetics laboratory offered athletes the chance to genetically modify themselves before the 2008 Beijing Olympic Games).
[46] Gretchen Reynolds, Outlaw DNA, 3 June 2007, https://www.nytimes.com/2007/06/03/sports/playmagazine/0603play-hot.html (Accessed 20 September 2018).

Schneider and Friedmann who correctly identify that sport represents: 'one of the early and most obvious areas of human activity in which serious attempts at genetic enhancement are likely to be made, and made fairly soon.'[47] This point was also echoed by WADA in its St Petersburg Declaration when it was concluded that 'sport will be one of the areas in which gene-based enhancement is first likely to arise.'[48] The reason for this is simple: athletes are reaching the limits of human achievement.[49] Consequently, given the desire amongst both participants and the public to see superhuman performances and the setting of new records in sport,[50] impatient athletes may be tempted by genetic enhancement if these recent allegations about the feasibility of gene doping are proven to be correct.

The middle-term response to the 'overhyping' of gene doping is that, even if it has not already started, a discussion of the problems it is likely to pose gives us a chance to be proactive rather than reactive. Former speed-skater and IOC member Johann Koss neatly encapsulated these sentiments when he stated that WADA must act 'in the early stages before any athlete starts using this. We need to act quickly.'[51] As demonstrated by the creation of WADA in the wake of the Festina affair,[52] sport often reacts to issues *after*-the-fact. For once, we now have a chance to be one step ahead of the 'cheaters'. However, whilst the pre-emptive banning of gene doping in 2003 was a step in the right direction, WADA has thus far failed to adequately discuss the multitude of ethical, legal and scientific issues associated with this form of enhancement.

[47] Schneider and Friedmann 2006, p. 37.
[48] World Anti-Doping Agency, Saint Petersburg Declaration, 11 June 2008, https://www.wada-ama.org/en/resources/science-medicine/saint-petersburg-declaration (Accessed 2 August 2018).
[49] See generally Berthelot et al. 2015; Desgorces et al. 2008.
[50] Todd and Todd 2009, p. 65 (highlighting that '[f]ans likes to see record lifts and our lifters like to make record lifts').
[51] Miah 2004, p. 54.
[52] For background, see Fotheringham 2017.

Finally, in the long-term, even if we concede that genetic enhancement is merely a fanciful dream, it is argued that we could use gene doping as a catalyst to provide a newfound impetus to re-thinking our current anti-doping policies. Ritchie contends that, because of the IOC's failure to take account of ethics when anti-doping policy was first introduced in the 1960s, there are now a 'series of contradictions in its policies that, arguably, continue to the present day.'[53] As outlined in Chapter 4.2, it is contended that one such contradiction is the current ethical status of genetics in sport. Perhaps, then, sport needs the shock of genetic doping to provoke an ethical debate that should really have occurred many years ago.

2.3 Detecting Gene Doping

Whichever perspective one favours, it should be emphasised here that gene doping differs greatly from traditional pharmaceutical doping in the sense that there is currently no WADA-accredited test to detect gene doping.[54] This is because the 'protein produced by the foreign gene… [is] structurally and functionally very similar to the endogenous proteins.'[55] Nevertheless, Fischetto and Bermon identify a number of experimental techniques that could be used to detect genetic enhancement in athletes.[56] The first method is a muscle biopsy at the point of injection.[57] However, aside from the issue of determining the exact location of the injection,[58] such a procedure raises numerous practical and legal concerns. Firstly, when would the biopsy take place? Removing a slice of muscle is likely to keep an athlete out of action for a significant period of time, so it could not be done near to, or during, any

[53] Ritchie 2015, p. 28.
[54] Ostrander et al. 2009; Azzazy and Mansour 2007, pp. 951-2.
[55] Brzezianska et al. 2014, p. 253.
[56] Fischetto and Bermon 2013, pp. 973-4.
[57] Ibid. However, c/f Guescini et al. 2007.
[58] Brzezianska et al. 2014, p. 255; Baoutina et al. 2008.

competitive tournament or game. Secondly, due to the extremely invasive nature of the operation, it is unlikely that any athlete would provide 'voluntary and informed' consent to the procedure as required by the 2016 Olympic Movement Medical Code.[59] As Hamlyn vividly concludes: '[p]eeing in a pot is one thing, but having your legs cut open is another.'[60]

However, it is a common misconception that removing pieces of a muscle is the only way to detect gene doping. Other more indirect methods of detection include measuring alterations in gene expression, most notably in white blood cells (transcriptomics) and blood or urine (proteomics).[61] In 2011, for example, Beiter et al highlighted that it may be possible to detect genetic manipulation based on 'the presence of traces of transgenic DNA in blood circulation after somatic gene transfer.'[62] However, whilst such indirect methods appear to be currently preferable to the harsh and somewhat inhumane approach of muscle biopsy, they are not without their own difficulties. Indeed, there appears to be no demarcation line between those blood/urine levels which could be considered 'normal', and those which would constitute evidence of gene doping,[63] a problem that is particularly pronounced when considering the different genetic makeup, diet, ethnicity and environment of various athletes.[64] For instance, it was found that a gene associated with lower testosterone levels was seven times more common in Korean males than in Swedish males.[65] Consequently, the

[59] International Olympic Committee (2016) Olympic Movement Medical Code, https://stillmed.olympic.org/media/Document%20Library/OlympicOrg/IOC/Who-We-Are/Commissions/Medical-and-Scientific-Commission/Olympic-Movement-Medical-Code-31-03-2016.pdf#_ga=2.33760802.2007459810.1529939714-1593240879.1529939714, Chapter 1.3 (Accessed 27 October 2018).
[60] Peter Hamlyn, Gene Genie Casts Ominous Shadow, 3 December 2001, https://www.telegraph.co.uk/sport/othersports/drugsinsport/3018080/Gene-genie-casts-ominous-shadow.html (Accessed 23 August 2018).
[61] See generally Baoutina et al. 2010.
[62] Beiter et al. 2011, p. 228.
[63] Fischetto and Bermon 2013, p. 974.
[64] Wells 2008, p. 629. See also the discussion of Finnish skier Eero Maentyranta in Chapter 4.2.
[65] Jakobsson et al. 2006.

lack of a definitive threshold for such tests suggests that the possibility of a false positive for these indirect methods of detection is rather high. In this light, they would also seem to fall foul of the requirement stemming from the seminal CAS award in *Quigley* which mandates that any anti-doping regulation should be 'predictable' and 'constitutionally proper'.[66]

For such reasons, Fore suggests that we should instead 'monitor an athlete's haematocrit levels over time' to form a 'baseline level' for each individual athlete.[67] The idea here is that WADA could compare this 'genetic fingerprint' of athletes against subsequent test samples to watch for any suspicious increases in haematocrit levels that could provide evidence of gene doping. This proposal to monitor hematologic variables is already a key component of the 'biological passport' program that was introduced by the UCI and WADA in 2008 after a number of athletes at the 2006 Winter Olympics exhibited unusually high levels of haemoglobin in their blood.[68] As Schmalzer explains, these 'blood passports' consist of a 'personalized haematological and steroid profile' that follows the athlete rather than the product.[69] However, in regards to genetic modification, it is suggested that even if such an approach was financially viable, it is somewhat impractical because it fails to consider the possibility that athletes may have gene doped *before* being tested for their baseline sample. Consequently, an athlete would then be able to conceal their illicit genetic enhancement because gene therapy, unlike more conventional drugs, has the potential to be permanent,[70] and WADA would logically presume that the athlete was simply born with these favourable athletic traits.

[66] CAS 94/129, USA Shooting & Quigley v UIT, para 34.
[67] Fore 2010, p. 81.
[68] Sottas et al. 2011, p. 971; Robinson et al. 2011.
[69] Schmalzer 2009, pp. 690-1 (paraphrasing one French official).
[70] On this point, see Chapter 3.2.

Because of these concerns, Munthe recommends that an athlete's genome is scanned in early adolescence or even during childhood.[71] However, it is argued that this may not be a wise suggestion because it may actually fuel the use of gene doping at an even earlier age in order to avoid detection. If gene therapy eventually becomes a legitimate form of treatment in society, Miah warns that its widespread availability may 'encourage prospective parents to seek the latest genetic enhancement to provide a good start in life for their child.'[72] This possibility raises two concerns. The first relates to the probable violation of a child's right to an autonomous and open future.[73] A parent who has gone to the trouble of designing their child to become an athlete is likely to unduly coerce them into sport, irrespective of their child's true desires or wishes. History dictates that this is a very real possibility. The father of Finnish runner Paavo Nurmi was reportedly so desperate for his infant son to become an elite runner like himself that he continually stretched the feet of his child.[74] As perhaps symbolised by the angry parent on the touchline of a Sunday league soccer game, we seem to put far too much pressure on the young shoulders of children to succeed in sport,[75] and the prospect of childhood genome scans is likely to only exacerbate this issue.

The second concern relates to the normalisation of drugs amongst children. As Donovan observes, 'more and more parents are seeking a "magic pill"' to improve their child's quality of life,[76] and this probably helps to explain why one French study shockingly found

[71] Munthe 2005, p. 112.
[72] Miah 2004, p. 145.
[73] See generally Simon et al. 2018, chapter 4.
[74] van Hilvoorde 2005, p. 94.
[75] Tom Farrey, Have Adults Ruined Children's Sport?, 28 December 2017, https://www.bbc.co.uk/news/world-us-canada-42329564 (Accessed 5 December 2018); David Conn, 'Football's Biggest Issue': The Struggle Facing Boys Rejected by Academies, 6 October 2017, https://www.theguardian.com/football/2017/oct/06/football-biggest-issue-boys-rejected-academies (Accessed 5 December 2018). See also the recent and tragic passing of 18-year old snowboarder Ellie Soutter, which her father attributed to the exorbitant levels of pressure imposed upon children in high-level sport: BBC, Ellie Soutter Death: Father Criticises Pressure on Athletes, 31 July 2018, https://www.bbc.co.uk/news/uk-england-surrey-45023187 (Accessed 5 December 2018).
[76] Donovan 2009, p. 119.

that '[c]hildren of six years find it just as legitimate to take drugs to improve sporting performance as it is to take them to cure a sickness.'[77] Such troubling findings are also reinforced by Holt and Sonksen who highlight that, in a US survey of 10th-grade boys, 5% admitted to taking growth hormones.[78] It would not be implausible to suggest that these laissez-faire views towards drugs stems from a "whatever it takes" attitude on behalf of the parents. Consequently, in order to overcome these dangers and ensure accurate detection, Mehlman provocatively suggests that baseline testing may have to take place at birth or even prenatally.[79]

Nevertheless, such a scheme is likely to be replete with privacy concerns,[80] and it remains highly doubtful whether the science or finances currently exist to implement it effectively.[81] Therefore, in the meantime, Custer maintains that, in the absence of any novel scientific breakthrough in regards to the detection of genetic modification, WADA's only viable method for catching gene dopers is through the use of circumstantial evidence.[82] The current World Anti-Doping Code (WADC) outlines in Article 2 that numerous anti-doping rule violations (ADRV) can occur without an adverse analytical finding.[83] However, it remains unclear whether the use of purely circumstantial evidence to detect gene doping will be enough to satisfy the remarkably high 'comfortable satisfaction' standard in Article 3.1 WADC.

[77] Hoberman 2009, p. 7.
[78] Holt and Sonksen 2008, p. 543.
[79] Mehlman 2009, p. 220.
[80] See generally Tamburrini 2005, pp. 86-7.
[81] However, note the recent reports from the genetic sequencing giant Illumina that it may soon be able to sequence an entire human genome for as little as $100: Meghana Keshavan, Illumina Says it Can Deliver a $100 Genome – Soon, 9 January 2017, https://www.statnews.com/2017/01/09/illumina-ushering-in-the-100-genome (Accessed 10 August 2018).
[82] Custer 2007, p. 204.
[83] World Anti-Doping Agency (2015) World Anti-Doping Code, https://www.wada-ama.org/en/resources/the-code/world-anti-doping-code, Article 2.5 (tampering with doping control); Article 2.6 (possession of a prohibited substance/method). See also Article 3.2 where it is stated that '[f]acts related to anti-doping rule violations may be established by *any reliable means*.' [emphasis added]

As noted in *USADA v Montgomery*,[84] where the allegation is particularly serious - and, it is submitted, an allegation of gene doping will usually be construed as particularly grave given not only its ramifications for sport, but also for humanity - the standard of proof may not be much different from the criminal standard of 'beyond a reasonable doubt'.[85] *French v ASC and Cycling Australia* also reiterates that proving a charge in the absence of analytical evidence is remarkably difficult; here, French was found not to have committed an ADRV despite the fact that the room used by the cyclist was found to contain a bucket of used syringes containing traces of a prohibited substance.[86]

Consequently, if WADA wish to pursue this method of detection, it may be necessary to update the WADC with guidance as to what kind of circumstantial evidence is required to convict an athlete of gene doping. Would, for example, an email depicting the details of a planned genetic modification between an athlete and scientist suffice?[87] It is tentatively suggested that in a borderline case such as this or *French*, the results of any indirect methods of detection (such as blood levels) could tip the scales. However, as was recently outlined by the CAS Panel in *WADA v Thomas Bellchambers et al*, where the circumstantial evidence is sufficiently strong, scientific evidence will not be necessary.[88]

Two further comments are made here. Firstly, given that WADA does not seemingly have the requisite authority to dictate what is sufficient circumstantial evidence to establish gene doping, it may be necessary to wait for such cases to first be brought forward to the CAS

[84] CAS 2004/O/645, USADA v Montgomery.
[85] Ibid, para 36. However, see the comments made in CAS 2015/A/4059, WADA v Thomas Bellchambers et al, AFL and ASDA where the CAS panel, at para 105, refused to accept that there is 'no material difference between proof beyond a reasonable doubt and proof of comfortable satisfaction.' The dictum in *Montgomery*, they argue, was case-specific.
[86] CAS 2004/A/651, French v Australian Sports Commission & Cycling Australia. See also USADA v Leogrande, AAA Panel Decision dated 1 December 2008 (admission of doping, alongside clear circumstantial evidence, was enough to establish an ADRV).
[87] USADA v Collins, AAA Panel Decision dated 9 December 2004 suggests that it might.
[88] Bellchambers (See n85), para 144.

(who, by contrast, *do* have sufficient legal jurisdiction to decide on this matter). Only then can the WADC be updated accordingly. Secondly, and in the meantime, WADA may wish to revisit and revise their current scheme of protection for whistleblowers. With one eye on *USADA v Gaines*,[89] McLaren notes that many circumstantial evidence cases turn on the testimony of those closest to the sport.[90] Indeed, it was only after a former coach anonymously mailed a syringe to USADA that the infamous BALCO scandal was finally exposed.[91] Therefore, it is imperative that the necessary emotional and financial support is offered to future whistleblowers to ensure that they do not feel unduly deterred by the criticism that often accompanies speaking out against cheaters. For example, the former executive of the Jamaican Anti-Doping Commission was recently branded a 'Judas' for speaking out against her country's poor levels of dope testing in 2013,[92] but WADA did not seem interested in offering her any assistance during this political backlash.[93] Clearly, there is much room for improvement in this regard, and it is hoped that the spectre of gene doping (and Custer's concomitant suggestion to rely solely on circumstantial evidence for its detection) proves to be the catalyst for this change.

[89] CAS 2004/0/649, USADA v Gaines. See also USADA v Armstrong (Decision of USADA on disqualification and ineligibility, dated 10 October 2012).
[90] McLaren 2006, pp. 198-203.
[91] See Tom Knight, Inside Information Gives Drug Investigators Shot in the Arm, 2 August 2004, https://www.telegraph.co.uk/sport/othersports/athletics/2383957/Inside-information-gives-drug-investigators-shot-in-the-arm.html (Accessed 15 November 2018). BALCO, a San Francisco-based company run by Victor Conte, was accused of supplying designer steroids to a number of high-profile UK and US athletes. For background see Fainaru-Wada and Williams 2006.
[92] Robin Scott-Elliott, I Had to Go into Hiding, Says Drug Test Whistle-Blower Renee-Anne Shirley, 20 March 2014, https://www.independent.co.uk/sport/general/athletics/i-had-to-go-into-hiding-says-drug-test-whistle-blower-renee-anne-shirley-9203734.html (Accessed 27 November 2018).
[93] Dimeo and Moller 2018, p. 72; Ben Bloom, WADA Warns Doping Whistleblowers about Dangers of Going Public, 8 February 2018, https://www.telegraph.co.uk/sport/2018/02/08/wada-warns-doping-whistleblowers-dangers-going-public (Accessed 14 August 2018).

2.4 Gene Doping and Health Risks

The discussion thus far has rested on the premise that WADA wishes to uphold the ban on gene doping. This is not, however, the only available option. With a focus on prioritising the health of athletes, this section now asks whether it might actually be preferable to abandon this paternalistic stance altogether and instead implement the rather inflammatory liberal-inspired proposal to allow the controlled use of genetic manipulation in sport. After all - and to paraphrase George Orwell - perhaps the best way to end a war is to lose it.[94]

One possible starting point in answering this question is to briefly consider a cost-benefit analysis of prohibiting genetic doping; in essence, and as some criminologists ask in relation to the debate on the criminalisation of 'soft' drugs in the UK,[95] would it do more harm than good to ban genetic technology? In the context of healthcare, we might answer this in the affirmative. For example, when 18-year-old Jesse Gelsinger died in one gene therapy experiment aimed to treat a usually fatal liver condition,[96] we might concede that the seriousness of the condition outweighed the potential risks of treatment. On the other hand, in sport the patients will presumably be young, healthy athletes, and in this case the benefits clearly do not outweigh the risks. As Friedmann and Hoffman conclude: 'gene transfer is justifiable only for serious and usually life-threatening disease, and certainly is not ready for non-disease, enhancement purposes.'[97]

Indeed, the dangers of even the safest forms of regulated gene therapy may carry a significant risk of harm to athletes. As van Hilvoorde recognises, 'health risks are the most

[94] Knowles 2007, p. 246.
[95] See generally Mallea 2014; O'Mahony 2008.
[96] Wilson 2009, pp. 152-3.
[97] Friedmann and Hoffman 2009, pp. 242-3.

powerful objection against the use of gene technology to enhance elite sport performance.'[98] One pertinent example of the perils of genetic enhancement is a French clinical trial headed by Dr Alain Fischer aimed at treating the so-called "bubble boy syndrome" in young children.[99] Three years after the completion of the study, two of the ten treated children contracted leukaemia, one of whom died.[100] Other current and potential health hazards of gene therapy include: an excess of red blood cells leading to decreased flow of blood;[101] a fall in EPO levels leading to severe anaemia;[102] an immune reaction to the genetic modification leading to an elimination of the endogenous protein;[103] and an overexpression of the gene leading to an 'overabundance of protein that could reach toxic levels.'[104] However, despite the well-documented and justifiable concerns surrounding this form of enhancement, it is suggested that three points may help to soothe the paternalistic fears we might hold about legalising gene doping.

Firstly, most new therapies often require somewhat hazardous and unpredictable human experimentation to begin with before they are gradually honed over a number of years. Chemotherapy, for instance, required a number of decades to fully develop before the cure rates of many of today's most treatable cancers significantly increased.[105] Consequently, whilst it is suggested that WADA should still remain proactive in regards to gene doping, it is perhaps best if we let genetic research develop a little more of its own accord before introducing any drastic or wholesale changes. The second rejection of the paternalistic stance (and one which stands in stark contrast to the potential health hazards listed above) is that

[98] van Hilvoorde et al. 2007, p. 191.
[99] Schneider and Friedmann 2006, pp. 29-31.
[100] Ibid. See also Hacein-Bey-Abina et al. 2003.
[101] Steiner 2011, p. 65; Juhn 2003, p. 929.
[102] Gao et al. 2004.
[103] Momaya et al. 2017, p. 484.
[104] Ibid.
[105] Miller et al. 2016, p. 279; Schneider and Friedmann 2006, p. 24.

gene doping may actually even *increase* safety. As Sweeney observes, it would be 'unethical to withhold from someone something that would actually allow their muscles to be much healthier now and in the future.'[106] This argument is reminiscent of the point made by some cyclists that the use of drugs may actually make their sport safer as it allows them to recover more quickly from their gruelling exertions.[107] In this light, it is also contended that if sport's stakeholders do decide to legalise and regulate genetic enhancement in a transparent manner, the financial resources that would likely be spent on it in an industry as lucrative as sport may produce scientific breakthroughs that could actually advance knowledge and improve health in the medical sphere. This symbiotic relationship between sport and society in the context of genetic enhancement is explored in further detail in Chapter 4.1.

The third and final point is that, even if regulated gene therapy never evolves into a completely safe procedure, it is still preferable to the probable alternative generated by the paternalistic stance – the possibility of athletes seeking out underground means of acquiring genetic modification. An analogy might be made here with the Prohibition era in the US (1920-1933).[108] The ban on alcohol during this period had simply created a black market for the product, and this resulted in even more harm from alcohol consumption due to the poor quality of the unregulated alcohol produced behind closed doors.[109] In similar fashion, the ban on gene doping might drive athletes to 'street dealers' or 'rogue laboratories' where the unregulated nature of such a procedure would mean that genetic enhancements could be administered to a level 'commensurate with the amount of performance gain [the athlete

[106] Tim Franks, Gene Doping: Sport's Biggest Battle?, 12 January 2014, https://www.bbc.co.uk/news/magazine-25687002 (Accessed 10 November 2018); c/f Fore 2010, p. 86 (noting that genetic enhancement could 'put a tremendous strain on other body parts essential to movement such as tendons and ligaments').
[107] Simon 2016, pp. 98-9.
[108] See generally Okrent 2011.
[109] Coffey 1975, pp. 196-8.

wishes] to attain, rather than the [level] which can be considered "safe"'.[110] This is reinforced by Cooper's somewhat startling prediction that, if safety is not a paramount concern, gene doping experiments could become possible in a garage laboratory or school project.[111] Gene therapy would 'require good storage' to ensure safety,[112] but it is highly questionable whether such underground research facilities would be aware of, or indeed concerned about, such issues. Another possibility is that athletes could begin 'forum shopping' by travelling to countries with the most lax gene therapy research regulations and receiving treatment there.

Despite these issues, some have rejected this generalised analogy to the Prohibition era in the case of drugs, because they argue that the 'nature' of the substance is the pivotal factor.[113] In essence, the argument here is that alcohol is not the same as gene therapy, so the policy response should not automatically be the same. However, it is precisely this difference which arguably even accentuates the case for legalisation. Unlike alcohol – which was, and still is, used largely for leisure and social purposes[114] – genetic enhancement is likely to be used to attain a much more serious ambition; to fulfil an insatiable, yet dangerous, desire for success in a field of activity that has, to return again to Orwell, been colourfully termed 'war minus the shooting'.[115] Therefore, it is probably even *more* likely that gene doping would be sourced from covert, underground origins than alcohol. Empirical evidence of this contention is provided by Goldman's infamous (yet perhaps questionable[116]) 1982

[110] Savulescu et al. 2004, p. 669.
[111] Cooper 2012, pp. 220-1.
[112] van der Gronde et al. 2013, p. 673.
[113] Cooper 2012, p. 227.
[114] Slavicek 2008, p. 7.
[115] Knowles 2007, p. 246.
[116] Although the 'Goldman dilemma' is a 'significant piece of evidence' that remains 'one of the most cited results in the anti-doping literature', some authors have questioned its credibility. For example, Connor et al. 2013 highlight various weaknesses in the work including: the wording of the questions, the use of the question method, generalisability over different times and contexts, and no comparable measure of acceptance among the general population. See also Woolf et al. 2017.

survey which highlighted that 52% of 200 professional athletes would take a drug that guaranteed them sporting success but would kill them within five years.[117] This can be contrasted with a more recent Australian survey which illustrated that less than 1% of the general public would accept this 'Faustian bargain'.[118] These widely differing statistics are perhaps also linked to another identifiable reason why athletes may risk their health to achieve genetic enhancement: the so-called 'Prisoner's dilemma' in sport.[119] This economic game theory suggests that whilst we would all be better off if no-one doped, no athlete can truly trust another not to cheat, so they too enhance themselves in order to keep up with the competition.[120]

Consequently, if WADA are serious about protecting the health of athletes, it is likely that in the future they may have to consider whether to allow – and supervise to a "safe" level through regular testing – this 'foolhardy, unethical and dangerous' form of therapy.[121] In so doing, Anderson postulates that this would transform WADA into a 'global sports-focused drugs and health-care regulatory agency' akin to the US Food and Drug Agency.[122] Two final points of clarification are made here. Firstly, this metamorphosis from punisher to regulator should be supplemented by the exclusive use of WADA-approved doctors to oversee the genetic enhancement of athletes. Private physicians – such as the infamous Eufemiano Fuentes[123] - have long been embroiled in the vast majority of doping scandals, presumably because of the added emotional and financial attachment felt towards individual

[117] Goldman et al. 1984, p. 32.
[118] Connor and Mazanov 2009, pp. 871-2.
[119] For an excellent and engaging discussion of this 'game theory' as applied to law see Farnsworth 2007, pp. 100-9.
[120] See generally Haugen 2004.
[121] Schneider and Friedmann 2006, p. 47.
[122] Anderson 2013, p. 152.
[123] For background on Fuentes and the surrounding 'Operacion Puerto' see Hardie 2011, p. 160.

athletes.[124] The sole use of more objective WADA-accredited doctors would not only remove the temptation of what Green terms 'doctor shopping',[125] but it would also further ensure that the safety of athletes is cemented as the number one priority in drugs-related sporting policy. The second point of interest is that this liberal-inspired position is further reinforced by the plethora of practical and legal concerns associated with the continued prohibition of gene doping.

3 Practical and Legal Considerations

3.1 Enhancement… or Therapy?

The first practical issue of continued proscription is whether we class genetic modification in sport as therapy or enhancement. As Juengst outlines:

> '…most biomedical interventions that could become problematic as enhancement interventions will also have legitimate therapeutic applications in treating bona fide medical maladies in non-athletes.'[126]

Schneider espouses that the usual approach has been that 'therapy, a repair to bring one back to "normal", has been permitted but "enhancement" (going beyond normal) has been banned.'[127] However, as we will see, the line between therapy and enhancement is a rather

[124] Dimeo and Moller 2018, pp. 151-3; Schjerling 2005, p. 29 (noting that 'physicians may… be pressed to allow the use to go too far to achieve the maximal effect').
[125] Green 2009, pp. 84-5.
[126] Juengst 2009, p. 184.
[127] Schneider 2005, p. 36.

tenuous one, and it may be that the introduction of gene doping further corrodes this line to the point of eradication.

To illustrate this point, consider this first hypothetical example.[128] *Weightlifter* is a young child diagnosed with severe muscular dystrophy. Without treatment, he will likely be relegated to a wheelchair for the rest of his life. *Weightlifter* is offered the innovative treatment of genetic therapy during childhood, and the procedure is extremely successful. In fact, the procedure is so successful that it actually over-compensates for muscle increase, and by the time *Weightlifter* reaches adulthood, he is breaking Olympic records in weightlifting. Suppose that WADA discovers this information through testing and/or circumstantial evidence: do we classify this as therapy or enhancement? Because genetic modification is currently on the Prohibited List, the answer perhaps turns on whether *Weightlifter* could be granted a Therapeutic Use Exemption (TUE) under Article 4.4 WADC. The stumbling block to attaining a TUE here is likely to be the second of the four criteria which must be satisfied before it is granted; that the therapy must not 'produce significant enhancement of performance'.[129] Even though WADA offers no clarity or guidance as to what this means, it is surely not satisfied in *Weightlifter's* situation. At one point during childhood, he probably could not walk; now he has been enhanced to such an extent that he is winning gold medals. Consequently, and in similar fashion to the incident involving cyclist Chris Boardman who was forced to retire from the sport in order to receive the necessary (yet prohibited) testosterone

[128] This is a slightly reworked example taken from Custer 2007, pp. 205-6.

[129] World Anti-Doping Agency, Therapeutic Use Exemption (TUE), https://www.wada-ama.org/en/questions-answers/therapeutic-use-exemption-tue#item-728 (Accessed 14 September 2018). The other three criteria are that (i) significant health problems would arise without the substance; (ii) there is no reasonable therapeutic alternative; and (iii) necessity of use is not a consequence of using another prohibited substance.

treatment for a bone condition,[130] it seems probable that *Weightlifter* would receive a ban from sport due to the likely refusal to grant a TUE.[131]

Compare this with the second hypothetical situation: *Archer*, an avid archery athlete and otherwise in good health, discovers that it is possible to undergo LASIK eye surgery to 'upgrade [his] vision to 20/15 or better'.[132] This procedure - even if used only to improve upon already good vision - is not currently banned by WADA, and has been described as one of the 'most popular and common form[s] of surgical performance enhancement among athletes'.[133] Like Tiger Woods who has also received the surgery,[134] *Archer* undergoes the operation and subsequently wins a silver medal at the Olympics due to his greatly enhanced vision. In this case, even though we might have less sympathy with *Archer's* situation than with *Weightlifter's* due to the motives of the two surgeries, WADA would likely view *Archer's* treatment as therapy and allow him to compete. However, both seem to enhance the athlete 'over and above their natural level of functioning',[135] so why is this dubious distinction made? Three points might be made in answering this question.

Firstly, the illogical and impractical therapy-enhancement distinction in sport is seemingly heavily influenced by what treatment is deemed legitimate in the field of healthcare.[136] Because of the aforementioned symbiotic relationship between sport and society, Filipp explains that there is a 'grey zone of performance enhancements that are

[130] Dimeo and Moller 2018, p. 102; William Fotheringham, Boardman Quitting to Take Drugs, 12 October 2000, https://www.theguardian.com/sport/story/0,3604,380917,00.html (Accessed 10 November 2018).
[131] The question of how long the ban would – and should - be is discussed shortly.
[132] Hamilton 2006, p. 40. See also, at pp. 39-40, Hamilton's discussion of 'Tommy John surgery' which can also be used to enhance athletic performance.
[133] Lewis 2013, p. 733.
[134] William Saletan, The Beam in Your Eye: If Steroids are Cheating, Why isn't LASIK?, 18 April 2005, http://www.slate.com/articles/health_and_science/human_nature/2005/04/the_beam_in_your_eye.html?via=gdpr-consent (Accessed 26 November 2018).
[135] Miah 2010, p. 224.
[136] See Miah 2004, p. 95; Schneider and Friedmann 2006, p. 87.

legally used in sports because they are accepted as standard medical treatments'.[137] This argument probably helps to explain why marijuana is on the Prohibited List,[138] despite having no ergogenic properties.[139] Because cannabis use is a 'matter of serious social concern',[140] sport has resultantly adopted a hard-line stance in relation to the substance, possibly in an attempt to preserve the role model status of professional athletes.[141] Therefore, and to return to the *Weightlifter-Archer* scenarios, it is possible that LASIK is only authorised by WADA because laser eye surgery is now quite a common and medically acceptable form of treatment in society. In contrast, genetic therapy is still very much in its infancy, so is consequently deemed an unethical and impermissible enhancement. However, it is suggested that, in time, WADA's view on genetic modification may gradually change if such procedures are used more frequently in medicine to treat some diseases and ailments. Indeed, scientific research indicates that gene therapy could soon be used to cure Alzheimer's, Parkinson's and various forms of cancer.[142]

The second reason for the arbitrariness of the therapy-enhancement distinction is related to the inconsistency in what substances and methods are added to, and removed from, the Prohibited List. For instance, when meldonium was classified as a prohibited substance at the beginning of 2016, there were concerns that its inclusion on the list was based on 'scant and scientifically unsound literature'.[143] This 'lack of transparency on the

[137] Filipp 2007, p. 434.
[138] WADA (See n14), section S8.
[139] Campos et al. 2003; Saugy et al. 2006, p. i14.
[140] CAS OG/98/002, Rebagliati v IOC, para 26.
[141] See generally Houlihan 2002, p. 91-2, 110.
[142] Schneider and Friedmann 2006, pp. 33-4.
[143] Isabelle Westbury, WADA Do about WADA's Bad Science?, 7 July 2017, http://www.sportsintegrityinitiative.com/wada-wadas-bad-science/ (Accessed 6 October 2018). See also Sean Ingle, Sport's War on Drugs is Being Lost on Many Fronts, 9 July 2018, https://www.theguardian.com/sport/2018/jul/09/wada-anti-doping?CMP=Share_iOSApp_Other (Accessed 9 September 2018) who highlights the dubious science behind Chris Froome's recent exoneration for high levels of salbutamol in 2017.

inclusion and revision process to the Prohibited List' is further demonstrated by the permissibility of hypoxic chambers in sport,[144] a pod that simulates training at a high altitude in order to improve endurance.[145] It is difficult to pinpoint any notable difference between these legal oxygen chambers and the illegal method of blood doping, particularly as the former is supposedly twice as effective at increasing oxygen saturation as the latter.[146] Consequently, it seems that Loland and Caplan are correct to argue that, when such pods are used as a 'pure performance-enhancing means to enhance the oxygen carrying capacity of the blood' (rather than as a means to level the playing field or protect the health of athletes), they cannot be justified.[147] To date, these pods are still legal for any such use.[148]

Therefore, whilst WADA states in Article 4.3.1 WADC that it has 'sole discretion' in deciding what to include on the Prohibited List,[149] the blurred and ultimately futile distinction between therapeutic and enhancing substances suggests that it is not exercising this discretion adroitly. Indeed, two of the following three criteria - an enhancement of performance; a risk to health; or a violation of the spirit of sport - should be satisfied before a substance or method is included on the Prohibited List,[150] but WADA continually fails to disclose which two of the three are actually violated by a drug when updating the list. Instead, it seems that a substance's inclusion is dictated by nothing more than intuitive moral preference. This is highlighted by the attitude of former IOC President Jacques Rogge when he stated, in relation to the controversial hypoxic tents: 'I don't like the idea that people have

[144] Viret 2015, p. 445.
[145] Sinex and Chapman 2015.
[146] Hannah Karp, Novak Djokovic's Secret: Sitting in a Pressurized Egg, 29 August 2011, https://www.wsj.com/articles/SB10001424053111904787404576532854267519860 (Accessed 3 December 2018).
[147] Loland and Caplan 2008, p. 75; see also Loland and Murray 2007, p. 195.
[148] See the most recent discussion in Murray 2018, pp. 139-44.
[149] WADA (See n83), Article 4.3.1.
[150] Ibid, Article 4.3.1.1 - 4.3.1.3.

to go into chambers, that's not my idea of sport, it is artificial, I don't like it.'[151] As demonstrated by the heavy use of first-person pronouns in this statement, the debate on the acceptability of gene doping in sport is seemingly taking place in a wholly subjective environment that is not conducive to a rational and objective debate on the actual scientific and ethical ramifications of this form of enhancement.

The third and final point on the therapy-enhancement distinction ties neatly into Rogge's statement because he seems to imply that the banning of certain substances and methods is based largely on 'what is or is not (loosely termed) 'natural''.[152] As Hoberman recognises, 'the distinction between what is "natural" and what is "unnatural" is at the heart of the twentieth-century controversy over the use of performance-enhancing drugs in sport'.[153] This natural-artificial distinction, seemingly recognised by both Sigman[154] and Lin and Allhoff,[155] could help to explain why genetic modification is not currently regarded as acceptable by WADA; it is simply too 'artificial'.

However, before we can state that a certain enhancement is artificial - and thus worthy of the term 'doping' - we first need to define, and distinguish it from, what is considered natural (and therefore therapeutic). It is at this point that we see the impracticality of such a distinction in sport. Is it natural to only consume a specialised diet aided by protein supplements?[156] If so, how natural is it for athletes to receive painkilling injections to play through the pain barrier?[157] And how natural are Fastskin swimsuits that minimise drag and

[151] Miah 2004, p. 36.
[152] Ibid.
[153] Hoberman 1992, p. 104.
[154] Sigman 2008, p. 133.
[155] Lin and Allhoff, pp. 252-4.
[156] Steiner 2011, p. 69.
[157] See generally Simon Mundie and Jonathan Jurejko, State of Sport: FIFA's Former Doctor says Painkiller use Risks Footballers' Health, 23 March 2017, https://www.bbc.co.uk/sport/39333763 (Accessed 13 December 2018).

improve buoyancy in the water?[158] Miah contends that sport *per se* might be described as 'artificial or technological',[159] so even on the basis of this tenuous natural-artificial distinction we might plausibly argue that genetic enhancement is not so 'unnatural' after all. Indeed, and as demonstrated in Chapter 4.1, the notion of 'naturalness' is really an ever-evolving social construct. With this in mind, two final comments on the natural-artificial distinction are made here.

Firstly, whilst Murray has recently argued that the idea of naturalness 'eludes simple, once-and-for-all definition',[160] he also acknowledges, in line with the views of Kaebnick,[161] that many other legal and philosophical concepts exhibit a similar 'definitional fuzziness'.[162] This has not, however, prevented them from being of some practical use. For example, the US Department of Agriculture has still produced what he terms a 'useful' list of what foods should not contain if they wish to avoid the somewhat nebulous label of "organic food".[163] In a similar vein, it is also contended that sport may be able to accommodate genetic modification, despite the fact that there is no clear and pristine definitional clarity in relation to 'naturalness'. The second point is made by the President's Council on Bioethics who conclude that, even if gene doping can be said to loosely resemble the use of technological equipment or adherence to a special diet, this 'does not by itself dissolve all our moral concerns.'[164] Before turning to such concerns, it is important to briefly consider one final

[158] Stefani 2012, p. 14 (noting that the suit has '15% less drag than conventional swimwear fabric'); Foster et al. 2012, p. 717.
[159] Miah 2004, p. 98.
[160] Murray 2018, p. 166. See also, at p. 56, where he states that 'the line between "natural" and "unnatural" can be tough to see at times'.
[161] Kaebnick 2013.
[162] Murray 2018, p. 166. He uses concepts such as 'organic', 'rational', 'voluntary' and 'person' to illustrate his point.
[163] Ibid, p. 167.
[164] President's Council on Bioethics, Beyond Therapy: Biotechnology and the Pursuit of Happiness, October 2003,

practical issue arising from the continued proscription of gene doping: the sanctioning of athletes.

3.2 Sanctioning Issues

The difficulties inherent in punishing athletes for gene doping can be demonstrated in two illustrative scenarios. The first is where an athlete knowingly, or negligently, somatically modifies himself at some point during his sporting career. Because there is currently no scientifically proven way to reverse or undo the genetic enhancement,[165] the standard four-year period of ineligibility now imposed for doping under Article 10.2 WADC may need to be replaced by a life-time ban for this form of modification. In effect, this would deny an athlete a second chance to come clean.[166] However, if the genetically doped athlete was allowed to return to competition in the future, it would, to quote the CAS panel in *Quigley*,[167] create an 'intentional unfairness to the whole body of other competitors' as they would be required to compete against a still-modified individual. Although some might see a life ban as a fair and proportional punishment, we should remember that it would probably be imposed against the backdrop of a rather unreliable and fragile detection procedure, as highlighted in Chapter 2.3. Consequently, if WADA insist on an outright ban for gene doping, they should expect to receive a high number of legal challenges – possibly on the basis of restraint of trade - from athletes who are contesting this somewhat draconian punishment.

https://biotech.law.lsu.edu/research/pbc/reports/beyondtherapy/beyond_therapy_final_report_pcbe.pdf, p. 122 (Accessed 27 October 2018).

[165] Steiner 2011, p. 71. However, c/f Siprashvili and Khavari 2004, pp. 97-8.

[166] Custer 2007, p. 208.

[167] Quigley (See n66), para 15.

An even more troubling scenario is where an athlete is genetically modified without knowing the full implications, or even the existence, of the procedure. This is likely to arise in situations where the genetic therapy is administered at a very early age (such as in the *Weightlifter* example) or where the individual is born with genetically enhanced traits through germ-line enhancement. In such cases, a life ban would truly be stretching the permissibility of the strict liability standard in anti-doping, particularly as Flint argues that a failure to 'take account of the relative culpability of the individual… risks compromising basic fairness and respect' for their rights.[168] WADA boldly declares that the WADC is compatible with the principles of proportionality and human rights,[169] but the extent to which this would remain true should an athlete such as *Weightlifter* be heavily sanctioned for genetic enhancement is highly questionable. As Miah concludes, an absolute ban in such cases would potentially conflict with Article 2 of UNESCO's "Universal Declaration on the Human Genome and Human Rights" which states that '[e]veryone has a right to respect for their dignity and for their rights regardless of their genetic characteristics.'[170]

Nevertheless, due to the gradual softening – or 'diluting' - of the strict liability standard over the years,[171] it could be argued that the current WADC is able to deal with such a scenario effectively. The relevant provision here is Article 10.4 WADC which highlights that a ban can be quashed if an athlete can demonstrate that he bore 'No Fault or Negligence' for the ADRV.[172] At first glance, and despite the 'very strict' nature of this test,[173] it appears that

[168] Flint 2008, pp. 835-6.
[169] WADA (See n83) 11.
[170] Miah 2004, p. 166.
[171] Anderson 2010, pp. 126-7.
[172] Demonstrating that one bore 'No *Significant* Fault or Negligence' for their genetic modification under Article 10.5 WADC is also another possibility, but it is perhaps a less attractive one for athletes because, unlike under Article 10.4, it does not necessarily lead to an automatic elimination of the period of ineligibility. In sum, the *degree* of fault is assessed under Article 10.5.
[173] CAS 2006/A/1025, Puerta v ITF, para 11.4.1.

an athlete who was modified in early childhood or even prenatally could easily satisfy this requirement. This assertion is perhaps supported by *ITF v Gasquet* where the athlete in question was able to successfully rely on Article 10.4 after it was found that the traces of cocaine in his system resulted from kissing a female in a nightclub.[174] If the defence can operate in this scenario, surely it can also operate when the athlete is too young to possess the mental capacity to fully understand the nature of the genetic therapy,[175] and where the enhancement can fairly be attributed to the fault of the parents (or perhaps even to society).

One potential hindrance to this line of reasoning is found in the WADC's Commentary to Article 10.4 where it is stated that No Fault or Negligence does not apply where a family member or coach sabotages the athlete's food or drink.[176] Could it therefore be argued that a parent's genetic enhancement of their child is simply an extension of this 'spiking' provision, thus barring the genetically doped athlete from the protection afforded by this defence? It is submitted that the answer is no. In short, the determining factor is one of control/responsibility. In the case of an associate who spikes their food or drink, the athlete has some degree of control over, and responsibility for, those who have access to their meals and beverages.[177] As McArdle highlights, sabotage by an individual within the athlete's circle of associates will not suffice because 'athletes are *responsible* for those to whom they allow access to their food and drink.'[178]

[174] CAS 2009/A/1296, ITF v Gasquet.
[175] See also the more recent example of The Football Association v Livermore, 8 September 2015, where a footballer was able to avoid a ban after he successfully attributed his ingestion of cocaine to a recent family bereavement.
[176] WADA (See n83) 63.
[177] The refusal to allow Article 10.4 to operate in such scenarios is to cater for those situations where an associate agrees to 'take the fall' for an athlete by claiming to have spiked their food or drink. See CAS 2002/A/432, D v FINA, para 9.3.11. For a more recent application which neatly highlights the strictness of this test, see CAS OG 16/25, WADA v Narsingh Yadav & NADA.
[178] McArdle 2015, p. 300 [emphasis added].

In contrast, an athlete who has been genetically modified as a child has no control or responsibility whatsoever over their ingestion of a particular prohibited substance. To suggest otherwise would be to foist an 'unrealistic and impractical' expectation on such athletes.[179] In fact, genetic modification at an early age is more akin to cases such as *Vassilev v FIBT & BBTF*[180] and *Pobyedonostsev v IIHF*[181] where, in both instances, Article 10.4 operated to provide a defence to the injection of a prohibited substance when the athletes required immediate emergency treatment. In such cases, the individual is 'unable to influence or control the treatment applied to him' in any way.[182] Consequently, on the basis of previous authority at least, it seems likely that WADA could not justifiably sanction athletes modified in this manner.

This raises an interesting issue. If the ban on gene doping cannot be practically enforced in this scenario, then it may be somewhat futile to continue to uphold its prohibition, because many athletes would likely be able to show, on the balance of probability,[183] that their genetic modification took place early in their life when they had no control over its administration. Therefore, it would probably be wiser to legalise genetic enhancement and find some way to accommodate it in sport, a suggestion that is explored later.[184] In this light, it is also contended that if WADA wish to impose sanctions on genetic modification, they should instead direct their attention to the *suppliers* of the genetic technology.[185] This would suppose both greater involvement of public authorities and state intervention measures.[186]

[179] See CAS 2005/C/976 & 986, FIFA & WADA, Advisory Opinion, para 73.
[180] CAS 2006/A/1041, Vassilev v FIBT & BBTF.
[181] CAS 2005/A/990, Pobyedonostsev v IIHF. For commentary on this case see David 2017, pp. 390-1.
[182] Ibid, para 36.
[183] WADA (See n83), Article 3.1.
[184] See Chapter 4.2.
[185] This is also a solution proposed by Anderson 2016, pp. 265-6.
[186] See text to n266. Given that WADA is a private foundation with no authority to target companies and individuals who have not submitted to sports regulations, such co-operation would be key.

The criminalisation of the supply of drugs was recently and emphatically proposed by the DCMS Committee in early-2018,[187] and it is maintained that even if WADA do eventually permit the safe use of genetic enhancement in sport, they should still heed this advice in order to demonstrate that the safety of athletes is their number one priority. Indeed, as Noakes outlines, most suppliers of these potentially dangerous substances 'appear to be indifferent to the misuse of their products by athletes for non-medical purposes.'[188]

4 A Social and Ethical Examination of Gene Doping

4.1 Society, Genetics and Sport

Having highlighted the numerous difficulties stemming from the continued proscription of genetic enhancement, we now turn to an examination of the potential social and ethical problems associated with the reverse side of the argument – that is, the legalisation of gene doping. Gardiner hypothesises that this new form of modification will present 'immense ethical dilemmas in the sports world',[189] and it is submitted that such dilemmas can be categorised into four overarching objections; the *aesthetic argument*; the *humanity argument*; the *semantic argument*; and the *unfairness argument*.

[187] Digital, Culture, Media and Sport Committee, Combatting Doping in Sport: Fourth Report of Session 2017-19, 5 March 2018, https://publications.parliament.uk/pa/cm201719/cmselect/cmcumeds/366/366.pdf, pp. 42-3 (Accessed 6 November 2018).

[188] Noakes 2006, p. 289.
[189] Gardiner et al. 2012, p. 68.

The *aesthetic argument* is, as its name suggests, based on the superficiality of sport and the concern that genetically altering an athlete could somehow subvert or destroy the idealistic notion that sport has assumed 'centre stage in the pantheon of fashion.'[190] Quinn articulates that sex appeal is now an important aspect of professional sport,[191] and this probably helps to explain why sport's stakeholders have generally been more accepting of technological innovations such as the aforementioned Fastskin swimsuit; as Craik notes, this tight-fitting suit helps to accentuate muscles and genitalia whilst also resembling S&M gear.[192] In contrast, genetic modification seems to evoke a fearful, rather than erotic, response as to what future athletes could potentially look like. For example, the cover of Miah's seminal publication on the topic, *Genetically Modified Athletes*, features a self-proclaimed disturbing 'Cheetah Man',[193] and we also see references in the surrounding literature to the possibility of so-called 'Bio-Amazon' women who could be genetically altered to enhance their strength.[194] The latter arguably generates 'fears of the monstrous feminine',[195] and this is likely to be incompatible with the aesthetically demanding nature of modern professional sport. However, it is suggested that, through proper education, this objection can easily be overcome. Instead of creating moral panics in the media through the use of such vivid and sensationalistic imagery as the 'Cheetah Man',[196] society should be informed that genetically modified athletes will probably be aesthetically indistinguishable from unmodified

[190] Craik 2011, p. 73.
[191] Quinn 2002, p. 186.
[192] Craik 2011, p. 72.
[193] Miah 2004, p. xviii.
[194] Sherwin and Schwartz 2005; Chadwick and Wilson 2005.
[195] Magdalinski and Brooks 2002.
[196] See, for example, Miah 2004, pp. 53-4 (stating that media attention surrounding gene doping has been 'sensationalistic and has sought to ground hysteria about the possibility for creating superhumans in sport').

athletes.[197] In this regard, one might also suggest that genetically enhanced sports stars could actually be viewed as no more superhuman than the athletes we currently admire today; being able to run 100 metres in 9.58 seconds like sprinter Usain Bolt is, to most of us, a distant and other-worldly fantasy. Consequently, there is no reason in principle why gene doped athletes cannot still be the subject of public admiration and a role model for millions.

Perhaps, however, the issue is much deeper than aesthetics. Perhaps the real ethical objection to genetic modification is instead rooted in the related *humanity argument* which suggests that tampering with one's genes is akin to "Playing God".[198] As Sandel outlines, the fundamental danger of genetic engineering is not that it undermines effort, but rather that it embodies a 'Promethean aspiration to remake nature, including human nature'.[199] In essence, the argument is that even if 'Cheetah Man' is not aesthetically any different from his competitors, he is 'less obviously himself and less obviously human than his unaltered counterpart.'[200] It is suggested that these concerns about the de-humanisation of sport and the possible erosion of human identity associated with genetic manipulation is a direct result of the fear (and, in some respects, awe) that currently surrounds genetics. In short, the special nature of our DNA militates against the acceptability of altering ourselves for the purposes of enhancement.[201] Although one might reject this assertion on the basis that genetic technology is still a relatively unknown phenomenon to the public and has therefore not yet

[197] Andy Miah, Genetically Modified Athletes in Athens? Bring Them On, 1 August 2004, https://www.theguardian.com/sport/2004/aug/01/athletics.athensolympics20042 (Accessed 29 October 2018).
[198] Tamburrini and Tannsjo 2005, p. 1.
[199] Sandel 2007, p. 26.
[200] President's Council on Bioethics (See n164), p. 142.
[201] See, for example, Nuffield Council on Bioethics, The Ethics of Patenting DNA, July 2002, http://nuffieldbioethics.org/wp-content/uploads/2014/07/The-ethics-of-patenting-DNA-a-discussion-paper.pdf, paras 3.3 - 3.7 (Accessed 16 August 2018).

acquired a social stigma,[202] this argument fails to recognise the deep-seated demonization of genetics that we might already identify in society. For instance, most works of popular culture dealing with genetic modification – such as *Frankenstein*, *The Fly* and *Jurassic Park* – seem to depict the technology in a wholly negative light. Moreover, the implicit societal suggestion that genes are somehow harmful or too precious to be tampered with is also symbolised and inculcated by the fact that genetically modified foods must be labelled as such.[203] Lopez has recently argued that the cultural bedrock of current anti-doping policy is perhaps premised on needle-phobia rather than scientific analysis,[204] and it is suggested here that a similar and equally corrosive *gene*-phobia could lie at the core of the *humanity argument*. For such reasons, one might argue that permitting genetic modification is not a viable option because it is simply not a socially acceptable practice.

However, bearing in mind that much of the preceding discussion contains largely speculative assumptions based on how society *might* feel, the *humanity argument* perhaps requires some form of substantiation before it can be accepted as a valid objection to the legalisation of gene doping. Surprisingly, the author has found only one public opinion survey on society's attitude towards genetic enhancement in sport.[205] This study came to an interesting conclusion: the majority of respondents may not be averse to genetically modified athletes provided that the procedure was reasonably safe.[206] This is illustrated in the further

[202] See Schneider 2005, p. 36 (arguing that 'the way in which the public will treat gene transfer technology if and when it becomes readily available is unknown').
[203] Food Standards Agency, Genetically Modified Foods, 9 January 2018, https://www.food.gov.uk/safety-hygiene/genetically-modified-foods (Accessed 10 November 2018); Rebecca Smithers, Two Thirds of British Consumers Say GM Food Labelling is Important, 9 January 2013, https://www.theguardian.com/environment/2013/jan/09/consumers-gm-food-labelling (Accessed 10 November 2018).
[204] Lopez 2017.
[205] Polcz and Lewis 2018. For an interesting survey of professional athletes' opinions on the topic see Dierickx et al. 2012.
[206] Polcz and Lewis 2018, pp. 5, 39-40.

findings that 79% of subjects were indifferent as to how an athlete came to possess a favourable gene, whilst only 18% supported an outright ban on genetic modification in sport.[207] Although these initial results provide a promising riposte to the *humanity argument*, it should be remembered that they are only scratching the tip of the iceberg. Indeed, Polcz and Lewis' study was answered by only 1000 individuals, all of whom were US-based.[208] It would be interesting to obtain viewpoints from a wider class of people - particularly those from other cultures who have experience of state-sponsored doping systems in their countries[209] - to help attain a more rounded response. After all, sport is a global phenomenon. Consequently, it is maintained that WADA should initiate their own set of public opinion surveys on a much larger scale to help further consolidate their knowledge of society's attitudes towards gene doping. Because '[a]pplications in genetics are not finite',[210] such surveys would likely need to be produced biennially or even annually.

This recommendation is important for two reasons. Firstly, and to return to the aforementioned symbiotic relationship between sport and society,[211] we should remember that genetic enhancement is not solely a sporting issue. Given that the topic raises such fundamental concerns for humanity in other aspects of life, sport would probably be overstepping its authority to claim complete control over the matter.[212] Consequently, any prudent response from WADA should have carefully and consciously considered society's viewpoint on the issue. Secondly, reliance on public opinion could also be used to support Posner's hypothesis that consumer preference should be at the centre of the debate on the

[207] Ibid, pp. 25-6.
[208] Ibid, p. 32.
[209] The citizens of East Germany, China and Russia, for example, may all have radically different views on the potential legalisation of gene doping in their respective countries.
[210] Miah 2004, p. 177.
[211] See text to n137.
[212] See generally Breivik 2005, p. 175.

prohibition of doping; in sum, the 'solution can largely be left to the free market'.[213] Due to the increasing professionalization and commercialisation of sport since the late-1970s,[214] sport has gradually morphed into a fan-driven enterprise that is just as concerned, if not *more* concerned, with financial gain as it is with the Corinthian values that initially underpinned its existence. The argument here then is that if surveys can demonstrate that fans are still willing to watch (and pay for!) sporting events where genetically modified athletes are competing, this can only strengthen the assertion that we should remove the ban on gene doping. Sport's stakeholders are arguably more likely to acquiesce and accept genetic enhancement in sport if they believe that their monetary profits will not be unduly affected.

The final social-based issue is the aptly titled *semantic argument* which relates to the negative connotations associated with the term 'doping'. As Dimeo and Moller explain, there is a 'profound stigma associated with doping',[215] a point that is perhaps highlighted by Ben Johnson's inability to recover both his reputation and career after his infamous positive test for stanozolol during the 1988 Olympics.[216] It is interesting then that WADA has seemingly already condemned genetic enhancement in sport by pre-emptively labelling it as a form of 'doping'.[217] In this light, WADA might fairly be accused of working backwards in order to justify its prohibition on 'gene doping', as it appears to be attempting (through its condemnatory use of the term 'doping') to dictate what the public *ought* to feel about this particular form of enhancement without first engaging in any extensive ethical discussions.

Furthermore, and to borrow from the criminal law context, it is also suggested that this unfounded prejudicial attitude towards genetics could be violating what Ashworth terms

[213] Posner 2008, p. 1734.
[214] See Griffith-Jones 1997, p. vii.
[215] Dimeo and Moller 2018, p. 24.
[216] Ibid, pp. 29-33.
[217] Custer 2007, p. 197.

the 'fair labelling' principle.[218] This concept seeks to ensure that offences are labelled 'so as to represent fairly the nature and magnitude' of the wrongdoing.[219] However, as Miah concludes, '[a]ll kinds of genetic modification are being given the generic term *gene doping*'.[220] Therefore, one modest, but still significant, proposal may be to reword the term 'gene doping' on the Prohibited List to something more nuanced and less judgmental – 'genetic alteration' or 'genetic modification' would perhaps suffice. The positive effect that this could have on society's tolerance towards the practice is starkly illustrated in Polcz and Lewis' public opinion survey where it was discovered that whilst only 17% of respondents were in favour of legalising drugs when the process was referred to as "doping", a considerable 56% were in agreement that an athlete should be able to enhance himself when the specified drug was classed as a "biomolecule".[221] WADA should therefore be cognisant of the need to make careful linguistic choices when creating policy on genetic enhancement in sport.

4.2 Unfairness

The final ethical dilemma associated with the legalisation of gene doping is the so-called *unfairness argument*, and it is premised on WADA's high-minded assumption that banning genetic enhancement is necessary to maintain a 'level playing field' in sport because it enables athletes to 'concentrate on the pursuit of athletic excellence through their natural talent –

[218] Ashworth 2013, p. 77.
[219] Ibid.
[220] Miah 2004, p. 171.
[221] Polcz and Lewis 2018, p. 33. Interestingly, 29% were in favour of legalisation when the substance was simply referred to as a "drug".

"playing true"'.[222] As Smith and Stewart recognise, the idea here is that, in order to uphold fairness and ensure an 'equal chance of success for all competitors', every athlete must compete from the same (unenhanced) starting point without the aid of drugs.[223] Only then can the "true" winner be revealed. However, whilst this argument may be *prima facie* attractive, it ultimately fails to stand up to scrutiny when we consider that the random and serendipitous nature of the genetic lottery means that sport is already operating on the basis of an unfair playing field.

Perhaps the most celebrated example of this unfairness is the widely successful Finnish cross-country skier Eero Maentyranta who was found to naturally possess a rare genetic mutation called erythrocytosis which enabled his body to deliver 50% more oxygen to his muscles than his competitors.[224] More recent examples of other biological inequalities include swimmer Michael Phelps (whose ultra-flexible size 14 feet have been comically referred to as 'virtual flippers'),[225] basketball legend Shaquille O'Neal (whose unusually tall physique gave him a 'competitive edge' over opponents),[226] and the now-disgraced American cyclist Lance Armstrong (who reportedly possessed a heart 30% larger than the average male's).[227] In this light, Savulescu queries how fair it is for most people to have to compete against what he caustically terms the 'genetic elite (or freak)'.[228] As Simon authoritatively concludes, 'pre-competitive inequalities that [are]… beyond the athlete's control are

[222] World Anti-Doping Agency, Athletes, https://www.wada-ama.org/en/athletes (Accessed 13 September 2018); Catlin and Murray 1996, p. 237 (stating that a ban on PEDs is necessary to ensure that 'all athletes compete on a level playing field').
[223] Smith and Stewart 2008, p. 124.
[224] Petersen and Kristensen 2009, p. 97.
[225] Adam Hadhazy, What Makes Michael Phelps So Good?, 18 August 2008, https://www.scientificamerican.com/article/what-makes-michael-phelps-so-good1/ (Accessed 24 October 2018).
[226] Dabholkar 2013, p. 58.
[227] Matt Seaton, What is Lance Armstrong's Secret?, 28 July 2005, https://www.theguardian.com/science/2005/jul/28/thisweeksscience questions3 (Accessed 20 October 2018).
[228] Savulescu et al. 2004, p. 667.

presumptively unfair'.[229] Consequently, if sport does 'discriminate against the genetically unfit',[230] allowing - and regulating to a safe level - the genetic enhancement of athletes may actually help to level the playing field, because it would seem to balance out the poor deal that some people undeservedly received from the natural lottery. Therefore, and with the interrelated doctrines of distributive justice and egalitarianism in mind, we might say that permitting gene doping is the best way to ensure equality and fairness in sport because it vastly minimises the role of luck.

This proposition is not, however, without opposition. Some commentators have suggested that permitting genetic modification may actually undermine the fundamental purpose of sport because it might somehow cheapen the value of sporting achievement.[231] If post-human sportsmen could not viably further perfect their athletic abilities, there would arguably be 'no value in they [*sic*] engaging in sports' because it 'renders the challenge raised by the game as meaningless'.[232] In contrast to Savulescu, Juengst argues that the *raison d'être* of sport is to identify and separate the so-called genetic "freaks" from their less-advantaged competitors.[233] So, the argument goes, the intrinsic purpose of sport would be severely compromised if our interference with the genetic lottery meant that it was the athlete with the best pharmaceutical company – rather than the athlete with the best natural ability – that eventually won.

Does this argument hold force in rejecting the legalisation of genetic doping? I believe not. This outlook takes a very limited view of what it means to be athletically successful. Put simply, embracing genetic alteration in sport would not diminish achievement or undermine

[229] Simon 2016, p. 103.
[230] Savulescu et al. 2004, p. 667.
[231] Juengst 2009, p. 197; Simon 2016, pp. 126-9.
[232] Frias 2016, p. 107.
[233] Juengst 2009, pp. 198-9.

any core values of sport because it takes more than just a favourable genome to win. Victorious athletes often exhibit a multitude of other admirable traits such as hard work, a strong mentality, tactical nous, and an ability to perform under pressure. As one anonymous athlete expounded in a recent opinion survey on the prospect of genetic testing in sport: '[g]enetics play a big part, but nothing substitutes hard work'.[234] Consequently, if WADA decide to allow genetic enhancement in sport, Tannsjo contends that our current 'fascistoid' admiration for the natural talents of athletes will be replaced with a less contemptuous and more equitable admiration for the athlete's aforementioned psychological characteristics (which they can presumably exercise more control over).[235] In this, he maintains that because we have no influence over our 'natural endowments',[236] shifting our recognition for sporting success to the traits listed above (hard work etc.) would transform sport into a fairer enterprise because it would mean that victory and desert would seemingly be more aligned than it presently is.[237] As Murray outlines, 'no-one "deserves" or "earns" their raw talents, so those abilities aren't morally admirable in the same way that dedication and courage are'.[238] Consequently, a competition that embraced the safe use of genetic modification would arguably be more meritocratic as it would test the moral virtues and mental character of athletes instead of the unearned physical advantages obtained from ethically arbitrary accidents of birth.

A number of further concerns are noted here. The first is more one of clarification and relates to the residual need to determine to what extent some mental traits themselves may

[234] Varley et al. 2018, p. 16.
[235] Tannsjo 2005.
[236] Ibid, p. 68; van Hilvoorde 2005, pp. 98-9 (stating that 'admiration of athletes will… be concentrated on the sacrifices endured to actualize their genetic predisposition').
[237] See generally Tamburrini 2007.
[238] Murray 2018, p. 16.

be influenced by genetics.[239] For example, whilst Murray outlines that there is 'no gene for dedication', he also suggests that it is not a 'crazy idea to assume that some genetic bases may be found that correlate… with those character traits.'[240] If scientific evidence discovered, for instance, that pain tolerance had a genetic basis,[241] some athletes might find it naturally easier to exhibit sacrifice and work harder than others, and sporting success would seemingly thus still be predicated on the basis of the natural lottery.[242] Therefore, Murray is perhaps accurate to state that the 'capacity for effort, itself, may be affected by morally unearned differences'.[243]

The second issue harks back to the earlier discussion surrounding how different sports may be impacted by the prominence of genetic modification.[244] The point here is that if tactical intelligence is one of the traits elevated above raw physical talent, sports that constitute more teamplay and tactical elements (such as soccer and American football) may be less affected by transferring our admiration from an athlete's natural physical ability to their mental characteristics; after all, science has yet to discover a gene for teamwork or ball control.[245] On the other hand, those sports that rely more on explosive power and basic bio-motor abilities at the expense of tactics (such as sprinting) might find that the *unfairness argument* is a more attractive objection to legalising gene doping.[246] A final concern that one

[239] For further insight into this issue see Sarah Knapton, Intelligence Genes Discovered by Scientists, 21 December 2015, https://www.telegraph.co.uk/news/science/science-news/12061787/Intelligence-genes-discovered-by-scientists.html (Accessed 3 December 2018); Bouchard 2004.
[240] Murray 2009b, p. 230.
[241] American Academy of Neurology, Low Tolerance for Pain? The Reason May Be in Your Genes, 20 April 2014, https://www.aan.com/PressRoom/Home/PressRelease/1269 (Accessed 30 November 2018).
[242] On this point, see also the related discussion surrounding the existence of so-called 'brain doping' amongst athletes, a technique that uses electrical stimulation to help make it easier to learn new sporting skills and reduce fatigue. If this were possible, it would mean that even admired personality traits could be modified independently from the question of genetics. See Reardon 2016.
[243] Murray 2009b, p. 228; Murray 2018, p. 22 (discussing the role that 'life experiences' may have on an athlete's ability to persevere through hardship).
[244] See text to n22.
[245] Allison 2005, p. 153.
[246] Loland 2005 skilfully outlines this distinction in his so-called 'vulnerability thesis'.

might have in relation to our current discussion on the ethics of genetic enhancement in sport is that the debate is premised largely on speculative and unproven assumptions. For example, whilst Tamburrini assumes that genetic technology will help to 'reduce gaps in skills and inherited traits between individuals',[247] van Hilvoorde replies that 'genetic modification may just as well accentuate some of the inequalities.'[248] Neither argument is technically incorrect – it is simply the abstract and speculative nature of the issue that makes it difficult to arrive at any firm moral conclusion.

Nevertheless, van Hilvoorde might still be on to something here. An additional (yet unavoidably conjectural) strand to the *unfairness argument* is that, due to the high costs of genetic technology, permitting genetic enhancement might further increase the inequality gap between the rich and the poor. Indeed, Carr notes that one aspect of the fairness principle is that we must share benefits and burdens equally,[249] but if Greif and Merz are correct in their estimation that IVF - the forerunner to many kinds of genetic modification - could cost up to $58,000,[250] we might question how the benefits of genetic enhancement could be evenly shared here. It seems likely that only the richest of athletes from the wealthiest of countries could afford this technology. As Larry Bowers, the former Chief Science Officer at USADA, argued in relation to the morally dubious hypoxic tents: 'not everyone has access to them, [so] they are unethical.'[251] Consequently, and in light of Cooper's prognostication that the safe use of genetic therapy would need to be supplemented by numerous 'million pound

[247] Tamburrini 2007, p. 261.
[248] van Hilvoorde 2005, p. 96.
[249] Carr 2000, p. 2.
[250] Greif and Merz 2007, p. 87; Mehlman 2009, p. 212.
[251] Miah 2004, p. 36.

clinical trials',[252] one might argue that the legalisation of gene doping could constitute an anti-competitive practice.

However, whilst the issue of access to genetic treatment is undoubtedly a legitimate concern, it is suggested that it may be somewhat overstated for two reasons. Firstly, inequality and unfairness in relation to the access of certain opportunities is already prevalent in sport. Those born in more affluent locations have a much greater chance to attain sporting success in a wider range of disciplines because their options are vastly increased. In sum, '[c]limate and geography shape opportunities.'[253] For example, there is little doubt that a talented F1 driver is more likely to succeed if he is born in England than if he is born in a war-torn country such as Syria. Furthermore, many (elite) athletes in wealthier countries are also able to afford the most effective high-tech equipment, such as the AlterG anti-gravity treadmill which is designed to aid faster recovery from injury and is reported to have a market value of $75,000.[254] In contrast, developing countries often have to make do with 'crude and/or improvised equipment'; as Onywera highlights, electronic timing is still a fantasy to most Kenyan athletes.[255] Consequently, if sport is seemingly already willing to tolerate these current inequalities acquired from the good fortune of one's environmental upbringing, is it really that much of a stretch to embrace the safe use of genetic technology for those that can afford it? Possibly. Perhaps the key is to assess *how far* the gap would be widened by permitting gene doping, but this seems a largely impractical response given the currently speculative nature of the debate.

[252] Cooper 2012, p. 220.
[253] Murray 2018, p. 75.
[254] Bacalao-Fleury 2011, p. 207.
[255] Onywera 2009, p. 106.

The second objection to this strand of the *unfairness argument* is based on the proposed solution for accommodating genetically modified athletes in sport. It is submitted that, if gene doping is to be legalised, athletes should be subsequently separated into different biological classes based on their genetic capabilities. Fore perhaps describes this idea best when he pithily states that WADA would need to 'shift away from concerns about what is in the body or how it got there', and instead focus on 'how much is present'.[256] Not only would this help to ensure the safety of athletes,[257] it would also help to finally level the playing field in sport, because it would not matter whether an athlete was born with a natural genetic mutation or whether an athlete from a richer country could afford more effective gene therapy - the only thing that would matter is the athlete's current genetic constitution, and they would be accordingly grouped with other athletes who had a similar level of genetic ability.

This suggestion is not quite as ludicrous as it first sounds. As demonstrated by the recent proceedings involving Caster Semenya, the major stakeholders in sport already seem prepared to use underlying biological traits to define and propagate fairer classifications. In this case, which concerned female hyperandrogenism, the IAAF recently defended its measures to place limits on the testosterone levels of women by stating that they were necessary to ensure that everyone in the female category would be competing 'on an even playing field'.[258] Moreover, we already have weight classes in sports such as boxing, rowing and judo, so it would not be wholly preposterous to suggest that a sort of 'genetic weigh-in'

[256] Fore 2010, p. 93.
[257] Athletes who exhibit levels of gene expression that are above what could be considered 'safe' should be prevented from competing.
[258] International Association of Athletics Federations, IAAF Response to Open Letter from the Women's Sports Foundation and Athlete Ally, 17 July 2018, https://www.iaaf.org/news/press-release/iaaf-response-to-womens-sports-foundation-and (Accessed 17 August 2018).

could be used in the future to accommodate genetic enhancement in sport. In preparation for this wholesale restructuring of sport, we might want to think about how a class-based system premised on the genetic characteristics of athletes could be gradually introduced into other sports in the immediate term to ensure a more even playing field. For example, could we introduce different height classes in basketball to allow shorter athletes to demonstrate their innate skills for the game? Or perhaps we could institute different classes in baseball based on the quality of the participants' vision? Implementing such suggestions now would arguably make the transition much smoother if - or perhaps when - the major players in sport begin to seriously discuss how genetically modified athletes are to be accommodated in sport.

Nevertheless, it is conceded that this solution is not a complete panacea; there are a number of lingering problems which suggest that this idea is ripe for further research. Firstly, even if we could somehow gather reliable test results for every athlete, on what genetic basis should some athletes be grouped? Soccer, for instance, relies on a diversity of different talents and physiques, and it would seem somewhat impractical to reduce this complex game down to a simple segregation of competitors based on (for example) endurance, speed or ball control. To do so would arguably destroy the essence of the 'beautiful game'. Other team sports that bring together a variety of different attributes might also fall prey to this issue.[259] Moreover, and as recently highlighted by Murray, attempting to neutralize the impact of natural genetic talents in this manner could lead to absurdities.[260] If we accept that intelligence is a factor in sporting success (think of the savvy soccer goalkeeper who is able to study and remember the penalty techniques of a multitude of players), must we also test for

[259] See Murray 2018, p. 14 (noting that in American football 'wide receivers can weigh half as much as offensive linemen, but they need to be fast, elusive, have great hands and the courage to catch a pass knowing they're likely to get hit').
[260] Ibid, p. 30.

that aswell so we can group athletes according to their natural intellect?[261] Consequently, and given the current difficulties we might identify in the knotty discussion regarding the proper classification of Paralympic athletes,[262] one could be forgiven for thinking that the pursuit to accurately and holistically measure the ability of every athlete (and to categorise them accordingly) is a futile one at best.

A second interrelated objection is that a 'genetic weigh-in' might lead to what Murray terms 'reverse doping' in that athletes could try to 'disguise or diminish their natural talents' in order to compete in a less genetically-gifted class where their chances of victory (and, presumably, financial gain) are much higher.[263] Unsurprisingly, there have been allegations that this form of 'doping' is already occurring at the Paralympic level with some athletes attempting to 'misrepresent their true ability in an attempt to get a class advantage'.[264] This indicates that, even if WADA decided to allow gene doping, there is seemingly nothing to stop athletes looking to other sources and substances in an attempt to gain a surreptitious and unfair competitive edge over their rivals. As Anderson concludes, there will still be scope for cheating in sport because 'some athletes will continue to exploit any administrative, medical or legal loopholes'.[265] Finally, and as with many suggestions in the context of anti-doping, funding such a system is likely to be a significant stumbling block; who exactly is going to pay for the regular and thorough examinations of every single athlete to determine their relevant genetic class?

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[261] Ibid.
[262] The Economist, The Rio Paralympics were Successful, but the Disability Classifications are Not, 21 September 2016, https://www.economist.com/game-theory/2016/09/21/the-rio-paralympics-were-successful-but-the-disability-classifications-are-not (Accessed 29 November 2018); BBC, Is Para-Sport Classification Fit for Purpose?, 30 October 2017, https://www.bbc.co.uk/sport/disability-sport/41802313 (Accessed 29 November 2018); Murray 2018, pp. 61-6.
[263] Murray 2009b, pp. 227-8.
[264] Buckley 2008, p. 90.
[265] Anderson 2010, p. 167.

5 Recommendations and Conclusions

This final section proposes, in chronological order, a brief five-point list of recommendations that WADA could follow if they wish to be proactive, rather than reactive, in their response to the looming threat of genetic modification in sport:

1. The first is to ensure that the Prohibited List is conducive to scientific clarity. This entails not only redrafting the definition of gene doping to ensure that a clear difference between somatic and germ-line enhancement is made, but also rewording the term 'gene doping' itself to something more accurate and less judgmental. Genetic *alteration* or *modification* might suffice. By helping to remove this stigma (or gene-phobia) currently attached to gene doping, we may also find that the prevalence of unsubstantiated moral panics in the media – such as the Springstein/Repoxygen saga – is gradually diminished.
2. The second reform is for WADA, in cooperation with global law enforcement agencies and national governments,[266] to criminalise the illicit supply of genetic technology. Focusing on the traffickers of these substances seems to be a more effective course of action as it is the suppliers that are more likely to be deterred by heavy criminal sanctions. We should remember that a significant number of athletes are, quite

[266] As Anderson 2016, p. 266 concludes, this approach would be an integrated one 'favouring statutory "gateways" of cooperation between sports bodies and drug, law and custom enforcement agencies'.

literally, willing to 'die to win', so the deterrent effect of criminalisation is perhaps not as strong for those many athletes that possess this win-at-all-costs mentality.

3. At this juncture, sport may soon have to choose whether to allow genetic enhancement. However, before reaching a final decision, it is recommended that WADA wait and see whether, and perhaps more importantly *how*, genetic therapy is first used in the medical context. In this light, and because of the appreciable symbiotic relationship between sport and society, it is also recommended that WADA should give due weight to the public's opinion. Consequently, instead of basing their decision on intuitive moral preference about what they think society *ought* to feel about this nascent form of enhancement, WADA should conduct a substantial number of regular public opinion surveys to acquire a clearer picture of the issue.
4. If WADA decide not to allow gene doping, they should implement a worldwide biological passport program that seeks to establish baseline levels for every athlete during childhood or at birth. Much greater funding would be required here to ensure that test results were as accurate as possible. In conjunction with this, WADA should also consider using circumstantial evidence to detect gene doping, as well as re-evaluating the amount of protection currently afforded to whistleblowers.
5. Finally, if it is concluded that prohibition is no longer a feasible option (perhaps because of the difficulties in sanctioning genetically altered athletes), WADA-accredited doctors could regulate genetic modification up to a medically-defined safe level. This proposal - which would probably prevent athletes from seeking out dangerous underground laboratories - is reminiscent of the argument made by former IOC President Juan Antonio Samaranch when he stated, in 1998, that the health of

athletes should be the only concern when banning substances.[267] Not only would this drastically transform the role of WADA, it would also mean that sport would probably need to be restructured in order to accommodate these athletes. Therefore, it is suggested that competitors could be segregated into different biological classes whereby victory is dictated more by effort and dedication rather than by natural talent. However, whilst this could lead to a fairer playing field in sport, WADA may wish to instigate further discussions on the number of practical and structural concerns that might arise from this proposal.

It is perhaps instructive here to end where we began: with the Banbury Conference. In his introductory remarks at the conference, Dick Pound correctly stated that 'only a collective response can have any hope of success.'[268] By adopting an inter-disciplinary approach that ties together some of the medical, legal, sociological and ethical concerns associated with gene doping, it is hoped that this article has gone some way to at least sparking a more rigorous debate on what is undoubtedly one of the toughest challenges that anti-doping authorities have yet to face. Alas, the future of cheating in sport is upon us.

[267] Associated Press, Cycling: A Call for Doping Changes, 27 July 1998, https://www.nytimes.com/1998/07/27/sports/cycling-a-call-for-doping-changes.html (Accessed 1 December 2018).
[268] Schneider and Friedmann 2006, p. 69.

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