

## **International Perspectives**

### **A Holistic Anti-doping Approach for a Fairer Future for Sport**

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### **The Problem: Inefficiency of Anti-doping Process**

There is no doubt that sport, as a credible brand, is in crisis. The magnitude of the problem is well illustrated with a brief description of three lines of evidence in recent years that demonstrate, in the words of David Howman, former director general of the World Anti-Doping Agency (WADA), “*We are catching the dopey dopers, but not the sophisticated ones*”(6). The first line of evidence is the exposure of the cyclist Lance Armstrong as a drug cheat. The evidence now shows that the U.S. Postal Service Pro Cycling Team ran, what some consider, the most sophisticated, professionalized and successful doping program that sport has ever seen (11). Despite being tested about 275 times in his cycling career, Lance Armstrong never failed a doping test and was only exposed by the testimonies of some of his co-conspirators. A look at the prohibited methods and substances the cyclist admittedly abused include blood transfusion, erythropoietin (EPO), growth hormone, cortisol and testosterone, and testify to an anti-doping problem in terms of detection of these traditional doping methods and substances. It is important to point out that the Lance Armstrong case pre-dates many of the more positive recent anti-doping developments associated with the new World Anti-Doping Code (WADC) (14) such as improved intelligence and smarter testing (*e.g.*, Athlete Biological Passport (ABP)).

The second line of suggestive evidence is the appearance of systematic and state-colluded doping in Russia; the events of which have been summarized recently (7). Briefly, an ever increasing body of evidence is emerging that indicates that there may have been a systematic state-sponsored subversion of the drug testing processes by the Russian government during and subsequent to the 2014 Winter Games in Sochi. Furthermore, it is alleged that from 2011 to 2015, more than 1,000 Russian competitors in various sports (including summer, winter, and Paralympic sports) benefited from the state-colluded systematic doping. In the words of Richard McLaren, appointed by WADA to conduct the investigation, “*The Russian Olympic team corrupted the London Games 2012 on an unprecedented scale, the extent of which will probably never be fully established... The desire to win medals superseded their collective moral and ethical compass and Olympic values of fair play*” (12,13).

While some in the media wish to take credit for exposing the Russian doping scandal (*e.g.*, headline by the Sunday Times “*sport’s dirtiest secrets*”) (3), further evidence of systematic doping, and incidentally not confined only to Russia, was published by the medical commission of the international governing body for athletics, the International Association of Athletics Federations (IAAF) in 2011 (8). Specifically, information was obtained from the blood-testing program to detect altered hematological profiles in the world’s top-level athletes, which the IAAF has implemented since 2001. Estimates of the prevalence of blood doping ranged

from 1% to 48% for sub-populations of samples and a mean of 14% for the entire study population (8). Of particular interest, however, are the striking prevalence ranges of two countries (estimates obtained assuming doping with microdoses of EPO) – Country A: 54% to 99% and Country H: 21% to 87%. From the above three lines of evidence it is clear that the anti-doping process, despite an ever increasing restriction and control, is still producing sub-optimal results at best. There is, therefore, an urgent need to increase the quality and efficiency of the anti-doping process in order to rebrand and restore the credibility of sport.

### **A Potential Solution: A Holistic Anti-doping Approach**

It is clear that anti-doping today is nowhere near as effective as stakeholders in sport and the public at large desire, yet it makes little sense to start afresh, especially given recent signs of progress. What is needed is an evolution rather than a revolution, building on the successes of a fairly young agency (WADA was established in 1999) but with substantial modernization to reflect cultural, economic, and social changes. In line with this need for modernization is potentially the currently discussed new Independent Testing Authority (ITA) that is expected to be operational before the Pyeongchang Winter Olympics in 2018. The startup costs for the ITA are being met by the International Olympic Committee (IOC), while running costs are expected from money generated on a pay-as-you-go basis from testing for International Sports Federations (IFs) and major event organizers. However, it remains to be determined how many IFs will utilize the ITA's testing services should its use be non-mandatory.

This evolution of the anti-doping process requires “out of the box” thinking. For example, a solution that encompasses a holistic anti-doping approach comprising of at least three primary anti-doping pillars or 3Ps (see Figure 1) motivated by the need to prevent doping, protect the clean athlete, and promote performance without doping. The WADC (14), which came into effect in 2003, as well as the subsequent Code amendments, which came into effect in 2009 but especially in 2015 is a key development that underpins the first two 3Ps, prevent doping and protect the clean athlete. New features of the Code allow anti-doping authorities to test intelligently, retest smartly (*i.e.*, samples stored for 10 years), work collaboratively, and impose quick and greater sanctions. This modernization process also must support state-of-the-art research that aims to develop more effective next-generation anti-doping tests that may possibly have the capacity, in the near future, to allow anti-doping authorities to impose greater sanctions — up to lifetime bans where there is indisputable evidence of long-term benefits from doping (*e.g.*, muscle memory (14)). There has been significant investment from WADA and other sources (*e.g.*, the IOC) to develop the next generation anti-doping tests involving “omics” methods (*i.e.*, genomics, transcriptomics, metabolomics, and proteomics) with improved discriminatory power relative to current detection protocols. Recent studies from numerous

laboratories have confirmed the potential of transcriptomic microarrays, which can reveal distinct changes in gene expression after blood manipulations, to enhance the ABP (2). There is, therefore, a pressing need to intensify research efforts that involve such state-of-the-art technologies, in order to identify new and even more robust molecular signatures of doping that can be used in combination with the ABP or the steroidal module and, intriguingly, even as a stand-alone test. In the future, this approach could also significantly impact the anti-doping obligations of athletes such as the “athletes whereabouts.”

[Insert Figure 1 here]

Equally, this modernization process must embrace peak performance development of all forms that do not violate anti-doping rules and/or the rules of the sport; the third of the 3Ps, promote performance without doping. Modern day sport also is big business — no longer an amateur pastime for the privileged few but a vocation for thousands of athletes and their extensive entourage of physiologists, nutritionists, biomechanists, psychologists, and the like. A recent example of this third pillar is the Sub2 marathon project ([www.sub2hrs.com](http://www.sub2hrs.com)) (15). The Sub2 project is the first dedicated international research initiative made up of specialist multidisciplinary scientists from academia, elite athletes, and strategic industry partners with the aim to promote high performance marathon running without doping. As such, all athletes participating in the Sub2 project undergo regular doping controls (blood and urine). Tests are currently carried out, handled, and analyzed and the data interpreted in accordance with WADA’s Anti-Doping regulations. The Sub2 project is in the process of implementing its new WADA+ programme (15) that involves adding extra information/education, extra testing, and extra storage of samples. The unique experiences gained from this innovative anti-doping project are being used to strengthen anti-doping intelligence and on-going scientific research. While there are no guarantees the Sub2 marathon project will succeed in delivering a <2 hour marathon within 5 years, a number of legacy outcomes beyond the breaking of the two hour barrier are envisaged including the promotion of clean high performance marathon running, development of next generation anti-doping tests, personalized medicine/rehabilitation, individualized training, performance nutrition, customized racing footwear designs, and real time performance management systems with broader telemedicine implications. The success of this innovative anti-doping project, even at this early stage, is attracting the development of other <2 hour marathon teams from industry, such as the Nike Breaking2 project and the Adidas equivalent; although these projects do not have an anti-doping focus (10). A first attempt to run <2 hour marathon took place on May 6, 2017; a Kenyan distance runner ran the marathon distance (42.195 km) in 2:00:25 at the Monza race track, Italy. Although, Eliud Kipchoge’s time marks the fastest marathon ever run, his exceptional performance cannot be considered an official world record

(currently set at 2:02:57) because he benefited from “unfair” advantages (*e.g.*, car drafting and rotating pacemakers (1), no anti-doping control, and controversial running shoes passed as legal by the IAAF technical committee only days before the Breaking2 attempt despite the shoe allegedly making runners up to 4% more efficient (9)). This third pillar, peak performance without doping, will require sport itself to modernize by continuing to welcome technological advances, such as when tracks were upgraded from cinder to synthetic rubber, pole vault poles evolved from bamboo to fiberglass, shoes that began for cushioning to incorporate air bladders, gels, and now a carbon-fiber plate in the midsole, and the introduction of a rule (144.4(d) by the IAAF (4) allowing heart rate and speed distance or stride sensors or similar devices worn by athletes during an event, provided that any such device cannot be used to communicate with any other person. Such technological advances to improve athletic performance are historically considered to be ethical, and as such they are acclaimed and considered to be part of the lore of Athleticism. The problem of course is that a spectator from the outside does not know when a world record is being broken or how much of the record is due to the athlete or due to other factors. This is where science can help, in quantifying the effects of these different factors. Anti-doping science in particular is necessary to maximize the confidence that can be given to the public that a particular athletic feat is indeed performed without the aid of prohibited substances or methods.

### **Concluding remarks**

The high profile doping cases such as Lance Armstrong and Russia clearly demonstrate, albeit indirectly, the inadequacies of the anti-doping process. That is not to say that there has not been significant progress in the fight for clean sport since the very dark days for sport in the 1980s and 90s. The Russian scandal is rather unique, regressing sport back to the days of the likes of East Germany, and almost no amount of regulation could have easily prevented its occurrence; this unprecedented case provides a unique opportunity for vital lessons to be learned moving forward. There is, therefore, an urgent need for “out of the box” thinking to continue to make improvements in order to secure a fairer future for sport. A unique solution is proposed here that encompasses a holistic anti-doping approach comprising of at least three primary anti-doping pillars or 3Ps motivated by the need to prevent doping, protect the clean athlete, and promote performance without doping. This holistic anti-doping approach exemplifies a more modern and fit-for-purpose anti-doping philosophy, one that is evidence-based, acknowledges and celebrates diversity in natural athletic talent and training environments with differing access to sponsorship, support teams, and technology. In order to rebrand and restore the credibility of sport, it is essential that all must play by the same rules so that everyone has a chance to succeed — albeit not an equal chance. This is the true essence of sport.

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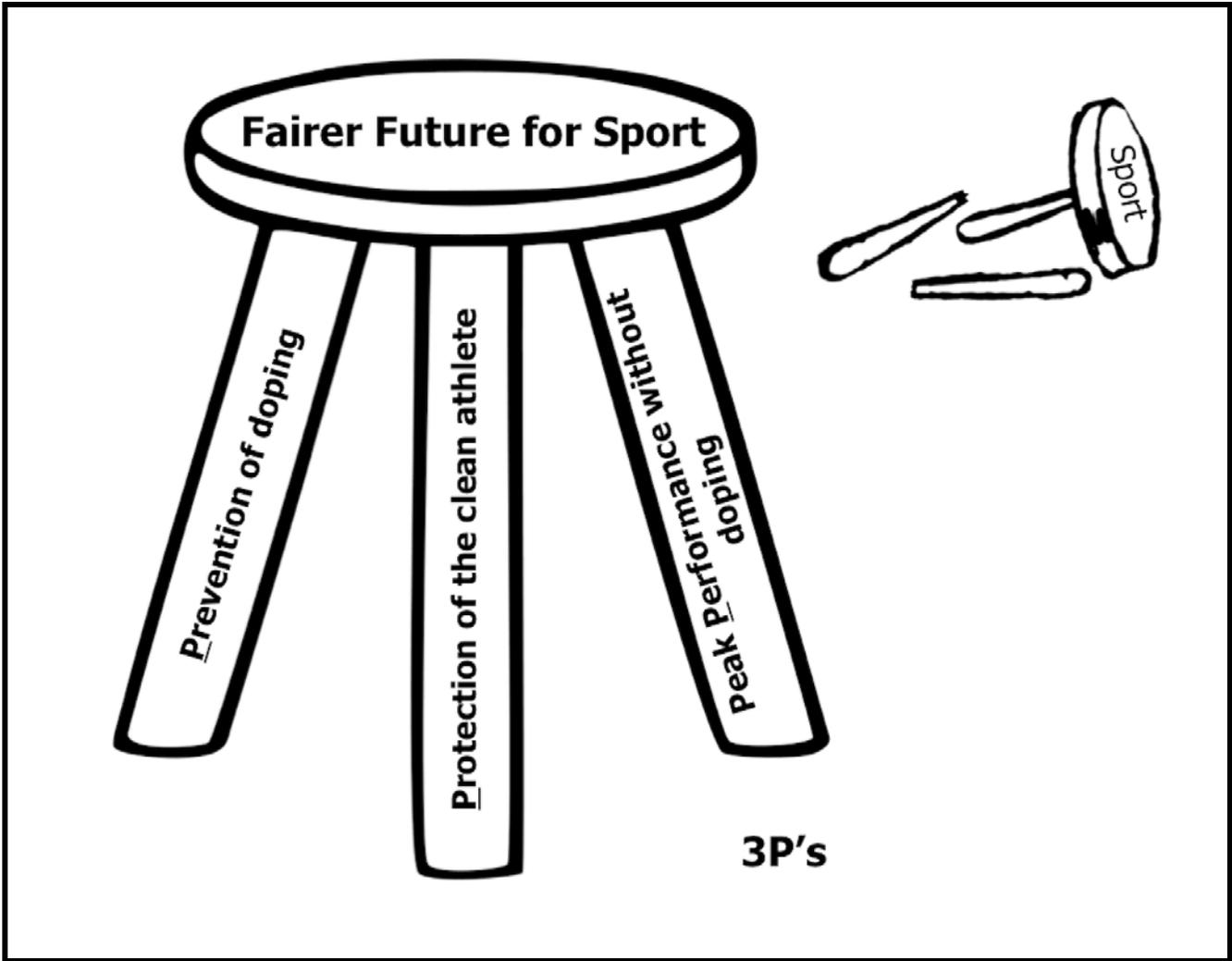


Figure 1: A Holistic Anti-doping Approach