

# Gene doping essay



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Gene Doping is probably today's competitive weapon in sport and is a human enhancement, it was defined by WADA or the World Anti Doping Agency as " Gene Doping is the non-therapeutic use of cells, genes, genetic elements, or of the modulation of gene expression, having the capacity to improve athletic performance". Basically it is an illegal ergogenic aid that is used to enhance performance in the highly developed sporting world today. It is a very complex subject that is spoken very frequently as science fiction becoming a reality whilst others fear it is an imminent threat to the athletic world.

What happens is that gene doping or therapy is the insertion, alteration, or removal of genes within an individual's cells in order to produce a so called ' genetically engineered super athlete' for different sporting disciplines such as aerobic endurance or anaerobic power. This idea has come from genetic engineering and gene therapy which was originally for trying to introduce genes directly into human cells, focusing on diseases caused by single-gene defects, such as muscular dystrophy.

Today gene therapy also has broader applications covering problems such as genetic disease, cancer and HIV. Although there have been complications in such a complex and fragile subject there have been successes, mainly in that the insertion of functional genes into an unspecified genomic location in order to replace a mutated gene which of course can cause disease. Gene doping is as I said very new meaning it is very expensive and difficult to attain where athletes would travel to specialist companies and scientists in countries such as Germany and the USA.

But basically it is a technique for correcting defective genes that are responsible for disease development and not for performance enhancement which is what WADA and IOC are trying to say to the athletic world, although some people say gene doping is more acceptable for sporting enhancement rather than drug taking. So, gene doping is the next step in terms of physiological aids in the sporting world. But of course it is illegal and is very difficult to detect such as you have drug testing or blood doping testing simply because for example genes are introduced into a tissue such as a muscle not via a drug making it virtually undetectable.

Although WADA have banned all gene doping it is still very difficult to detect, because even with DNA testing how would we know if the performer inherited it or used gene doping to acquire it? Because there are individuals who naturally have high-levels of some of these so-called sport genes. Gene doping may be measurable only shortly after administration and in many cases would require tissue sampling, again making it difficult, and taking muscle samples from athletes is no option taking it out of account in terms of detection.

Because not all forms of gene doping is done via injection, and anyway looking for the site of the injection is like looking for a needle in a hay stack. Obviously easier and more efficient ways will be found to identify gene doping but what makes it so necessary and efficient for athletes is the fact it is very new and difficult to detect. Many ergogenic aids are specific for certain types of athletes such as blood doping for aerobic athletes but gene doping can be used for all types of athletes between you anaerobic and aerobic.

For example there already exists a Human Gene Map for performance and health-related fitness phenotypes which is updated every year which lists the genes which, in different combinations, could hypothetically produce a so-called genetically engineered super athlete. It is displayed in a table format as ACE-II which benefits aerobic endurance performers it improves the efficiency of mitochondria and also extra ATP has been shown to improve or benefit these athletes.

And also IGF-1 which benefit anaerobic athletes of more power and strength abilities because there is an increase in enzyme activation for increasing the update of amino acids to increase muscle growth and strength. So, this map just indicates what gene doping is capable of in a more simple way or enlarged way rather. Genetic technologies, which is a biotech company based in Australia has developed a DNA test which it claims can identify whether a child has the genetic make-up to excel in either sprint and power sports or endurance sports.

This would be extremely useful for predicting their trainability and thus the specificity of training regimes, which will help the development of young athletes as trainers and sporting academies will know of their genetic expression or make-up then knowing what they can excel in and what type of training they will need to succeed at the highest level. This again is the next step in sporting excellence and development. Gene therapy or doping is very new in terms of sporting enhancement therefore there have not been many if any long term side effects established.

So far it has been fairly safe in terms of gene therapy as it is done in enhanced clinics but with gene doping, the so called gene transfer vectors may be produced in non-controlled laboratories, where DNA can be easily and cheaply produced with materials available from legal suppliers. These preparations may be contaminated with chemicals and other impurities from the production and purification process; including pyrogens which causes or induces a fever also known as pyrexia causing increased temperatures and shivering.

So, health and hygiene is seen as a big threat in gene doping but there is also the risk of viral genes being produced which can cause major health risks to not only the performer but larger populations because viruses spread vigorously. Overall there are yet still to be any bad side effects due to the fact long term effects have yet to be discovered and analysed, but I am sure there will be long term effects affecting peoples DNA and gene patterns, particularly if athletes continue to use gene doping.

Although gene doping is illegal, athletes at the highest and most extreme levels are undertaking gene doping, meaning they are cheating and having an unfair advantage above other athletes, but it still goes on. Despite the fact it is highly expensive under professional standards and also very difficult in terms of access, without mentioning positive side effects that goes on. It is because of the fact some athletes want to be at the top of their game and compete with the best in order to be the best, even if it means cheating, unfortunately.

So, despite these factors, gene doping does have its benefits hence why top athletes go to these extremes. The most common genes used in gene doping for athletes are Erythropoetin (Epo) and Growth Hormones which we know can be taken as drugs or chemicals which are though detectable. Whereas by doing so via gene doping it is as we know virtually undetectable. But the exact number of years that it will take for this method to enter the athletic arena is difficult to estimate, but it is most likely that this will happen within 5 years.

So, athletes may be able to use gene doping to re-engineer their bodies for better performance, and many genes have the potential to enhance athletic performance, depending on what the athlete wants and what physical aspects they are stronger in such as aerobic and anaerobic activities, or what muscle fibre types they are. But clearly the benefits are very positive particularly on a large scale as it is available to all athletes. Gene doping can also be used as well to identify an athlete's genetic make-up so coaches can see where they are likely to be stronger and what training needs to be done, as I explained earlier.

Finally, the fact that gene doping can also be used in the matter of injuries in sport as injury healing may be improved by gene therapy because the recovery process can be speeded up in the longer term and muscle atrophy can be decreased. At the moment gene doping is very experimental but as science and technology develops this is the next step for ergogenic aids in sport, particularly in the long term as the genes will take place within 5 years in order to make a better engineered athlete.