PROJECT REVIEW

"Gene doping detection by next generation sequencing"

Dr. H. Haisma, Dr. C.C. van Diemen (University of Groningen, The Netherlands)

Gene doping represents a threat to the integrity of sport and the suitable for publication on WADA's website health of athletes. The anti-doping community has been focusing efforts on developing a test for its detection. The current methodology to detect doping genes in an athletes' blood uses the polymerase chain reaction (PCR) that targets unique sequences in a doping gene, which correspond to exon-exon junctions in the intronless transgene. These so-called real-time PCR assays detect unique sequences in the complementary DNA (cDNA) for human erythropoietin (EPO) and other doping genes such as insulin-like growth factor-1, growth hormone, growth hormone releasing hormone and follistatin.

As the sequences of cDNA of Epo and other doping genes are known, it is relatively easy to aggravate these tests, which will then result in a false-negative result. Recently, we developed a new gene doping detection assay that will overcome this problem. The test is based on targeted sequencing of doping genes with potential to detect any doping gene in any context with a very high sensitivity. Using an in-house designed next generation sequencing assay, we developed a gene doping detection assay for cDNA of EPO which targets all potential exon-exon junctions of all possible EPO-transcripts.

We propose to evaluate and further develop a multiplex 'gene doping detection panel' which targets genes for, among others, insulin-like growth factor-1, growth hormone, growth hormone releasing hormone and follistatin. The panel allows simultaneous detection of several 'sport-specific' genes in one sample, reducing the test's cost and turn-around-time. This research is crucial in the development of a reliable routine method for detection of gene doping that may be potentially used in all sports.