

Editorial

Nowadays – we have just had the 2012 Olympic and Paralympic Games in London – sports seems to have an increasing impact on society. This impact is of course ambivalent, i.e. sport *can* promote health but sport, especially high performance sports, can quite often be nothing but a health ruining activity. At the same time we can observe that progress in the field of genomics is enormous. Discoveries in this area are a source of inspiration for researchers in various fields to apply the findings not only to the field of plants and animals genomics, but also to human beings. It seems as if sports serves as the ideal playground (maybe laboratory would be the better metaphor) for genomics in order to test outcomes in real life. The possibilities range from apparently ethically tolerable applications (preventive genetic testing), to ethically unacceptable measures (gene doping). But it is necessary to avoid black and white thinking and to identify the ethical issues in genomics when applied to the field of sports, and not to let one's opinion be influenced by a superficial perception of the problems. With this special issue we want to provide material for future discourse and future policy making (including guidelines and recommendations) in this area. Thus the focus of this special issue is clearly on questions around genetic testing/screening, especially in prevention, particularly genetic testing as a diagnostic tool to identify hereditary health risks that could have severe consequences if undetected in athletes. However, preventive/diagnostic applications are sometimes hard to distinguish from enhancing measures, especially when we are talking about sports. Although the focus is not on gene doping, van Hilvoorde and Camporesi and McNamee address this subject in order to provide the reader with a complete picture of possible use and misuse.

The first paper, by Ivo van Hilvoorde, paves the way into the topic of sports and genomics. He provides a first sketch of possible applications of genomics in the field of physical activity by focusing on a) the prevention of sports-related genetic risks, b) on genetic screening in order to create an 'efficient' selection process in elite sport, and c) on utopian and dystopian scenarios around genetic enhancement. Although the application of DNA testing as a preventive tool seems morally more acceptable than the selection of talents with the help of genetic screenings, van Hilvoorde reflects upon the ethical controversies in both applications. For example, mandatory DNA testing in high-performance athletes (e.g. tests for boxers, in order to reduce their risks for Parkinson's or Alzheimer's disease) is ethically ambivalent, even if it is applied for a preventive reason. As van Hilvoorde informs us, on the one hand knowledge about our genetic makeup can contribute to a process of *empowerment* (the enhancement of the athletes autonomy), but on the other hand this information can lead to a *restriction* of our choices (athletes, especially children, might feel preassigned to a certain sports discipline, hence limited in their sporting future by knowledge about their genetic makeup). Another example of ambivalence is presented when van Hilvoorde touches upon the question of gene doping, especially when he reflects on the problem of defining the border between *therapy* and *enhancement*.

Let's buy a test online and soon you will know what kind of sport star you could become. Sabine Rudnik-Schöneborn destroys such fantasies at the very beginning of her paper. She provides results of research studies that tried to confirm the promises of, for example, commercially available tests for ACTN3 (=α-actinin 3) – such tests are said to forecast whether a person has a higher potential in sprint and strength training or endurance sports – however, the promising results could not be reproduced in scientifically sound settings (such as a larger test population). Rudnik-Schöneborn's sobering conclusion is that although many genes are supposed to have an influence on sports performance, the current state of knowledge in this field is still in its infancy. However, she states that there are other (rare) genes which are highly predictive of certain disorders, where competitive sports should be avoided, to avoid sudden cardiac death (see also the Löllgen/Löllgen paper in this issue). While the screening of the whole population seems to be impossible, according to Rudnik-Schöneborn cascade screening of relatives in families with known mutations could be a clever strategy for detection.

What's the difference between a scenario where an athlete asks for a gene transfer in order to increase their pain tolerance and a scenario where a (regular) patient asks for the same? Camporesi and McNamee explore the differences and similarities of those two scenarios. They also reflect upon the therapy/enhancement issue introduced by van Hilvoorde. The authors show that the boundaries between these two – therapy and enhancement – are easily blurred. Interestingly, the authors take Dr Gregory House from the TV series *House MD* as an example for a regular patient having a gene transfer to solve his pain issues. In the second scenario they take endurance athletes who are seeking a VEGF (Vascular Endothelial Growth Factor) gene transfer to better cope with pain and who could therefore perform better than other athletes with a normal pain sensitivity. The authors analyse these two scenarios with the help of two ethical frameworks: firstly, the ethics of translational research (referring to the gap between cutting-edge research and its clinical application), and secondly, the ethics of sports enhancement. While the authors conclude that it is acceptable for a regular patient to have gene transfer, they provide sound ethical arguments for not allowing the same in the case of a performance athlete.

As we have seen in the paper by Rudnik-Schöneborn it might be sensible to recommend a genetic test to athletes to avoid, for example, sudden cardiac death. Herbert Löllgen and Ruth Löllgen elaborate in depth the empirical evidence, possibilities and recommendations in this area. They provide up-to-date scientific data for various inherited cardiological diseases. Nevertheless, the authors remind us of the limited nature of genetic testing, i.e. that we are dealing with probabilistic scores only rather than quantitative results. However, they state that it is essential that professionals from various disciplines should co-operate in order to create the best results for the athlete/ patient.

Besides the scientific evidence and the ethical reflection on the issues around genetics and sports presented by the authors mentioned above, we are honoured that this

special issue includes an interview with an internationally renowned athlete and member of one of the most powerful sports associations, the International Olympic Committee (IOC), Claudia Bokel. Mrs Bokel, an Olympic medal-winning fencer, provides us with comments on a number of issues ranging from the development of the Paralympic Games and its relation to technological doping, through genetic testing for performance athletes, to responsibilities of various stakeholders in regard to the athlete's health.

Finally, I would like to thank . Hub Zwart for the invitation and the honour to serve as guest editor for this special issue of *Genomics, Society and Policy*. I would like to thank all the authors and Claudia Bokel for their thoughtful contributions to a discourse on a speedily evolving field, and all reviewers for their helpful comments. I would also like to express my heartfelt thanks and appreciation for Claire Packman, who did an outstanding job as managing editor.

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