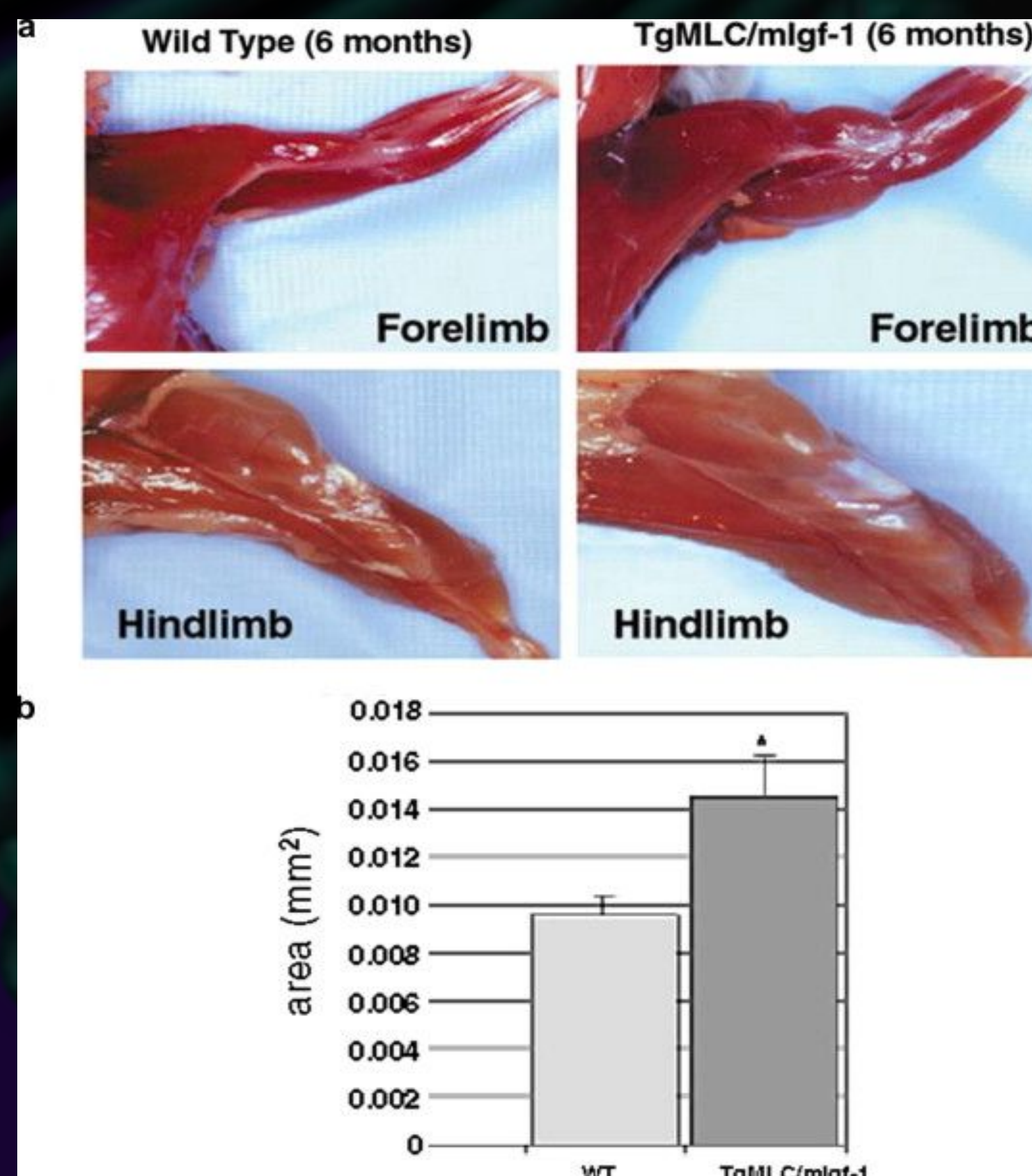


Faith Cosgrove  
fcosgrov@terpmail.umd.edu  
Science and Global Change  
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**What are the ethical implications behind genetic differences in sports and how will this affect the future of elite athletic competition in light of new gene modification technology?**

## Concern

Certain genes have been known to provide enhanced athletic performance in sports, leaving some individuals predisposed to advantages in athletic events. With new gene manipulation technology like CRISPR, the issue of direct modification of genes for their intended athletic advantages becomes more and more pertinent. Such gene modification poses a threat to the recognition of elite athletic status and has the potential to dismantle the credibility of titles awarded at the Olympics.



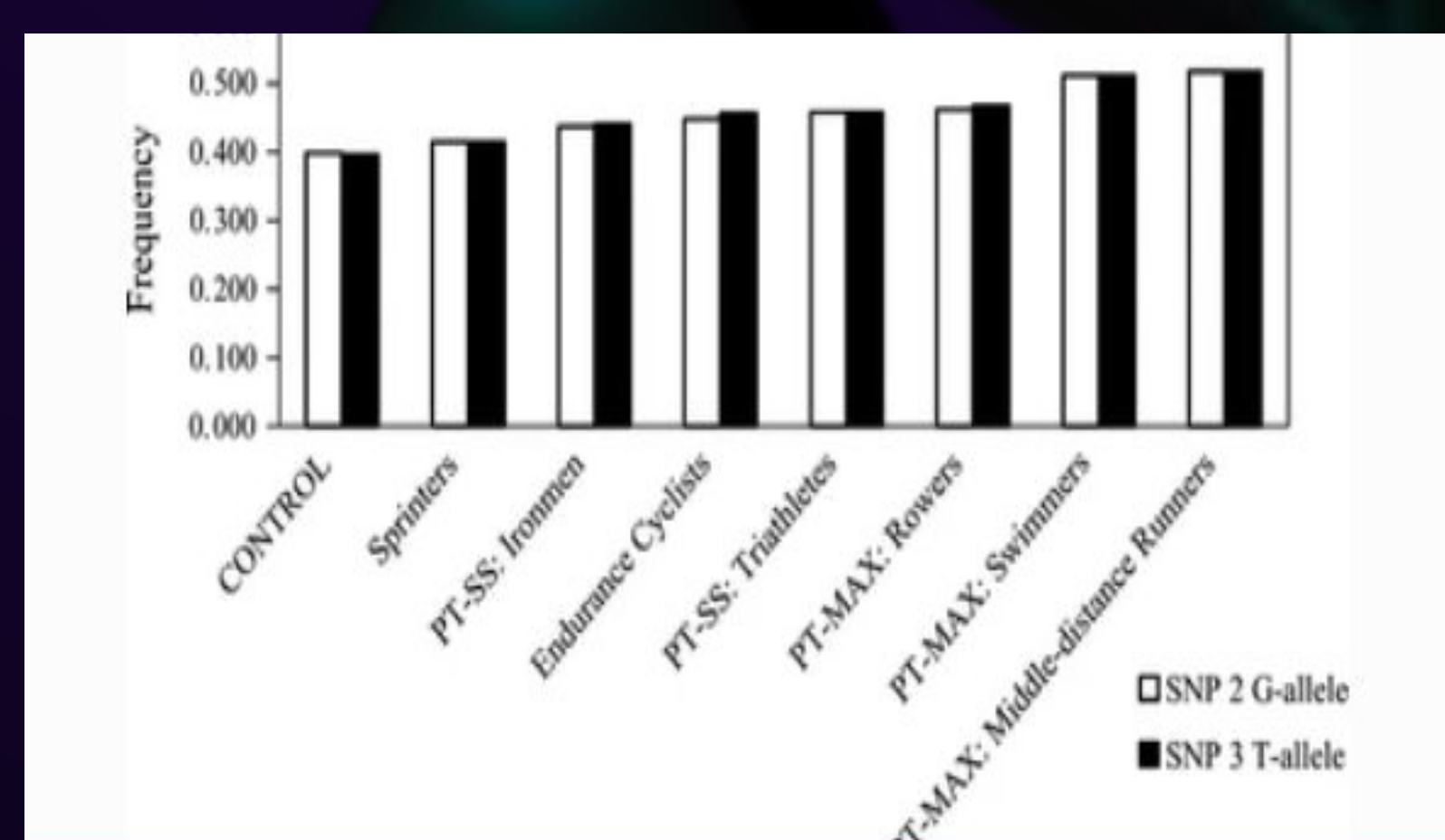
This image depicts the effects of gene doping on the muscle mass of mice. The gene IGF-I was directly infused into the skeletal muscle of mice and resulted in dramatic muscle growth after 6 months.

## Ethical Considerations

- Athletes are marked by their drive to win, can the use of naturally occurring biological substances be viewed as just an extension of this drive?
- Athletes competing at Olympic levels are 3x more likely than normal healthy people to have athletically advantageous genes, so at what point is it fair to bar athletes for having too many favorable genes?
- Can the history of genetic manipulation weigh into current decisions?

## Methods

To investigate this problem, I researched examples of genes that impact athletic performance, the history of genetic manipulation, and the advancements in gene doping technology. In my exploration of this topic, I came across many peer-reviewed journals and reviews as well as excerpts from history and science textbooks.



This data represents the frequency of different variations of the EPAS1 gene in different elite athletes. This gene associated with endurance is shown to be the prevalent in the genetics of all types of stamina-related elite athletes.

## Conclusion

Genetic differences between athletes allot for healthy competition, but the deliberate modification of genes inspires unfair conditions at elite levels of athleticism. Using technology involving the detection of the Cas9 protein required for the process of gene modification, the identification of gene doping in sports is now a possibility and can be implemented in the future.

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