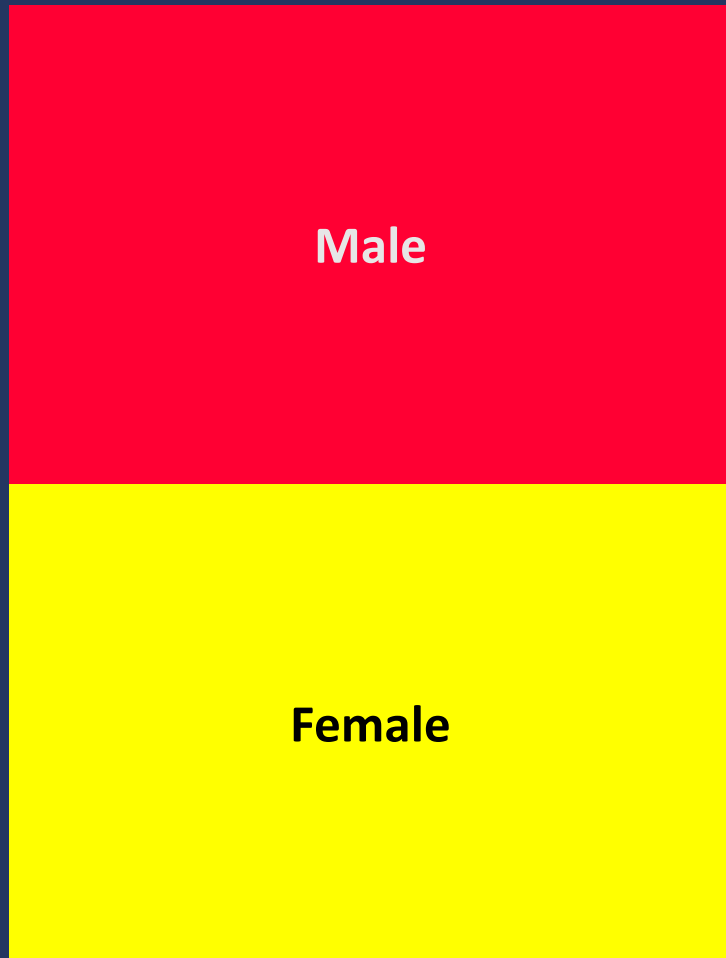


Biology – competitive advantages in sport

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Sex categories in sport



What are the typical male sport-related biological advantages?

Male biological advantages

(Stebbings *et al.*, 2021)

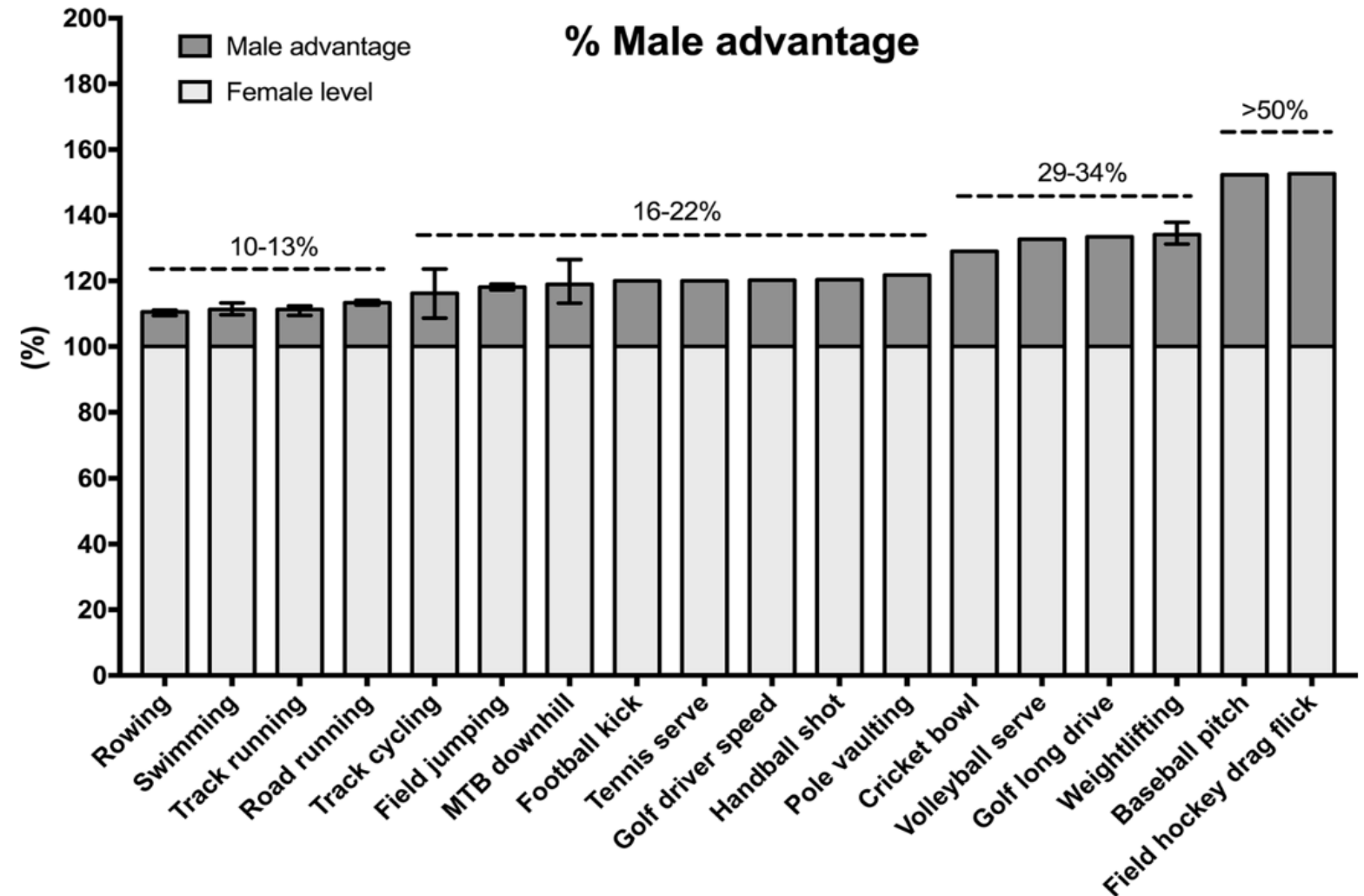
Table 1. Extent of male advantage in selected physiological characteristics relevant for athletic performance. Adapted from Hilton & Lundberg (2020).

Characteristic	Approximate male advantage
Limb length	~12%
Muscle mass	~37%
Muscle strength	~55%
Cardiovascular function	~27%

Male performance advantages

(Hilton & Lundberg, 2020)

Fig. 1 The male performance advantage over females across various selected sporting disciplines. The female level is set to 100%. In sport events with multiple disciplines, the male value has been averaged across disciplines, and the error bars represent the range of the advantage. The metrics were compiled from publicly available sports federation databases and/or tournament/competition records. *MTB* mountain bike



Why do those typical male vs. female differences exist?

- Genetics

- Whole chromosome different (Y) between typical males and females

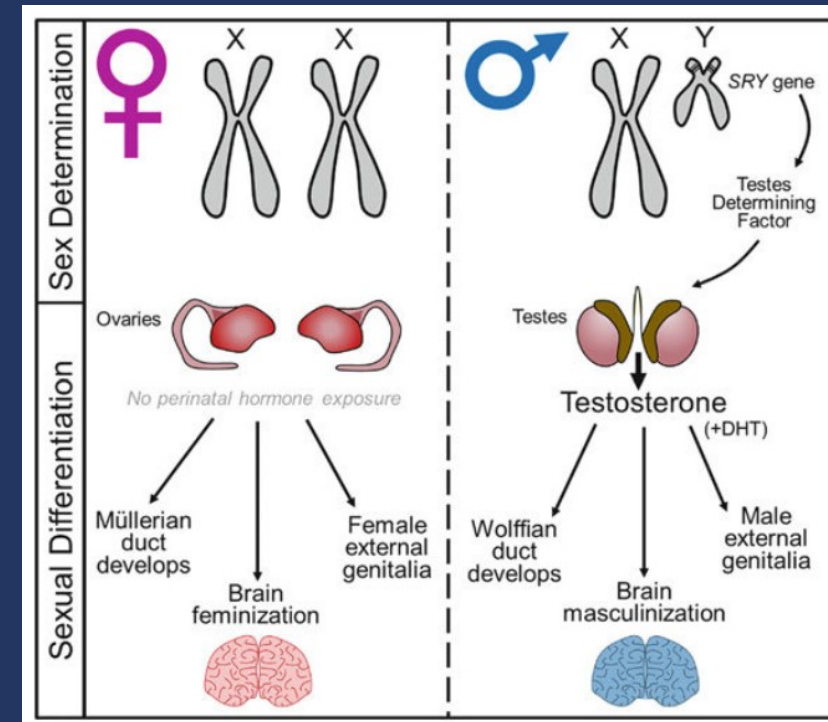
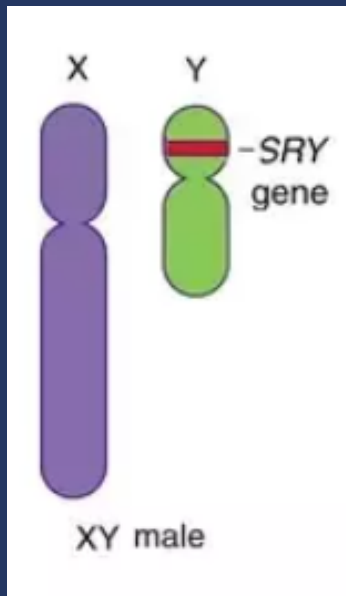
- Y chromosome contains *SRY* (sex determining region Y) gene

- *SRY* → Sry protein (testis-determining factor)

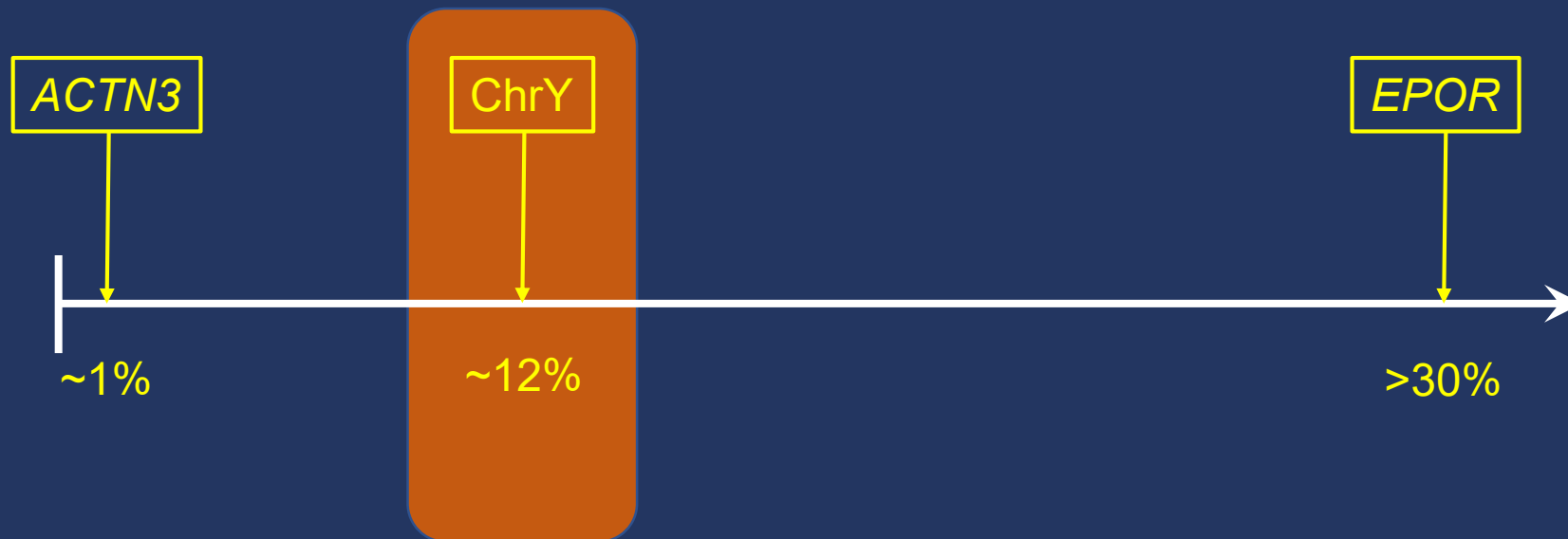
- Sry protein develops testes, not ovaries

- Testes produce testosterone (T), especially from puberty

- T stimulates additional growth of skeleton, skeletal muscle, organs related to exercise performance, and raises blood Hb



Performance improvements from genetic differences:



Only available to most males,
not most females

Effects of testosterone suppression

(Stebbings *et al.*, 2021)

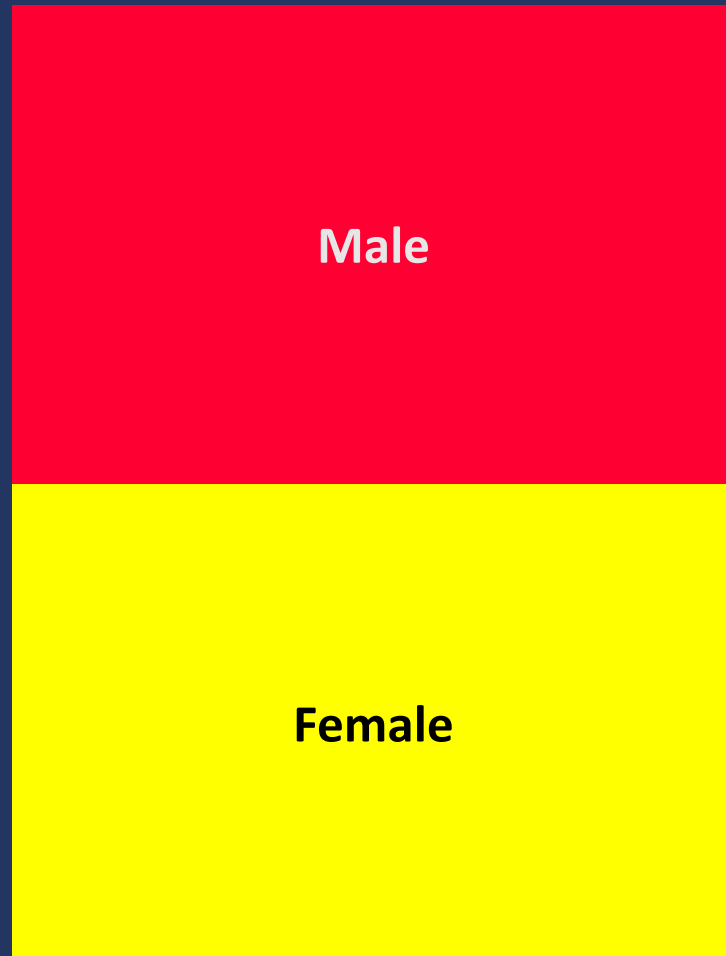
“While muscle mass (~5%) and strength (~4%) reduce in trans women following 12 months ... reductions are much less than typical advantages in muscle mass (~37%) and strength (~55%) of cis men” *†

* very little evidence from well-trained trans women

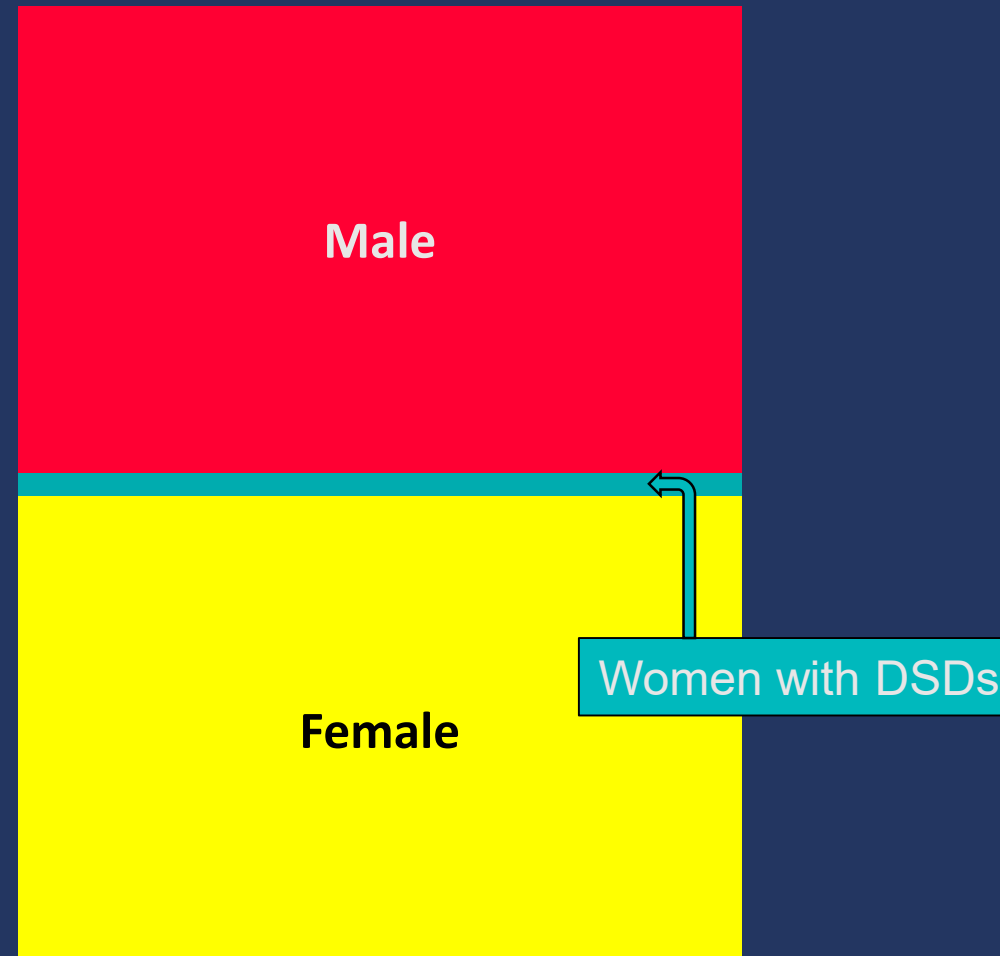
† very little evidence in sport-specific actions

Sex categories...

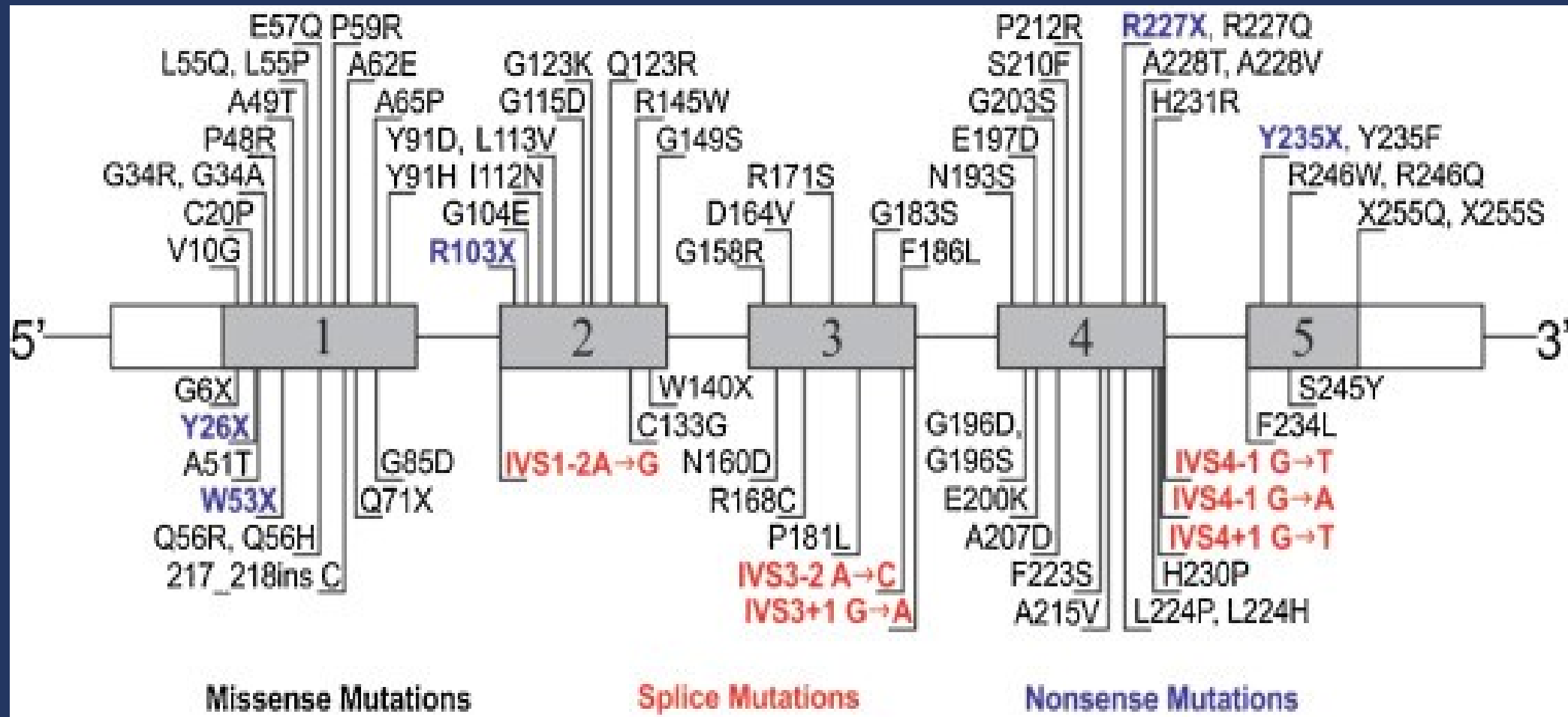
Typically in sport



Genetic and biological reality



SRD5A2, Chr 2p23.1 Steroid 5 alpha-reductase 2



Individuals with a mutation: 5-ARD

Do DSD women have the same biological sport performance advantages of most men?

- Biological certainty
 - Y chromosome
 - T in typical male range
 - Response to T is measurable
- Biological complexity of DSDs
 - Highly individual rare genetic characteristics
 - T not always in typical male range
 - Variable response to T/related hormones, very difficult to measure
- Existing evidence is extremely limited/problematic
- Practical regulatory difficulties

References

Hilton EN & Lundberg TR (2020) Transgender women in the female category of sport: Perspectives on testosterone suppression and performance advantage. *Sports Med*, doi: 10.1007/s40279-40020-01389-40273.

Mendonca BB *et al.* (2016) Steroid 5 α -reductase 2 deficiency. *J Steroid Biochem Mol Biol*, 163, 206-211.

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Turano A *et al.* (2018) Sexual differentiation and sex differences in neural development. In *Current topics in behavioral neurosciences*, doi: 10.1007/7854_2018_1056.



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