No. 24-43

In the Supreme Court of the United States

STATE OF WEST VIRGINIA, ET AL.,

v.

B.P.J., BY NEXT FRIEND AND MOTHER,
HEATHER JACKSON,

ON WRIT OF CERTIORARI
TO THE UNITED STATES COURT OF APPEALS
FOR THE FOURTH CIRCUIT

JOINT APPENDIX (VOLUME VI OF X)

(Pages 2116-2520)

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(continued from front cover)

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IN THE UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA

CHARLESTON DIVISION

B. P. J., et al.,

Plaintiffs,

v. CIVIL ACTION NO. 2:21-cv-00316

WEST VIRGINIA STATE BOARD OF EDUCATION, et al.,

Defendants,

and

LAINEY ARMISTEAD,

Defendant-Intervenor.

DECLARATION OF GREGORY A. BROWN, PH.D., FACSM

I, Dr. Gregory A. Brown, pursuant to 28 U.S. Code § 1746, declare under penalty of perjury under the laws of the United States of America that the facts contained in my Expert Declaration of Gregory A. Brown, Ph.D., FACSM in the Case of B.P.J. v. West Virginia State Board of Education, attached hereto, are true and correct to the best of my knowledge and belief, and that the opinions expressed therein represent my own expert opinions.

Executed on February 23, 2022.

/s/ Gregory A. Brown
Gregory A. Brown

Expert Report of

Gregory A Brown, Ph.D. FACSM

In the case of B.P.J. vs. West Virginia State Board of Education.

Personal Qualifications and Disclosure

I serve as Professor of Exercise Science in the Department of Kinesiology and Sport Sciences at the University of Nebraska Kearney, where I teach classes in Exercise Physiology among other topics. I am also the Director of the General Studies program. I have served as a tenured (and nontenured) professor at universities since 2002.

In August 2002, I received a Doctor of Philosophy degree from Iowa State University, where I majored in Health and Human Performance, with an emphasis in the Biological Bases of Physical Activity. In May 1999, I received a Master of Science degree from Iowa State University, where I majored in Exercise and Sport Science, with an emphasis in Exercise Physiology.

I have received many awards over the years, including the Mortar Board Faculty Excellence Honors Award, College of Education Outstanding Scholarship / Research Award, and the College of Education Award for Faculty Mentoring of Undergraduate Student Research. I have authored more than 40 refereed publications and more than 50 refereed presentations in the field of Exercise Science. I have authored chapters for multiple books in the field of Exercise Science. And I have served as a peer reviewer for over 25 professional journals, including *The American Journal of Physiology,* the *International Journal of Exercise Science,* the *Journal of Strength and Conditioning Research,* and *The Journal of Applied Physiology.*

My areas of research have included the endocrine response to testosterone prohormone supplements in men and women, the effects of testosterone prohormone supplements on health and the adaptations to strength training in men, the effects of energy drinks on the physiological response to exercise, and assessment of various athletic training modes in males and females. Articles that I have published that are closely related to topics that I discuss in this white paper include:

- Studies of the effect of ingestion of a testosterone precursor on circulating testosterone levels in young men. Douglas S. King, Rick L. Sharp, Matthew D. Vukovich, Gregory A. Brown, et al., *Effect of Oral Androstenedione on Serum Testosterone and Adaptations to Resistance Training in Young Men: A Randomized Controlled Trial,* JAMA 281: 2020-2028 (1999); G. A. Brown, M. A. Vukovich, et al., *Effects of Anabolic Precursors on Serum Testosterone Concentrations and Adaptations to Resistance Training in Young Men,* Int J SPORT NUTR EXERC METAB 10: 340-359 (2000).

- A study of the effect of ingestion of that same testosterone precursor on circulating testosterone levels in young women. G. A. Brown, J. C. Dewey, et al., *Changes in Serum Testosterone and Estradiol Concentrations Following Acute Androstenedione Ingestion in Young Women,* HORM METAB RES 36: 6266 (2004.)

- A study finding (among other things) that body height, body mass, vertical jump height, maximal oxygen consumption, and leg press maximal strength were higher in a group of physically active men than comparably active women, while the women had higher percent body fat. G. A. Brown, Michael W. Ray, et *al.*, *Oxygen Consumption, Heart Rate, and Blood Lactate Responses to* an *Acute Bout of Plyometric Depth Jumps in College-Aged Men And Women, J.* STRENGTH COND RES 24: 2475-2482 (2010).

- A study finding (among other things) that height, body mass, and maximal oxygen consumption were higher in a group of male NCAA Division 2 distance runners, while women NCAA Division 2 distance runners had higher percent body fat. Furthermore, these male athletes had a faster mean competitive running speed (-3.44 min/km) than women (-3.88 minfkm), even though the men ran 10 km while the women ran 6 km. Katherine Semin, Alvah C. Stahlnecker, Kate A. Heelan, G. A. Brown, et al, *Discrepancy Between Training, Competition and Laboratory Measures of Maximum Heart Rate in NCAA Division 2 Distance Runners,* JOURNAL OF SPORTS SCIENCE AND MEDICINE 7: 455-460 (2008).
- A presentation at the 2021 American Physiological Society New Trends in Sex and Gender Medicine Conference entitled "Transwomen Competing in Women's Sports: What We Know and What We Don't". I have also authored an August 2021 entry for the American Physiological Society Physiology Educators Community of Practice Blog (PECOP Blog) titled "The Olympics, Sex, and Gender in the Physiology Classroom."

A list of my published scholarly work for the past 10 years appears as an Appendix.

Purpose of this Declaration

I have been asked by counsel for Defendant State of West Virginia and Intervenor Defendant Lainey Armistead in the matter of *B.P.J. by her next friend and mother Heather Jackson, v. State of West Virginia State Board of Education, et al.* to offer my opinions about the following: (a) whether males have inherent advantages in athletic performance over females, and if so the scale and physiological basis of those advantages, to the extent currently understood by science and (b) whether the sex-based performance advantage enjoyed by males is eliminated if feminizing hormones are administered to male athletes who identify as transgender (and in the case of prepubertal children, whether puberty blockers eliminate the advantage). In this declaration, when I use the terms "boy" or "male," I am referring to biological males based on the individual's reproductive biology and genetics as determined at birth. Similarly, when I use the terms "girl" or "female," I am referring to biological females based on the individual's reproductive biology and genetics as determined at birth. When I use the term transgender, I am referring to persons who are males or females, but who identify as a member of the opposite sex.

I have previously provided expert information in cases similar to this one in the form of a written declaration and a deposition in the case of *Soule vs. CIAC* in the state of Connecticut, and in the form of a written declaration in the case of *Hecox vs. Little* in the state of Idaho. I have not previously testified as an expert in any trials.

The opinions I express in this declaration are my own, and do not necessarily reflect the opinions of my employer, the University of Nebraska.

I have been compensated for my time serving as an expert in this case at the rate of $150 per hour. My compensation does not depend on the outcome in the case.

Overview

In this declaration, I explore three important questions relevant to current discussions and policy decisions concerning inclusion of transgender individuals in women's athletic competitions. Based on my professional familiarity with exercise physiology and my review of the currently available science, including that contained in the many academic sources I cite in this report, I set out and explain three basic conclusions:

- At the level of (a) elite, (b) collegiate, (c) scholastic, and (d) recreational competition, men, adolescent boys, or male children, have an advantage over equally aged, gifted, and trained women, adolescent girls, or female children in almost all athletic events;
- Biological male physiology is the basis for the performance advantage that men, adolescent boys, or male children have over women, adolescent girls, or female children in almost all athletic events; and
- The administration of androgen inhibitors and cross-sex hormones to men or adolescent boys after the onset of male puberty does not eliminate the performance advantage that men and adolescent boys have over women and adolescent girls in almost all athletic events. Likewise, there is no published scientific evidence that the administration of puberty blockers to males before puberty eliminates the pre-existing athletic advantage that

> prepubertal males have over prepubertal females in almost all athletic events.

In short summary, men, adolescent boys, and prepubertal male children perform better in almost all sports than women, adolescent *girls,* and prepubertal female children because of their inherent physiological advantages. In general, men, adolescent boys, and prepubertal male children, can run faster, output more muscular power, jump higher, and possess greater muscular endurance than women, adolescent girls, and prepubertal female children. These advantages become greater during and after male puberty, but they exist before puberty.

Further, while after the onset of puberty males are on average taller and heavier than females, a male performance advantage over females has been measured in weightlifting competitions even between males and females matched for body mass.

Male advantages in measurements of body composition, tests of physical fitness, and athletic performance have also been shown in children before puberty. These advantages are magnified during puberty, triggered in large part by the higher testosterone concentrations in men, and adolescent boys, after the onset of male puberty. Under the influence of these higher testosterone levels, adolescent boys and young men develop even more muscle mass, greater muscle strength, less body fat, higher bone mineral density, greater bone strength, higher hemoglobin concentrations, larger hearts and larger coronary blood vessels, and larger overall statures than women. In addition, maximal oxygen consumption (VO2max), which correlates to —30-40% of success in endurance sports, is higher in both elite and average men and boys than in comparable women and girls when measured in regard to absolute volume of oxygen consumed and when measured relative to body mass.

Although androgen deprivation (that is, testosterone suppression) may modestly decrease some physiological advantages that men and adolescent boys have over women and adolescent girls, it cannot fully or even largely eliminate those physiological advantages once an individual has passed through male puberty.

Evidence and Conclusions

I. The scientific reality of biological sex

1. The scientific starting point for the issues addressed in this report is the biological fact of dimorphic sex in the human species. It is now well recognized that dimorphic sex is so fundamental to human development that, as stated in a recent position paper issued by the Endocrine Society, it "must be considered in the design and analysis of human and animal research. . . . Sex is dichotomous, with sex determination in the fertilized zygote stemming from unequal expression of sex chromosomal genes." (Bhargava et al. 2021 at 220). As stated by Sax (2002 at 177), "More than 99.98% of humans are either male or female." All humans who do not suffer from some genetic or developmental disorder are unambiguously male or female.

2. Although sex and gender are used interchangeably in common conversation, government documents, and in the scientific literature, the American Psychological Association defines sex as "physical and biological traits" that "distinguish between males and females" whereas gender "implies the psychological, behavioral, social, and cultural aspects of being male or female (i.e., masculinity or femininity)" (https://dictionary.apa.org, accessed

January 14, 2022). The concept that sex is an important biological factor determined at conception is a well-established scientific fact that is supported by statements from a number of respected organizations including, but not limited to, the Endocrine Society (Bhargava et al. 2021 at 220), the American Physiological Society (Shah 2014), the Institute of Medicine, and the National Institutes of Health (Miller 2014 at H78182). Collectively, these and other organizations have stated that every cell has a sex and every system in the body is influenced by sex. Indeed, "sex often influences gender, but gender cannot influence sex." (Bhargava 2021 at 228.)

3. To further explain: "The classical biological definition of the 2 sexes is that females have ovaries and make larger female gametes (eggs), whereas males have testes and make smaller male gametes (sperm) ... the definition can be extended to the ovaries and testes, and in this way the categories—female and male—can be applied also to individuals who have gonads but do not make gametes ... sex is dichotomous because of the different roles of each sex in reproduction." (Bhargava 2021 at 221.) Furthermore, "sex determination begins with the inheritance of XX or XY chromosomes" (Bhargava 2021 at 221.) And, "Phenotypic sex differences develop in XX and XY embryos as soon as transcription begins. The categories of X and Y genes that are unequally represented or expressed in male and female mammalian zygotes ... cause phenotypic sex differences" (Bhargava 2021 at 222.)

4. Although disorders of sexual development (DSDs) are sometimes confused with discussions of transgender individuals, the two are different phenomena. DSDs are disorders of physical development. Many DSDs are "associated with genetic mutations that are now well

known to endocrinologists and geneticists." (Bhargava 2021 at 225) By contrast, a sense of transgender identity is usually not associated with any physical disorder, and "a clear biological causative underpinning of gender identity remains to be demonstrated." (Bhargava 2021 at 226.)

5. Further demonstrating the biological importance of sex, Gershoni and Pietrokovski (2017) detail the results of an evaluation of "18,670 out of 19,644 informative protein-coding genes in men versus women" and reported that "there are over 6500 protein-coding genes with significant S [ex] D [ifferential] E [xpression] in at least one tissue. Most of these genes have SDE in just one tissue, but about 650 have SDE in two or more tissues, 31 have SDE in more than five tissues, and 22 have SDE in nine or more tissues" (Gershoni 2017 at 2-3.) Some examples of tissues identified by these authors that have SDE genes include breast mammary tissue, skeletal muscle, skin, thyroid gland, pituitary gland, subcutaneous adipose, lung, and heart left ventricle. Based on these observations the authors state "As expected, Y-linked genes that are normally carried only by men show SDE in many tissues" (Gershoni 2017 at 3.) A stated by Heydari et al. (2022, at 1), "Y chromosome harbors male-specific genes, which either solely or in cooperation with their X-counterpart, and independent or in conjunction with sex hormones have a considerable impact on basic physiology and disease mechanisms in most or all tissues development."

6. In a review of 56 articles on the topic of sex-based differences in skeletal muscle, Haizlip et al., (2015) state that "More than 3,000 genes have been identified as being differentially expressed between male and female skeletal muscle." (Haizlip 2015 at 30.) Furthermore, the authors

state that "Overall, evidence to date suggests that skeletal muscle fiber-type composition is dependent on species, anatomical location/function, and sex" (Haizlip 2015 at 30.) The differences in genetic expression between males and females influence the skeletal muscle fiber composition (i.e. fast twitch and fast twitch sub-type and slow twitch), the skeletal muscle fiber size, the muscle contractile rate, and other aspects of muscle function that influence athletic performance. As the authors review the differences in skeletal muscle between males and females they conclude, "Additionally, all of the fibers measured in men have significantly larger cross-sectional areas (CSA) compared with women." (Haizlip 2015 at 31.) The authors also explore the effects of thyroid hormone, estrogen, and testosterone on gene expression and skeletal muscle function in males and females. One major conclusion by the authors is that "The complexity of skeletal muscle and the role of sex adding to that complexity cannot be overlooked." (Haizlip 2015 at 37.) The evaluation of SDE in protein coding genes helps illustrate that the differences between men and women are intrinsically part of the chromosomal and genetic makeup of humans which can influence many tissues that are inherent to the athletic competitive advantages of men compared to women.

II. Biological men, or adolescent boys, have large, well-documented performance advantages over women and adolescent girls in almost all athletic contests.

7. It should scarcely be necessary to invoke scientific experts to "prove" that men are on average larger, stronger, and faster than women. All of us, along with our siblings and our peers and perhaps our children, have passed through puberty, and we have watched that

differentiation between the sexes occur. This is common human experience and knowledge.

8. Nevertheless, these differences have been extensively studied and measured. I cited many of these studies in the first paper on this topic that I prepared, which was submitted in litigation in January 2020. Since then, in light of current controversies, several authors have compiled valuable collections or reviews of data extensively documenting this objective fact about the human species, as manifest in almost all sports, each of which I have reviewed and found informative. These include Coleman (2020), Hilton & Lundberg (2021), World Rugby (2020), Harper (2021), Hamilton (2021), and a "Briefing Book" prepared by the Women's Sports Policy Working Group (2021). The important paper by Handelsman et al. (2018) also gathers scientific evidence of the systematic and large male athletic advantage.

9. These papers and many others document that men, adolescent boys, and prepubertal male children, substantially outperform comparably aged women, adolescent girls and prepubertal female children, in competitions involving running speed, swimming speed, cycling speed, jumping height, jumping distance, and strength (to name a few, but not all, of the performance differences). As I discuss later, it is now clear that these performance advantages for men, adolescent boys, and prepubertal male children, are inherent to the biological differences between the sexes.

10. In fact, I am not aware of any scientific evidence today that disproves that after puberty men possess large advantages in athletic performance over women—so large that they are generally insurmountable for comparably gifted and trained athletes at every level (i.e. (a) elite, (b) collegiate, (c) scholastic, and (d) recreational competition).

And I am not aware of any scientific evidence today that disproves that these measured performance advantages are at least largely the result of physiological differences between men and women which have been measured and are reasonably well understood.

11. My use of the term "advantage" in this paper must not be read to imply any normative judgment. The adult female physique is simply different from the adult male physique. Obviously, it is optimized in important respects for the difficult task of childbearing. On average, women require far fewer calories for healthy survival. Evolutionary biologists can and do theorize about the survival value or "advantages" provided by these and other distinctive characteristics of the female physique, but I will leave that to the evolutionary biologists. I use "advantage" to refer merely to performance advantages in athletic competitions.

12. I find in the literature a widespread consensus that the large performance and physiological advantages possessed by males—rather than social considerations or considerations of identity—are precisely the *reason* that most athletic competitions are separated by sex, with women treated as a "protected class." To cite only a few statements accepting this as the justification:

- Handelsman et al. (2018) wrote, "Virtually all elite sports are segregated into male and female competitions. The main justification is to allow women a chance to win, as women have major disadvantages against men who are, on average, taller, stronger, and faster and have greater endurance due to their larger, stronger, muscles and bones as well as a higher circulating hemoglobin level." (803)

- Millard-Stafford et al. (2018) wrote "Current evidence suggests that women will not swim or run as fast as men in Olympic events, which speaks against eliminating sex segregation in these individual sports" (530) "Given the historical context (2% narrowing in swimming over 44 y), a reasonable assumption might be that no more than 2% of the current performance gap could still potentially be attributed to sociocultural influences.", (533) and "Performance gaps between US men and women stabilized within less than a decade after federal legislation provided equal opportunities for female participation, but only modestly closed the overall gap in Olympic swimming by 2% (5% in running)." (533) Dr. Millard-Stafford, a full professor at Georgia Tech, holds a Ph.D. in Exercise Physiology and is a past President of the American College of Sports Medicine.
- In 2021, Hilton et al. wrote, "most sports have a female category the purpose of which is the protection of both fairness and, in some sports, safety/welfare of athletes who do not benefit from the physiological changes induced by male levels of testosterone from puberty onwards." (204)
- In 2020 the Swiss High Court ("Tribunal Federal") observed that "in most sports . . . women and men compete in two separate categories, because the latter possess natural advantages in terms of physiology."[1]

[1] dans la plupart des sports . . . les femmes et les hommes concourent dans deux categories separees, ces derniers etant naturellement avantages du point de vue physique."

- The members of the Women's Sports Policy Working Group wrote that "If sports were not sex-segregated, female athletes would rarely be seen in finals or on victory podiums," and that "We have separate sex sport and eligibility criteria based on biological sex because this is the only way we can assure that female athletes have the same opportunities as male athletes not only to participate but to win in competitive sport. . . . If we did not separate athletes on the basis of biological sex—if we used any other physical criteria—we would never see females in finals or on podiums." (WSPWG Briefing Book 2021 at 5, 20.)

- In 2020, the World Rugby organization stated that "the women's category exists to ensure protection, safety and equality for those who do not benefit from the biological advantage created by these biological performance attributes." (World Rugby Transgender Women Guidelines 2020.)

- In 2021 Harper et al. stated "...the small decrease in strength in transwomen after 12-36 months of GAHT [Gender Affirming Hormone Therapy] suggests that transwomen likely retain a strength advantage over cisgender women." (7) and "...observations in trained transgender individuals are consistent with the findings of the current review in untrained transgender individuals, whereby 30 months of GAHT may be sufficient to attenuate some, but not all, influencing factors associated with muscular endurance and performance." (8)

Tribunal Federal decision of August 25, 2020, Case 4A_248/2019, 4A_398/2019, at §9.8.3.3.

- Hamilton et al. (2021), in a consensus statement for the International Federation of Sports Medicine (FIMS) concluded that "Transwomen have the right to compete in sports. However, cisgender women have the right to compete in a protected category." (1409)

13. While the sources I mention above gather more extensive scientific evidence of this uncontroversial truth, I provide here a brief summary of representative facts concerning the male advantage in athletic performance.

A. Men are stronger.

14. Males exhibit greater strength throughout the body. Both Handelsman et al. (2018) and Hilton & Lundberg (2021) have gathered multiple literature references that document this fact in various muscle groups.

15. Men have in the neighborhood of 60%-100% greater **arm strength** than women. (Handelsman 2018 at 812.)[2] One study of elbow flexion strength (basically, bringing the fist up towards the shoulder) in a large sample of men and women found that men exhibited 109% greater isometric strength, and 89% higher strength in a single repetition. (Hilton 2021 at 204, summarizing Hubal (2005) at Table 2.)

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[2] Handelsman expresses this as women having 50% to 60% of the "upper limb" strength of men. Handelsman cites Sale, *Neuromuscular function,* for this figure and the "lower limb" strength figure. Knox et al., *Transwomen in elite sport* (2018) are probably confusing the correct way to state percentages when they state that "differences lead to decreased trunk and lower body strength by 64% and 72% respectively, in women" (397): interpreted literally, this would imply that men have **almost 4x as much** lower body strength as do women.

16. **Grip strength** is often used as a useful proxy for strength more generally. In one study, men showed on average 57% greater grip strength than women. (Bohannon 2019.) A wider meta-analysis of multiple grip-strength studies not limited to athletic populations found that 18- and 19-year-old males exhibited in the neighborhood of 2/3 greater grip strength than females. (Handelsman 2017 Figure 3, summarizing Silverman 2011 Table 1.)[3]

17. In an evaluation of maximal isometric handgrip strength in 1,654 healthy men, 533 healthy women aged 20-25 years and 60 "highly trained elite female athletes from sports known to require high hand-grip forces (judo, handball)," Leyk et al. (2007) observed that, "The results of female national elite athletes even indicate that the strength level attainable by extremely high training will rarely surpass the 50th percentile of untrained or not specifically trained men." (Leyk 2007 at 415.)

18. Men have in the neighborhood of 25%-60% greater **leg strength** than women. (Handelsman 2018 at 812.) In another measure, men exhibit 54% greater knee extension torque and this male leg strength advantage is consistent across the lifespan. (Neder 1999 at 120-121.)

19. When male and female Olympic weightlifters of the same body weight are compared, the top males lift weights between 30% and 40% greater than the females of the same body weight. But when top male and female performances are compared in powerlifting, without imposing any artificial limitations on bodyweight, the male

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[3] Citing Silverman, *The secular trend for grip strength in Canada and the United States,* J. Ports Sci. 29:599-606 (2011).

record is 65% higher than the female record. (Hilton 2021 at 203.)

20. In another measure that combines many muscle groups as well as weight and speed, moderately trained males generated 162% greater punching power than females even though men do not possess this large an advantage in any single bio-mechanical variable. (Morris 2020.) This objective reality was subjectively summed up by women's mixed-martial arts fighter Tamikka Brents, who suffered significant facial injuries when she fought against a biological male who identified as female and fought under the name of Fallon Fox. Describing the experience, Brents said:

> "I've fought a lot of women and have never felt the strength that I felt in a fight as I did that night. I can't answer whether it's because she was born a man or not because I'm not a doctor. I can only say, I've never felt so overpowered ever in my life, and I am an abnormally strong female in my own right."[4]

B. Men run faster.

21. Many scholars have detailed the wide performance advantages enjoyed by men in running speed. One can come at this reality from a variety of angles.

22. Multiple authors report a male speed advantage in the neighborhood of 10%-13% in a variety of events, with a variety of study populations. Handelsman et al. 2018 at 813 and Handelsman 2017 at 70 both report a male advantage of about 10% by age 17. Thibault et al. 2010 at 217 similarly reported a stable 10% performance advantage across multiple events at the Olympic level.

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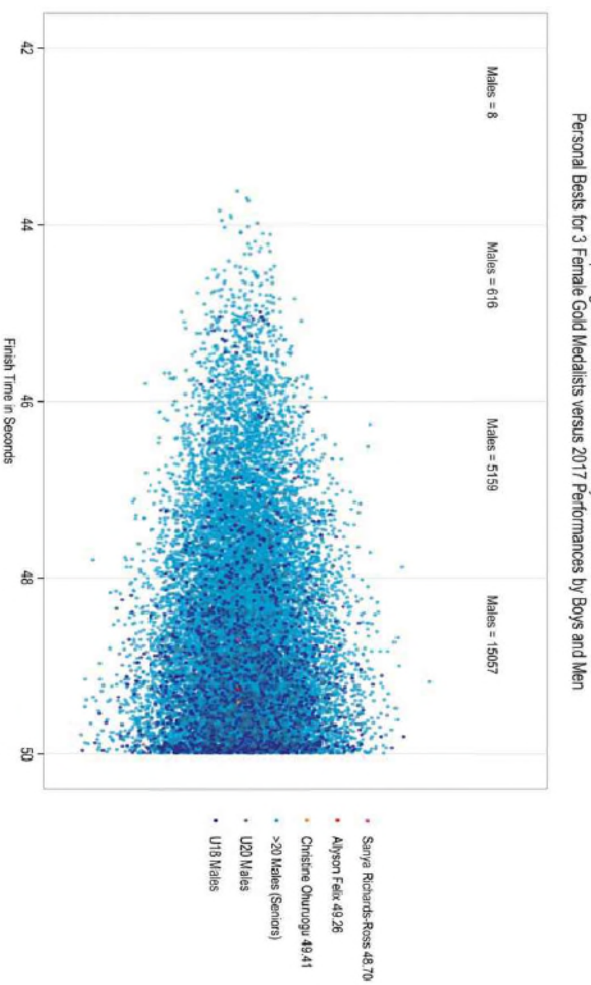
[4] http://whoatv.com/exclusive-fallon-foxs-latest-opponent-opens-up-to-whoatv/ (last accessed October 5, 2021).

Tonnessen et al. (2015 at 1-2) surveyed the data and found a consistent male advantage of 10%12% in running events after the completion of puberty. They document this for both short sprints and longer distances. One group of authors found that the male advantage increased dramatically in ultra-long-distance competition (Lepers & Knechtle 2013.)

23. A great deal of current interest has been focused on track events. It is worth noting that a recent analysis of publicly available sports federation and tournament records found that men enjoy the *least* advantage in running events, as compared to a range of other events and metrics, including jumping, pole vaulting, tennis serve speed, golf drives, baseball pitching speed, and weightlifting. (Hilton 2021 at 201-202.) Nevertheless, as any serious runner will recognize, the approximately 10% male advantage in running is an overwhelming difference. Dr. Hilton calculates that "approximately 10,000 males have personal best times that are faster than the current Olympic 100m female champion." (Hilton 2021 at 204.) Professors Doriane Coleman, Jeff Wald, Wickliffe Shreve, and Richard Clark dramatically illustrated this by compiling the data and creating the figure below (last accessed on February 10, 2022, at https://bit.ly/35yOyS4), which shows that the *lifetime best performances* of three female Olympic champions in the 400m event—including Team USA's Sanya Richards-Ross and Allyson Felix—would not match the performances of "literally thousands of boys and men, including thousands who would be considered second tier in the men's category" *just in 2017 alone:* (data were drawn from the International Association of Athletics Federations (IAAF) website which provides complete, worldwide results for individuals and events, including on an annual and an all-time basis).



Comparing the Best Elite Females to Boys and Men:
Personal Bests for 3 Female Gold Medalists versus 2017 Performances by Boys and Men
Males = 8
Males = 616
Males = 5159
Males = 15057
42
44
46
48
50
Finish Time in Seconds
Sanya Richards-Ross 48.70
Allyson Felix 49.26
Christine Ohuruogu 49.41
>20 Males (Seniors)
U20 Males
U18 Males

24. Professor Coleman and her colleague Wicklyffe Shreve also created the table below (last accessed on February 10, 2022, at https://bitly/37E1s2X), which "compares the number of men-males over 18-competing in events reported to the International Association of Athletics Federation whose results in each event in 2017 would have ranked them above the very best elite woman that year."

TABLE 2 – World's Best Woman v. Number of Men Outperforming			
Event	Best Women's Result	Best Men's Result	# of Men Outperforming
100 Meters	10.71	9.69	2,474
200 Meters	21.77	19.77	2,920
400 Meters	49.46	43.62	4,341
800 Meters	1:55.16*	1:43.10	3,992+
1500 Meters	3:56.14	3:28.80	3,216+
3000 Meters	8:23.14	7:28.73	1307+
5000 Meters	14:18.37	12:55.23	1,243
High Jump	2.06 meters	2.40 meters	777
Pole Vault	4.91 meters	6.00 meters	684
Long Jump	7.13 meters	8.65 meters	1,652
Triple Jump	14.96 meters	18.11 meters	969

25. The male advantage becomes insuperable well before the developmental changes of puberty are complete. Dr. Hilton documents that even "schoolboys"-defined as age 15 and under-have beaten the female world records in running, jumping, and throwing events. (Hilton 2021 at 204.)

26. Similarly, Coleman and Shreve created the table below (last accessed on February 10, 2022, at https://bit.ly/37E1s2X), which "compares the number of boys-males under the age of 18-whose results in each event in 2017 would rank them above the single very best elite [adult] woman that year:" data were drawn from the International Association of Athletics Federations (IAAF) website

TABLE 1 – World's Best Woman v. Under 18 Boys			
Event	Best Women's Result	Best Boys' Result	# of Boys Outperforming
100 Meters	10.71	10.15	124+
200 Meters	21.77	20.51	182
400 Meters	49.46	45.38	285
800 Meters	1:55.16*	1:46.3	201+
1500 Meters	3:56.14	3:37.43	101+
3000 Meters	8:23.14	7:38.90	30
5000 Meters	14:18.37	12:55.58	15
High Jump	2.06 meters	2.25 meters	28
Pole Vault	4.91 meters	5.31 meters	10
Long Jump	7.13 meters	7.88 meters	74
Triple Jump	14.96 meters	17.30 meters	47

27. In an analysis I have performed of running events (consisting of the 100 m, 200 m, 400 m, 800 m, 1500 m, 5000 m, and 10000 m) in the Division 1, Division 2, and Division 3 NCAA Outdoor track championships for the years of 2010-2019, the average performance across all events of the 1st place man was 14.1% faster than the 1st place woman, with the smallest difference being a 10.2% advantage for men in the Division 1 100 m race. The average 8th place man across all events (the last place to earn the title of All American) was 11.2% faster than 1st place woman, with the smallest difference being a 6.5% advantage for men in the Division 1 100 m race. (Brown et al. Unpublished observations, to be presented at the 2022 Annual Meeting of the American College of Sports Medicine.)

28. Athletic.net® is an internet-based resource providing "results, team, and event management tools to help coaches and athletes thrive." Among the resources available on Athletic.net are event records that can be searched by nationally or by state age group, school grade, and state. Higerd (2021) in an evaluation of high school track running performance records from five states(CA, FL, MN, NY, WA), over three years (2017 — 2019)

observed that males were 14.38% faster than females in the 100M (at 99), 16.17% faster in the 200M (at 100), 17.62% faster in the 400M (at 102), 17.96% faster in the 800M (at 103), 17.81% faster in the 1600M (at 105), and 16.83% faster in the 3200M (at 106).

C. Men jump higher and farther.

29. Jumping involves both leg strength and speed as positive factors, with body weight of course a factor working against jump height. Despite their substantially greater body weight, males enjoy an even greater advantage in jumping than in running. Handelsman 2018 at 813, looking at youth and young adults, and Thibault 2010 at 217, looking at Olympic performances, both found male advantages in the range of 15%-20%. See also Tonnessen 2015 (approximately 19%); Handelsman 2017 (19%); Hilton 2021 at 201 (18%). Looking at the vertical jump called for in volleyball, research on elite volleyball players found that males jumped on average 50% higher during an "attack" at the net than did females. (Sattler 2015; see also Hilton 2021 at 203 (33% higher vertical jump).)

30. Higerd (2021) in an evaluation of high school high jump performance available through the track and field database athletic.net®, which included five states (CA, FL, MN, NY, WA), over three years (2017 — 2019) (at 82) observed that in 23,390 females and 26,843 males, females jumped an average of 1.35 m and males jumped an average of 1.62 m, for an 18.18% performance advantage for males (at 96). In an evaluation of long jump performance in 45,705 high school females and 54,506 high school males the females jumped an average of 4.08 m and males jumped an average of 5.20 m, for a 24.14% performance advantage for males (at 97).

31. The combined male advantage of body height and jump height means, for example, that a total of seven women in the WNBA have ever dunked a basketball in the regulation 10 foot hoop,[5] while the ability to dunk appears to be almost universal among NBA players: "Since the 1996-97 season (the earliest data is available from Basketball-Reference.com), 1,801 different [NBA] players have combined for 210,842 regular-season dunks, and 1,259 out of 1,367 players (or 92%) who have played at least 1,000 minutes have dunked at least once."[6]

D. Men throw, hit, and kick faster and farther.

32. Strength, arm-length, and speed combine to give men a large advantage over women in throwing. This has been measured in a number of studies.

33. One study of elite male and female baseball pitchers showed that men throw baseballs 35% faster than women-81 miles/hour for men vs. 60 miles/hour for women. (Chu 2009.) By age 12, "boys' throwing velocity is already between 3.5 and 4 standard deviation units higher than the girls'." (Thomas 1985 at 276.) By age seventeen, the *average* male can throw a ball farther than 99% of seventeen-year-old females. (Lombardo 2018; Chu 2009; Thomas 1985 at 268.) Looking at publicly available data, Hilton & Lundberg found that in both baseball pitching and the field hockey "drag flick," the *record* ball speeds achieved by males are more than 50% higher than those achieved by females. (Hilton 2021 at 202-203.)

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[5] https://www.espn.com/wnba/storyuid/32258450/2021-wnba-playoffs-brittney-griner-owns-wnba-dunking-record-coming-more.

[6] https://www.si.com/nba/2021/02/22/nba-non-dunkers-patty-mills-tj-mcconnell-steve-novak-daily-cover

34. Men achieve serve speeds in tennis more that 15% faster than women; and likewise in golf achieve ball speeds off the tee more than 15% faster than women. (Hilton 2021 at 202.)

35. Males are able to throw a javelin more than 30% farther than females. (Lombardo 2018 Table 2; Hilton 2021 at 203.)

36. Men serve and spike volleyballs with higher velocity than women, with a performance advantage in the range of 29-34%. (Hilton 2021 at 204 Fig. 1.)

37. Men are also able to kick balls harder and faster. A study comparing collegiate soccer players found that males kick the ball with an average 20% greater velocity than females. (Sakamoto 2014.).

E. Males exhibit faster reaction times.

38. Interestingly, men enjoy an additional advantage over women in reaction time—an attribute not obviously related to strength or metabolism (e.g. V02max). "Reaction time in sports is crucial in both simple situations such as the gun shot in sprinting and complex situations when a choice is required. In many team sports this is the foundation for tactical advantages which may eventually determine the outcome of a game." (Dogan 2009 at 92.) "Reaction times can be an important determinant of success in the 100m sprint, where medals are often decided by hundredths or even thousandths of a second." (Tonnessen 2013 at 885.)

39. The existence of a sex-linked difference in reaction times is consistent over a wide range of ages and athletic abilities. (Dykiert 2012.) Even by the age of 4 or 5, in a ruler-drop test, males have been shown to exhibit 4% to 6% faster reaction times than females. (Latorre-Roman

2018.) In high school athletes taking a common baseline "ImPACT" test, males showed 3% faster reaction times than females. (Mormile 2018.) Researchers have found a 6% male advantage in reaction times of both first-year medical students (Jain 2015) and world-class sprinters (Tonnessen 2013).

40. Most studies of reaction times use computerized tests which ask participants to hit a button on a keyboard or to say something in response to a stimulus. One study on NCAA athletes measured "reaction time" by a criterion perhaps more closely related to athletic performance—that is, how fast athletes covered 3.3 meters after a starting signal. Males covered the 3.3 meters 10% faster than females in response to a visual stimulus, and 16% faster than females in response to an auditory stimulus. (Spierer 2010.)

41. Researchers have speculated that sex-linked differences in brain structure, as well as estrogen receptors in the brain, may be the source of the observed male advantage in reaction times, but at present this remains a matter of speculation and hypothesis. (Mormile at 19; Spierer at 962.)

III. Men have large measured physiological differences compared to women which demonstrably or likely explain their performance advantages.

42. No single physiological characteristic alone accounts for all or any one of the measured advantages that men enjoy in athletic performance. However, scientists have identified and measured a number of physiological factors that contribute to superior male performance.

A. Men are taller and heavier than women

43. In some sports, such as basketball and volleyball, height itself provides competitive advantage. While some women are taller than some men, based on data from 20 countries in North America, Europe, East Asia, and Australia, the 50th percentile for body height for women is 164.7 cm (5 ft 5 inches) and the 50^{th} percentile for body height for men is 178.4 cm (5 ft 10 inches). Helping to illustrate the inherent height difference between men and women, from the same data analysis, the **95th** percentile for body height for women is 178.9 cm (5 feet 10.43 inches), which is only 0.5 cm taller than the 50th percentile for men (178.4 cm; 5 feet 10.24 inches), while the 95th percentile for body height for men is 193.6 cm (6 feet 4.22 inches). (Roser 2013.)

44. To look at a specific athletic population, an evaluation of NCAA Division 1 basketball players compared 68 male guards and 59 male forwards to 105 female guards and 91 female forwards, and found that on average the male guards were 187.4 ± 7.0 cm tall and weighed 85.2 ± 7.4 kg while the female guards were 171.6 ± 5.0 cm tall and weighed 68.0 ± 7.4 kg. The male forwards were 201.7 ± 4.0 cm tall and weighed 105.3 ± 5.9 kg while the female forwards were 183.5 ± 4.4 cm tall and weighed 82.2 ± 12.5 kg. (Fields 2018 at 3.)

B. Males have larger and longer bones, stronger bones, and different bone configuration.

45. Obviously, males on average have longer bones. "Sex differences in height have been the most thoroughly investigated measure of bone size, as adult height is a stable, easily quantified measure in large population samples. Extensive twin studies show that adult height is highly heritable with predominantly additive genetic effects that diverge in a sex-specific manner from the age of puberty

onwards." (Handelsman 2018 at 818.) "Pubertal testosterone exposure leads to an ultimate average greater height in men of 12-15 centimeters, larger bones, greater muscle mass, increased strength and higher hemoglobin levels." (G-ooren 2011 at 653.)

46. "Men have distinctively greater bone size, strength, and density than do women of the same age. As with muscle, sex differences in bone are absent prior to puberty but then accrue progressively from the onset of male puberty due to the sex difference in exposure to adult male circulating testosterone concentrations." (Handelsman 2018 at 818.)

47. "[O]n average men are 7% to 8% taller with longer, denser, and stronger bones, whereas women have shorter humerus and femur cross-sectional areas being 65% to 75% and 85%, respectively, those of men." (Handelsman 2018 at 818.)

48. Greater height, leg, and arm length themselves provide obvious advantages in several sports. But male bone geometry also provides less obvious advantages. "The major effects of men's larger and stronger bones would be manifest via their taller stature as well as the larger fulcrum with greater leverage for muscular limb power exerted in jumping, throwing, or other explosive power activities." (Handelsman 2018 at 818.)

49. Male advantage in bone size is not limited to length, as larger bones provide the mechanical framework for larger muscle mass. "From puberty onwards, men have, on average, 10% more bone providing more surface area. The larger surface area of bone accommodates more skeletal muscle so, for example, men have broader shoulders allowing more muscle to build. This translates into 44% less upper body strength for women, providing

men an advantage for sports like boxing, weightlifting and skiing. In similar fashion, muscle mass differences lead to decreased trunk and lower body strength by 64% and 72%, respectively in women. These differences in body strength can have a significant impact on athletic performance, and largely underwrite the significant differences in world record times and distances set by men and women." (Knox 2019 at 397.)

50. Meanwhile, distinctive aspects of the female pelvis geometry cut against athletic performance. "[T]he widening of the female pelvis during puberty, balancing the evolutionary demands of obstetrics and locomotion, retards the improvement in female physical performance." (Handelsman 2018 at 818.) "[T]he major female hormones, oestrogens, can have effects that disadvantage female athletic performance. For example, women have a wider pelvis changing the hip structure significantly between the sexes. Pelvis shape is established during puberty and is driven by oestrogen. The different angles resulting from the female pelvis leads to decreased joint rotation and muscle recruitment ultimately making them slower." (Knox 2019 at 397.)

51. There are even sex-based differences in foot size and shape. Wunderlich & Cavanaugh (2001) observed that a "foot length of 257 mm represents a value that is ... approximately the 20th percentile men's foot lengths and the 80th percentile women's foot lengths." (607) and "For a man and a woman, both with statures of 170 cm (5 feet 7 inches), the man would have a foot that was approximately 5 mm longer and 2 mm wider than the woman." (608). Based on these, and other analyses, they conclude that "female feet and legs are not simply scaled-down versions of male feet but rather differ in a number of shape characteristics, particularly at the arch, the lateral side of

the foot, the first toe, and the ball of the foot." (605) Further, Fessler et al. (2005) observed that "female foot length is consistently smaller than male foot length" (44) and concludes that "proportionate foot length is smaller in women" (51) with an overall conclusion that "Our analyses of genetically disparate populations reveal a clear pattern of sexual dimorphism, with women consistently having smaller feet proportionate to stature than men." (53)

52. Beyond simple performance, the greater density and strength of male bones provide higher protection against stresses associated with extreme physical effort: "[S]tress fractures in athletes, mostly involving the legs, are more frequent in females, with the male protection attributable to their larger and thicker bones." (Handelsman 2018 at 818.)

C. Males have much larger muscle mass.

53. The fact that, on average, men have substantially larger muscles than women is as well known to common observation as men's greater height. But the male advantage in muscle size has also been extensively measured. The differential is large.

54. "On average, women have 50% to 60% of men's upper arm muscle cross-sectional area and 65% to 70% of men's thigh muscle cross-sectional area, and women have 50% to 60% of men's upper limb strength and 60% to 80% of men's leg strength. Young men have on average a skeletal muscle mass of >12 kg greater than age-matched women at any given body weight." (Handelsman 2018 at 812. See also Gooren 2011 at 653, Thibault 2010 at 214.)

55. "There is convincing evidence that the sex differences in muscle mass and strength are sufficient to account for the increased strength and aerobic performance of men compared with women and is in

keeping with the differences in world records between the sexes." (Handelsman 2018 at 816.)

56. Once again, looking at specific and comparable populations of athletes, an evaluation of NCAA Division 1 basketball players consisting of 68 male guards and 59 male forwards, compared to 105 female guards and 91 female forwards, reported that on average the male guards had 77.7 ± 6.4 kg of fat free mass and 7.4 ± 3.1 kg fat mass while the female guards had 54.6 ± 4.4 kg fat free mass and 13.4 ± 5.4 kg fat mass. The male forwards had 89.5 ± 5.9 kg fat free mass and 15.9 ± 5.6 kg fat mass while the female forwards had 61.8 ± 5.9 kg fat free mass and 20.5 ± 7.7 kg fat mass. (Fields 2018 at 3.)

D. Females have a larger proportion of body fat.

57. While women have smaller muscles, they have proportionately more body fat, in general a negative for athletic performance. "Oestrogens also affect body composition by influencing fat deposition. Women, on average, have higher percentage body fat, and this holds true even for highly trained healthy athletes (men 5%-10%, women 8%-15%). Fat is needed in women for normal reproduction and fertility, but it is not performance-enhancing. This means men with higher muscle mass and less body fat will normally be stronger kilogram for kilogram than women." (Knox 2019 at 397.)

58. "[E]lite females have more (<13 vs. <5 %) body fat than males. Indeed, much of the difference in [maximal oxygen uptake] between males and females disappears when it is expressed relative to lean body mass. . . . Males possess on average 7-9 % less percent body fat than females." (Lepers 2013 at 853.)

59. Knox et al. observe that both female pelvis shape and female body fat levels "disadvantage female athletes

in sports in which speed, strength and recovery are important," (Knox 2019 at 397), while Tonnessen et al. describe the "ratio between muscular power and total body mass" as "critical" for athletic performance. (Tennessen 2015 at 7.)

E. Males are able to metabolize and release energy to muscles at a higher rate due to larger heart and lung size, and higher hemoglobin concentrations.

60. While advantages in bone size, muscle size, and body fat are easily perceived and understood by laymen, scientists also measure and explain the male athletic advantage at a more abstract level through measurements of metabolism, or the ability to deliver energy to muscles throughout the body.

61. Energy release at the muscles depends centrally on the body's ability to deliver oxygen to the muscles, where it is essential to the complex chain of biochemical reactions that make energy available to power muscle fibers. Men have multiple distinctive physiological attributes that together give them a large advantage in oxygen delivery.

62. Oxygen is taken into the blood in the lungs. Men have greater capability to take in oxygen for multiple reasons. **"[L]ung capacity** [is] larger in men because of a lower diaphragm placement due to Y-chromosome genetic determinants." (Knox 2019 at 397.) Supporting larger lung capacity, men have "greater cross-sectional area of the trachea"; that is, they can simply move more air in and out of their lungs in a given time. (Hilton 2021 at 201.)

63. More, male lungs provide superior oxygen exchange even for a given volume: "The greater lung volume is complemented by testosterone-driven **enhanced alveolar multiplication** rate during the early

years of life. Oxygen exchange takes place between the air we breathe and the bloodstream at the alveoli, so more alveoli allows more oxygen to pass into the bloodstream. Therefore, the greater lung capacity allows more air to be inhaled with each breath. This is coupled with an improved uptake system allowing men to absorb more oxygen." (Knox 2019 at 397.)

64. "Once in the blood, oxygen is carried by haemoglobin. **Haemoglobin concentrations** are directly modulated by testosterone so men have higher levels and can carry more oxygen than women." (Knox 2019 at 397.) "It is well known that levels of circulating hemoglobin are androgen-dependent and consequently higher in men than in women by 12% on average.... Increasing the amount of hemoglobin in the blood has the biological effect of increasing oxygen transport from lungs to tissues, where the increased availability of oxygen enhances aerobic energy expenditure." (Handelsman 2018 at 816.) (See also Lepers 2013 at 853; Handelsman 2017 at 71.) "It may be estimated that as a result the average maximal oxygen transfer will be —10% greater in men than in women, which has a direct impact on their respective athletic capacities." (Handelsman 2018 at 816.)

65. But the male metabolic advantage is further multiplied by the fact that men are also able to **circulate more blood per second** than are women. "Oxygenated blood is pumped to the active skeletal muscle by the heart. The left ventricle chamber of the heart is the reservoir from which blood is pumped to the body. The larger the left ventricle, the more blood it can hold, and therefore, the more blood can be pumped to the body with each heartbeat, a physiological parameter called `stroke volume'.The female heart size is, on average, 85% that of a male resulting in the stroke volume of women being

around 33% less." (Knox 2018 at 397.) Hilton cites different studies that make the same finding, reporting that men on average can pump 30% more blood through their circulatory system per minute ("cardiac output") than can women. (Hilton 2021 at 202.)

66. Finally, at the cell where the energy release is needed, men appear to have yet another advantage. "Additionally, there is experimental evidence that testosterone increases . . . **mitochondrial biogenesis,** myoglobin expression, and IGF-1 content, which may augment energetic and power generation of skeletal muscular activity." (Handelsman 2018 at 811.)

67. "Putting all of this together, men have a much more efficient cardiovascular and respiratory system." (Knox 2019 at 397.) A widely accepted measurement that reflects the combined effects of all these respiratory, cardiovascular, and metabolic advantages is referred to as "V02max," which refers to the maximum rate at which an individual can consume oxygen during aerobic exercise.[7] Looking at 11 separate studies, including both trained and untrained individuals, Pate et al. concluded that men have a 50% higher VO2max than women on average, and a 25% higher VO2max in relation to body weight. (Pate 1984 at 92. See also Hilton 2021 at 202.)

IV. The role of testosterone in the development of male advantages in athletic performance.

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[7] VO2max is "based on hemoglobin concentration, total blood volume, maximal stroke volume, cardiac size/mass/compliance, skeletal muscle blood flow, capillary density, and mitochondrial content." International Statement, *The Role of Testosterone in Athletic Performance* (January 2019), available at https://law.duke.edu/sites/default/files/centers/sportslaw/Experts_T_Statement_201 9.pdf.

68. The following tables of reference ranges for circulating testosterone in males and females are presented to help provide context for some of the subsequent information regarding athletic performance and physical fitness in children, youth, and adults, and regarding testosterone suppression in transwomen and athletic regulations. These data were obtained from the Mayo Clinic Laboratories (available at https://www.mayocliniclabs.com/test-catalog/overview/83686#Clinical-and-Interpretive, accessed January 14, 2022).

Reference ranges for serum testosterone concentrations in males and females.

Age	**Males**	**Females**
0 – 5 months	2.6 – 13.9 nmol/l	0.7 – 2.8 nmol/l
6 months – 9 years	0.2 – 0.7 nmol/l	0.2 – 0.7 nmol/l
10 – 11 years	0.2 – 4.5 nmol/l	0.2 – 1.5 nmol/l
12 -13 years	0.2 – 27.7 nmol/l	0.2 – 2.6 nmol/l
14 years	0.2 – 41.6 nmol/l	0.2 – 2.6 nmol/l
15 – 16 years	3.5 – 41.6 nmol/l	0.2 – 2.6 nmol/l
17 – 18 years	10.4 – 41.6 nmol/l	0.7 – 2.6 nmol/l
19 years and older	8.3 – 32.9 nmol/l	0.3 – 2.1 nmol/l

Please note that testosterone concentrations are sometimes expressed in units of ng/dl, and 1 nmo1/1 = 28.85 ng/dl.

69. Tanner Stages can be used to help evaluate the onset and progression of puberty and may be more helpful in evaluating normal testosterone concentrations than age in adolescents. “Puberty onset (transition from Tanner stage I to Tanner stage II) occurs for boys at a median age

of 11.5 years and for girls at a median age of 10.5 years. . . . Progression through Tanner stages is variable. Tanner stage V (young adult) should be reached by age 18." (https://www.mayocliniclabs.com/test-catalog/overview/83686#Clinical-and-Interpretive, accessed January 14, 2022).

Reference Ranges for serum testosterone concentrations by Tanner stage

Tanner Stage	**Males**	**Females**
I (prepubertal)	0.2 – 0.7 nmol/l	0.7 – 0.7 nmol/l
II	0.3 – 2.3 nmo/l	0.2 – 1.6 nmol/l
III	0.9 – 27.7 nmol/l	0.6 – 2.6 nmol/l
IV	2.9 – 41.6 nmol/l	0.7 – 2.6 nmol/l
V (young adult)	10.4 – 32.9 nmol/	0.4 – 2.1 nmol/l

70. Senefeld et al. (2020 at 99) state that "Data on testosterone levels in children and adolescents segregated by sex are scarce and based on convenience samples or assays with limited sensitivity and accuracy." They therefore "analyzed the timing of the onset and magnitude of the divergence in testosterone in youths aged 6 to 20 years by sex using a highly accurate assay" (isotope dilution liquid chromatography tandem mass spectrometry). Senefeld observed a significant difference beginning at age 11, which is to say about fifth grade.

Serum testosterone concentrations (nmol/L) in youths aged 6 to 20 years measured using isotope dilution liquid chromatography tandem mass spectrometry (Senefeld et al. ,2020, at 99)

	Boys			Girls		
Age (y)	**5th**	**50th**	**95th**	**5th**	**50th**	**95th**
6	0.0	0.1	0.2	0.0	0.1	0.2
7	0.0	0.1	0.2	0.0	0.1	0.3
8	0.0	0.1	0.3	0.0	0.1	0.3
9	0.0	0.1	0.3	0.1	0.2	0.6
10	0.1	0.2	2.6	0.1	0.3	0.9
11	0.1	0.5	11.3	0.2	0.5	1.3
12	0.3	3.6	17.2	0.2	0.7	1.4
13	0.6	9.2	21.5	0.3	0.8	1.5
14	2.2	11.9	24.2	0.3	0.8	1.6
15	4.9	13.2	25.8	0.4	0.8	1.8
16	5.2	14.9	24.1	0.4	0.9	2.0
17	7.6	15.4	27.0	0.5	1.0	2.0
18	9.2	16.3	25.5	0.4	0.9	2.1
19	8.1	17.2	27.9	0.4	0.9	2.3
20	6.5	17.9	29.9	0.4	1.0	3.4

A. Boys exhibit advantages in athletic performance even before puberty.

71. It is often said or assumed that boys enjoy no significant athletic advantage over girls before puberty. However, this is not true. Writing in their seminal work on the physiology of elite young female athletes, McManus and Armstrong (2011) reviewed the differences between boys and girls regarding bone density, body composition, cardiovascular function, metabolic function, and other physiologic factors that can influence athletic performance. They stated, "At birth, boys tend to have a greater lean mass than girls. This difference remains

small but detectable throughout childhood with about a 10% greater lean mass in boys than girls prior to puberty." (28) "Sexual dimorphism underlies much of the physiologic response to exercise," and most importantly these authors concluded that, "Young girl athletes are not simply smaller, less muscular boys." (23)

72. Certainly, boys' physiological and performance advantages increase rapidly from the beginning of puberty until around age 17-19. But much data and multiple studies show that significant physiological differences, and significant male athletic performance advantages in certain areas, exist before significant developmental changes associated with male puberty have occurred.

73. Starting at birth, girls have more body fat and less fat-free mass than boys. Davis et al. (2019) in an evaluation of 602 infants reported that at birth and age 5 months, infant boys have larger total body mass, body length, and fat-free mass while having lower percent body fat than infant girls. In an evaluation of 20 boys and 20 girls ages 3-8 years old, matched for age, height, and body weight Taylor et al. (Taylor 1997) reported that the "boys had significantly less fat, a lower % body fat and a higher bone-free lean tissue mass than the girls" when "expressed as a percentage of the average fat mass of the boys", the girls' fat mass was 52% higher than the boys "...while the bone-free lean tissue mass was 9% lower" (at 1083.) In an evaluation of 376 prepubertal [Tanner Stage 1] boys and girls, Taylor et al. (2010) observed that the boys had 21.6% more lean mass, and 13% less body fat (when expressed as percent of total body mass) than did the girls. In a review of 22 peer reviewed publications on the topic, Staiano and Katzmarzyk (2012) conclude that "... girls have more

T[otal]B[ody]F[at] than boys throughout childhood and adolescence. (at 4.)

74. In the seminal textbook, *Growth, Maturation, and Physical Activity,* Malina et al. (2004) present a summary of data from Gauthier et al. (1983) which present data from "a national sample of Canadian children and youth" demonstrating that from ages 7 to17, boys have a higher aerobic power output than do girls of the same ages when exercise intensity is measured using heart rate (Malina at 242.) That is to say, that at a heart rate of 130 beats per minute, or 150, or 170, a 7 to 17 year old boy should be able to run, bike, or swim faster than a similarly aged girl.

75. Considerable data from school-based fitness testing exists showing that prepubertal boys outperform comparably aged girls in tests of muscular strength, muscular endurance, and running speed. These sex-based differences in physical fitness are relevant to the current issue of sex-based sports categories because, as stated by Lesinski et al. (2020), in an evaluation "of 703 male and female elite young athletes aged 8-18" (1) "fitness development precedes sports specialization" (2) and further observed that "males outperformed females in C[ounter]M[ovement]J[ump], D[rop]J[ump], C[hange]o[f] D[irection speed] performances and hand grip strength." (5).

76. Tambalis et al. (2016) states that "based on a large data set comprising 424,328 test performances" (736) using standing long jump to measure lower body explosive power, sit and reach to measure flexibility, timed 30 second sit ups to measure abdominal and hip flexor muscle endurance, 10 x 5 meter shuttle run to evaluate speed and agility, and multi-stage 20 meter shuttle run test to estimate aerobic performance (738). "For each of the fitness tests, performance was better in boys compared

with girls ($p < 0.001$), except for the S[it and] R[each] test ($p < 0.001$).” (739) In order to illustrate that the findings of Tambalis (2016) are not unique to children in Greece, the authors state “Our findings are in accordance with recent studies from Latvia [ ] Portugal [ ] and Australia [Catley & Tomkinson (2013)].”(744).

77. The 20-m multistage fitness test is a commonly used maximal running aerobic fitness test used in the Eurofit Physical Fitness Test Battery and the FitnessGram Physical Fitness test. It is also known as the 20-meter shuttle run test, PACER test, or beep test (among other names; this is not the same test as the shuttle run in the Presidential Fitness Test). This test involves continuous running between two lines 20 meters apart in time to recorded beeps. The participants stand behind one of the lines facing the second line and begin running when instructed by the recording. The speed at the start is quite slow. The subject continues running between the two lines, turning when signaled by the recorded beeps. After about one minute, a sound indicates an increase in speed, and the beeps will be closer together. This continues each minute (level). If the line is reached before the beep sounds, the subject must wait until the beep sounds before continuing. If the line is not reached before the beep sounds, the subject is given a warning and must continue to run to the line, then turn and try to catch up with the pace within two more ‘beeps’. The subject is given a warning the first time they fail to reach the line (within 2 meters) and eliminated after the second warning.

78. To illustrate the sex-based performance differences observed by Tambalis, I have prepared the following table showing the number of laps completed in the 20 m shuttle run for children ages 6-18 years for the low, middle, and top decile (Tambalis 2016 at 740 & 742), and have

calculated the percent difference between the boys and girls using the same equation as Millard-Stafford (2018).

Number of laps completed in the 20m shuttle run for children ages 6-18 years

	Male			Female			Male-Female % Difference		
Age	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile
6	4	14	31	4.0	12.0	26.0	0.0%	16.7%	19.2%
7	8	18	38	8.0	15.0	29.0	0.0%	20.0%	31.0%
8	9	23	47	9.0	18.0	34.0	0.0%	27.8%	38.2%
9	11	28	53	10.0	20.0	40.0	10.0%	40.0%	32.5%
10	12	31	58	11.0	23.0	43.0	9.1%	34.8%	34.9%
11	15	36	64	12.0	26.0	48.0	25.0%	38.5%	33.3%
12	15	39	69	12.0	26.0	49.0	25.0%	50.0%	40.8%
13	16	44	76	12.0	26.0	50.0	33.3%	69.2%	52.0%
14	19	50	85	12.0	26.0	50.0	58.3%	92.3%	70.0%
15	20	53	90	12.0	25.0	47.0	66.7%	112.0%	91.5%
16	20	54	90	11.0	24.0	45.0	81.8%	125.0%	100.0%
17	18	50	86	10.0	23.0	50.0	80.0%	117.4%	72.0%
18	13	48	87	8.0	23.0	39.5	62.5%	108.7%	120.3%

79. The Presidential Fitness Test was widely used in schools in the United States from the late 1950s until 2013 (when it was phased out in favor of the Presidential Youth Fitness Program and FitnessGram, both of which focus on health-related physical fitness and do not present data in percentiles). Students participating in the Presidential Fitness Test could receive "The National Physical Fitness Award" for performance equal to the 50th percentile in five areas of the fitness test, "while performance equal to the 85th percentile could receive the Presidential Physical Fitness Award." Tables presenting the 50th and 85th percentiles for the Presidential Fitness Test for males and females ages 6 - 17, and differences in performance between males and females, for curl-ups, shuttle run, 1 mile run, push-ups, and pull-ups appear in the Appendix.

80. For both the 50th percentile (The National Physical Fitness Award) and the 85th percentile (Presidential Physical Fitness Award), with the exception of curl-ups in 6-year-old children, boys outperform girls.

The difference in pull-ups for the 85th percentile for ages 7 through 17 are particularly informative with boys outperforming girls by 100% - 1200%, highlighting the advantages in upper body strength in males.

81. A very recent literature review commissioned by the five United Kingdom governmental Sport Councils concluded that while "[i]t is often assumed that children have similar physical capacity regardless of their sex, . . . large-scale data reports on children from the age of six show that young males have significant advantage in cardiovascular endurance, muscular strength, muscular endurance, speed/agility and power tests," although they "score lower on flexibility tests." (UK Sports Councils' Literature Review 2021 at 3.)

82. Hilton et al., also writing in 2021, reached the same conclusion: "An extensive review of fitness data from over 85,000 Australian children aged 9-17 years old showed that, compared with 9-year-old females, 9-year-old males were faster over short sprints (9.8%) and 1 mile (16.6%), could jump 9.5% further from a standing start (a test of explosive power), could complete 33% more push-ups in 30 [seconds] and had 13.8% stronger grip." (Hilton 2021 at 201, summarizing the findings of Catley & Tomkinson 2013.)

83. The following data are taken from Catley & Tomkinson (2013 at 101) showing the low, middle, and top decile for 1.6 km run (1.0 mile) run time for 11,423 girls and boys ages 9-17.

1.6 km run (1.0 mile) run time for 11,423 girls and boys ages 9-17

	Male			Female			Male-Female % Difference		
Age	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile
9	684	522	423	769.0	609.0	499.0	11.1%	14.3%	15.2%
10	666	511	420	759.0	600.0	494.0	12.3%	14.8%	15.0%
11	646	500	416	741.0	586.0	483.0	12.8%	14.7%	13.9%
12	621	485	408	726.0	575.0	474.0	14.5%	15.7%	13.9%
13	587	465	395	716.0	569.0	469.0	18.0%	18.3%	15.8%
14	556	446	382	711.0	567.0	468.0	21.8%	21.3%	18.4%
15	531	432	373	710.0	570.0	469.0	25.2%	24.2%	20.5%
16	514	423	366	710.0	573.0	471.0	27.6%	26.2%	22.3%
17	500	417	362	708.0	575.0	471.0	29.4%	27.5%	23.1%

84. Tomkinson et al. (2018) performed a similarly extensive analysis of literally millions of measurements of a variety of strength and agility metrics from the "Eurofit" test battery on children from 30 European countries. They provide detailed results for each metric, broken out by decile. Sampling the low, middle, and top decile, 9-year-old boys performed better than 9-year-old girls by between 6.5% and 9.7% in the standing broad jump; from 11.4% to 16.1% better in handgrip; and from 45.5% to 49.7% better in the "bent-arm hang." (Tomkinson 2018.)

85. The Bent Arm Hang test is a measure of upper body muscular strength and endurance used in the Eurofit Physical Fitness Test Battery. To perform the Bent Arm Hang, the child is assisted into position with the body lifted to a height so that the chin is level with the horizontal bar (like a pull up bar). The bar is grasped with the palms facing away from body and the hands shoulder width apart. The timing starts when the child is released. The child then attempts to hold this position for as long as possible. Timing stops when the child's chin falls below the level of the bar, or the head is tilted backward to enable the chin to stay level with the bar.

86. Using data from Tomkinson (2018; table 7 at 1452), the following table sampling the low, middle, and top

decile for bent arm hang for 9- to 17-year-old children can be constructed:

Bent Arm Hang time (in seconds) for children ages 9 – 17 years

	Male			Female			Male-Female % Difference		
Age	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile
9	2.13	7.48	25.36	1.43	5.14	16.94	48.95%	45.53%	49.70%
10	2.25	7.92	26.62	1.42	5.15	17.06	58.45%	53.79%	56.04%
11	2.35	8.32	27.73	1.42	5.16	17.18	65.49%	61.24%	61.41%
12	2.48	8.79	28.99	1.41	5.17	17.22	75.89%	70.02%	68.35%
13	2.77	9.81	31.57	1.41	5.18	17.33	96.45%	89.38%	82.17%
14	3.67	12.70	38.39	1.40	5.23	17.83	162.14%	142.83%	115.31%
15	5.40	17.43	47.44	1.38	5.35	18.80	291.30%	225.79%	152.34%
16	7.39	21.75	53.13	1.38	5.63	20.57	435.51%	286.32%	158.29%
17	9.03	24.46	54.66	1.43	6.16	23.61	531.47%	297.08%	131.51%

87. Evaluating these data, a 9-year-old boy in the 50th percentile (that is to say a 9-year-old boy of average upper body muscular strength and endurance) will perform better in the bent arm hang test than 9 through 17-year-old girls in the 50th percentile. Similarly, a 9-year-old boy in the 90th percentile will perform better in the bent arm hang test than 9 through 17-year-old girls in the 90th percentile.

88. Using data from Tomkinson et al. (2017; table 1 at 1549), the following table sampling the low, middle, and top decile for running speed in the last stage of the 20 m shuttle run for 9- to 17-year-old children can be constructed.

20 m shuttle Running speed (km/h at the last completed stage)

	Male			Female			Male-Female % Difference		
Age	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**
9	8.94	10.03	11.13	8.82	9.72	10.61	1.36%	3.19%	4.90%
10	8.95	10.13	11.31	8.76	9.75	10.74	2.17%	3.90%	5.31%
11	8.97	10.25	11.53	8.72	9.78	10.85	2.87%	4.81%	6.27%
12	9.05	10.47	11.89	8.69	9.83	10.95	4.14%	6.51%	8.58%
13	9.18	10.73	12.29	8.69	9.86	11.03	5.64%	8.82%	11.42%
14	9.32	10.96	12.61	8.70	9.89	11.07	7.13%	10.82%	13.91%
15	9.42	11.13	12.84	8.70	9.91	11.11	8.28%	12.31%	15.57%
16	9.51	11.27	13.03	8.71	9.93	11.14	9.18%	13.49%	16.97%
17	9.60	11.41	13.23	8.72	9.96	11.09	10.09%	14.56%	19.30%

89. Evaluating these data, a 9-year-old boy in the 50th percentile (that is to say a 9-year-old boy of average running speed) will run faster in the final stage of the 20 m shuttle run than 9 through 17-year-old girls in the 50th percentile. Similarly, a 9-year-old boy in the 90th percentile will run faster in the final stage of the 20-m shuttle run than 9 through 15, and 17-year-old girls in the 90th percentile and will be 0.01 km/h (0.01%) slower than 16-year-old girls in the 90th percentile.

90. Just using these two examples for bent arm hang and 20-m shuttle running speed (Tomkinson 2107, Tomkinson 2018) based on large sample sizes (thus having tremendous statistical power) it becomes apparent that a 9-year-old boy will be very likely to outperform similarly trained girls of his own age and older in athletic events involving upper body muscle strength and/or running speed.

91. Another report published in 2014 analyzed physical fitness measurements of 10,302 children aged 6 -10.9 years of age, from the European countries of Sweden, Germany, Hungary, Italy, Cyprus, Spain, Belgium, and Estonia. (De Miguel-Etayo et al. 2014.) The authors observed "... that boys performed better than girls in speed, lower- and upper-limb strength and cardiorespiratory fitness." (57) The data showed that for children of comparable fitness

(i.e. 99th percentile boys vs. 99th percentile girls, 50th percentile boys vs. 50th percentile girls, etc.) the boys outperform the girls at every age in measurements of handgrip strength, standing long jump, 20-m shuttle run, and predicted VO_2max (pages 63 and 64, respectively). For clarification, VO_2max is the maximal oxygen consumption, which correlates to 30-40% of success in endurance sports.

92. The standing long jump, also called the Broad Jump, is a common and easy to administer test of explosive leg power used in the Eurofit Physical Fitness Test Battery and in the NFL Combine. In the standing long jump, the participant stands behind a line marked on the ground with feet slightly apart. A two-foot take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The participant attempts to jump as far as possible, landing on both feet without falling backwards. The measurement is taken from takeoff line to the nearest point of contact on the landing (back of the heels) with the best of three attempts being scored.

93. Using data from De Miguel-Etayo et al. (2014, table 3 at 61), which analyzed physical fitness measurements of 10,302 children aged 6 -10.9 years of age, from the European countries of Sweden, Germany, Hungary, Italy, Cyprus, Spain, Belgium, and Estonia, the following table sampling the low, middle, and top decile for standing long jump for 6- to 9-year-old children can be constructed:

Standing Broad Jump (cm) for children ages 6-9 years

	Male			Female			Male-Female % Difference		
Age	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile
6-<6.5	77.3	103.0	125.3	69.1	93.8	116.7	11.9%	9.8%	7.4%
6.5-<7	82.1	108.0	130.7	73.6	98.7	121.9	11.5%	9.4%	7.2%
7-<7.5	86.8	113.1	136.2	78.2	103.5	127.0	11.0%	9.3%	7.2%
7.5-<8	91.7	118.2	141.6	82.8	108.3	132.1	10.7%	9.1%	7.2%
8-<8.5	96.5	123.3	146.9	87.5	113.1	137.1	10.3%	9.0%	7.1%
8.5-<9	101.5	128.3	152.2	92.3	118.0	142.1	10.0%	8.7%	7.1%

94. Another study of Eurofit results for over 400,000 Greek children reported similar results. "[C]ompared with 6-year-old females, 6-year-old males completed 16.6% more shuttle runs in a given time and could jump 9.7% further from a standing position." (Hilton 2021 at 201, summarizing findings of Tambalis et al. 2016.)

95. Silverman (2011) gathered hand grip data, broken out by age and sex, from a number of studies. Looking only at the nine direct comparisons within individual studies tabulated by Silverman for children aged 7 or younger, in eight of these the boys had strength advantages of between 13 and 28 percent, with the remaining outlier recording only a 4% advantage for 7-year-old boys. (Silverman 2011 Table 1.)

96. To help illustrate the importance of one specific measure of physical fitness in athletic performance, Pocek (2021) stated that to be successful, volleyball "players should distinguish themselves, besides in skill level, in terms of above-average body height, upper and lower muscular power, speed, and agility. Vertical jump is a fundamental part of the spike, block, and serve." (8377) Pocek further stated that "relative vertical jumping ability is of great importance in volleyball regardless of the players' position, while absolute vertical jump values can differentiate players not only in terms of player position and performance level but in their career trajectories." (8382)

97. Using data from Ramirez-Velez (2017; table 2 at 994) which analyzed vertical jump measurements of 7,614 healthy Colombian schoolchildren aged 9 -17.9 years of age the following table sampling the low, middle, and top decile for vertical jump can be constructed:

Vertical Jump Height (cm) for children ages 9 - 17 years

	Male			Female			Male-Female % Difference		
Age	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile
9	18.0	24.0	29.5	16.0	22.3	29.0	12.5%	7.6%	1.7%
10	19.5	25.0	32.0	18.0	24.0	29.5	8.3%	4.2%	8.5%
11	21.0	27.0	32.5	19.5	25.0	31.0	7.7%	8.0%	4.8%
12	22.0	27.5	34.5	20.0	25.5	31.5	10.0%	7.8%	9.5%
13	23.0	30.5	39.0	19.0	25.5	32.0	21.1%	19.6%	21.9%
14	23.5	32.0	41.5	20.0	25.5	32.5	17.5%	25.5%	27.7%
15	26.0	35.5	43.0	20.2	26.0	32.5	28.7%	36.5%	32.3%
16	28.0	36.5	45.1	20.5	26.5	33.0	36.6%	37.7%	36.7%
17	28.0	38.0	47.0	21.5	27.0	35.0	30.2%	40.7%	34.3%

98. Similarly, using data from Taylor (2010; table 2, at 869) which analyzed vertical jump measurements of 1,845 children aged 10 -15 years in primary and secondary schools in the East of England, the following table sampling the low, middle, and top decile for vertical jump can be constructed:

Vertical Jump Height (cm) for children 10 -15 years

	Male			Female			Male-Female % Difference		
Age	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile
10	16.00	21.00	29.00	15.00	22.00	27.00	6.7%	-4.5%	7.4%
11	20.00	27.00	34.00	19.00	25.00	32.00	5.3%	8.0%	6.3%
12	23.00	30.00	37.00	21.00	27.00	33.00	9.5%	11.1%	12.1%
13	23.00	32.00	40.00	21.00	26.00	34.00	9.5%	23.1%	17.6%
14	26.00	36.00	44.00	21.00	28.00	34.00	23.8%	28.6%	29.4%
15	29.00	37.00	44.00	21.00	28.00	39.00	38.1%	32.1%	12.8%

99. As can be seen from the data from Ramirez-Velez (2017) and Taylor (2010), males consistently outperform females of the same age and percentile in vertical jump

height. Both sets of data show that an 11-year-old boy in the 90th percentile for vertical jump height will outperform girls in the 90th percentile at ages 11 and 12, and will be equal to girls at ages 13, 14, and possibly 15. These data indicate that an 11-year-old would be likely to have an advantage over girls of the same age and older in sports such as volleyball where "absolute vertical jump values can differentiate players not only in terms of player position and performance level but in their career trajectories." (Pocek 2021 at 8382.)

100. Boys also enjoy an advantage in throwing well before puberty. "Boys exceed girls in throwing velocity by 1.5 standard deviation units as early as 4 to 7 years of age. . . The boys exceed the girls [in throwing distance] by 1.5 standard deviation units as early as 2 to 4 years of age." (Thomas 1985 at 266.) This means that the average 4- to 7-year-old boy can out-throw approximately 87% of all girls of his age.

101. Record data from USA Track & Field indicate that boys outperform girls in track events even in the youngest age group for whom records are kept (age 8 and under).[8]

American Youth Outdoor Track & Field Record Times (Age 8 and Under)

Event	Boys	Girls	Difference
100M	13.65	13.78	0.95%
200M	27.32	28.21	3.26%

[8] http://legacy.usatf.org/statistics/records/view.asp?division=american&location=outdoor%20track%20%26%20field&age=youth&sport=TF

Event	Boys	Girls	Difference
400M	62.48	66.10	5.79%
800M	148.59	158.11	6.41%
1500M	308.52	314.72	2.01%
Mean			**3.68%**

102. Looking at the best times within a single year shows a similar pattern of consistent advantage for even young boys. I consider the 2018 USATF Region 8 Junior Olympic Championships for the youngest age group (8 and under).[9]

2018 USATF Region 8 Junior Olympic Championships (Age 8 and Under)

Event	Boys	Girls	Difference
100M	15.11	15.64	3.51%
200M	30.79	33.58	9.06%
400M	71.12	77.32	8.72%
800M	174.28	180.48	3.56%
1500M	351.43	382.47	8.83%

[9] https://www.athletic.net/TrackAndField/meet/384619/results/m/1/100m;
https://www.athletic.net/CrossCountry/Division/List.aspx?DivID=62211

Event	Boys	Girls	Difference
Mean			**6.74%**

103. Using Athletic.net[9], for 2021 Cross Country and Track & Field data for boys and girls in the 7-8, 9-10, and 11-12 year old age group club reports, and for 5th, 6th, and 7th grade for the whole United States I have compiled the tables for 3000 m events, and for the 100-m, 200-m, 400-m, 800-m, 1600-m, 3000-m, long jump, and high jump Track and Field data to illustrate the differences in individual athletic performance between boys and girls, all of which appear in the Appendix. The pattern of males outperforming females was consistent across events, with rare anomalies, only varying in the magnitude of difference between males and females.

104. Similarly, using Athletic.net, for 2021 Track & Field data for boys and girls in the 6th grade for the state of West Virginia, I have compiled tables, which appear in the appendix, comparing the performance of boys and girls for the 100-m, 200-m, 400-m, 800-m, 1600-m, and 3200-m running events in which the 1st place boy was consistently faster than the 1st place girl, and the average performance of the top 10 boys was consistently faster than the average performance for the top 10 girls. Based on the finishing times for the 1st place boy and girl in the 6th grade in West Virginia 1600-m race, and extrapolating the running time to a running pace, the 1st place boy would be expected to finish 273 m in front of the 1st place girl, which is 2/3 of a lap on a standard 400-m track, or almost the length of 3 football fields. In comparison, the 1st place boy would finish 66 m in front of the 2nd place boy, and the 1st place girl would finish 20 m in front of the 2nd place girl.

Top 10 West Virginia boys and girls 6th grade outdoor track for 2021 (time in seconds)

	100 m			200 m			400 m		
	Boys	**Girls**		**Boys**	**Girls**		**Boys**	**Girls**	
1	13.18	14.00	Difference	26.97	29.28	Difference	60.04	65.50	Difference
2	13.94	14.19	between #1	29.38	30.05	between #1	60.48	67.51	between #1
3	14.07	14.47	boy and # 1	30.09	30.34	boy and # 1	66.26	68.60	boy and # 1
4	14.44	14.86	girl	30.10	30.73	girl	67.12	70.43	girl
5	14.46	14.92	5.9%	30.24	31.00	7.9%	68.28	71.09	8.3%
6	14.53	15.04		30.38	31.04		68.36	71.38	
7	14.75	15.04	Average	30.54	31.10	Average	69.65	73.61	Average
8	14.78	15.20	difference boys vs	30.69	31.10	difference boys vs	69.70	73.87	difference boys vs
9	14.84	15.25	girls	30.74	31.35	girls	69.76	74.07	girls
10	14.94	15.28	2.9%	30.99	31.64	2.4%	70.63	74.21	5.6%

	800 m			1600 m			3200 m		
	Boys	**Girls**		**Boys**	**Girls**		**Boys**	**Girls**	
1	147.2	164.5	Difference	305.5	357.8	Difference	678.4	776.6	Difference
2	147.9	166.1	between #1	318.1	361.6	between #1	750.0	809.8	between #1
3	152.1	167.2	boy and # 1	322.0	379.8	boy and # 1	763.3	811.0	boy and # 1
4	153.2	170.2	girl	336.0	385.2	girl	766.3	843.0	girl
5	155.3	171.0	10.6%	342.2	390.2	14.6%	771.7	850.6	12.7%
6	159.5	171.5		348.0	392.0		782.8	852.1	
7	159.9	174.8	Average	356.6	393.3	Average	794.1	858.0	Average
8	167.8	174.9	difference boys vs	357.5	395.7	difference boys vs	803.0	862.8	difference boys vs
9	169.2	175.9	girls	362.4	398.1	girls	812.1	869.9	girls
10	172.6	177.6	7.5%	366.0	403.2	11.5%	814.3	883.3	8.1%

105. As serious runners will recognize, differences of 3%, 5%, or 8% are not easily overcome. During track competition the difference between first and second place, or second and third place, or third and fourth place (and so on) is often 0.5 0.7%, with some contests being determined by as little as 0.01%.

106. I performed an analysis of running events (consisting of the 100-m, 200-m, 400-m, 800-m, 1500-m, 5000-m, and 10,000-m) in the Division 1, Division 2, and Division 3 NCAA Outdoor championships for the years of 2010-2019: the mean difference between 1st and 2nd place was 0.48% for men and 0.86% for women. The mean difference between 2nd and 3rd place was 0.46% for men and 0.57% for women. The mean difference between 3rd place and 4th place was 0.31% for men and 0.44% for

women. The mean difference between 1st place and 8th place (the last place to earn the title of All American) was 2.65% for men and 3.77% for women. (Brown et al. Unpublished observations, to be presented at the 2022 Annual Meeting of the American College of Sports Medicine.)

107. A common response to empirical data showing pre-pubertal performance advantages in boys is the argument that the performance of boys may represent a social—cultural bias for boys to be more physically active, rather than representing inherent sex-based differences in pre-pubertal physical fitness. However, the younger the age at which such differences are observed, and the more egalitarian the culture within which they are observed, the less plausible this hypothesis becomes. Eiberg et al. (2005) measured body composition, VO_2max, and physical activity in 366 Danish boys and 332 Danish girls between the ages of 6 and 7 years old. Their observations indicated that VO2max was 11% higher in boys than girls. When expressed relative to body mass the boys' VO2max was still 8% higher than the girls. The authors stated that "...no differences in haemoglobin or sex hormones[10] have been reported in this age group," yet "... when children with the same VO2max were compared, boys were still more active, and in boys and girls with the same P[hysical] A[ctivity] level, boys were fitter." (728). These data indicate that in pre-pubertal children, in a very egalitarian culture regarding gender roles and gender norms, boys still have a measurable advantage in regards to aerobic fitness when known physiological and physical activity differences are accounted for.

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[10] This term would include testosterone and estrogens.

108. And, as I have mentioned above, even by the age of 4 or 5, in a ruler-drop test, boys exhibit 4% to 6% faster reaction times than girls. (Latorre-Roman 2018.)

109. When looking at the data on testosterone concentrations previously presented, along with the data on physical fitness and athletic performance presented, boys have advantages in athletic performance and physical fitness before there are marked differences in testosterone concentrations between boys and girls.

110. For the most part, the data I review above relate to pre-pubertal children. Today, we also face the question of inclusion in female athletics of males who have undergone "puberty suppression." The UK Sport Councils Literature Review notes that, "In the UK, so-called `puberty blockers' are generally not used until Tanner maturation stage 2-3 (i.e. after puberty has progressed into early sexual maturation)." (9.) While it is outside my expertise, my understanding is that current practice with regard to administration of puberty blockers is similar in the Unites States. Tanner stages 2 and 3 generally encompass an age range from 10 to 14 years old, with significant differences between individuals. Like the authors of the UK Sports Council Literature Review, I am "not aware of research" directly addressing the implications for athletic capability of the use of puberty blockers. (UK Sport Councils Literature Review at 9.) As Handelsman documents, the male advantage begins to increase rapidly—along with testosterone levels—at about age 11, or "very closely aligned to the timing of the onset of male puberty." (Handelsman 2017.) It seems likely that males who have undergone puberty suppression will have physiological and performance advantages over females somewhere between those possessed by pre-pubertal boys, and those who have gone

through full male puberty, with the degree of advantage in individual cases depending on that individual's development and the timing of the start of puberty blockade.

111. Tack et al. (2018) observed that in 21 transgender-identifying biological males, administration of antiandrogens for 5-31 months (commencing at 16.3 ± 1.21 years of age), resulted in nearly, but not completely, halting of normal age-related *increases* in muscle strength. Importantly, muscle strength did not decrease after administration of antiandrogens. Rather, despite antiandrogens, these individuals retained higher muscle mass, lower percent body fat, higher body mass, higher body height, and higher grip strength than comparable girls of the same age. (Supplemental tables).

112. Klaver et al. (2018 at 256) demonstrated that the use of puberty blockers did not eliminate the differences in lean body mass between biological male and female teenagers. Subsequent use of puberty blockers combined with cross-sex hormone use (in the same subjects) still did not eliminate the differences in lean body mass between biological male and female teenagers. Furthermore, by 22 years of age, the use of puberty blockers, and then puberty blockers combined with cross sex hormones, and then cross hormone therapy alone for over 8 total years of treatment still had not eliminated the difference in lean body mass between biological males and females.

113. The effects of puberty blockers on growth and development, including muscle mass, fat mass, or other factors that influence athletic performance, have been minimally researched. Indeed, Klaver et al. (2018) is the only published research that I am aware of that has evaluated the use of puberty blockers on body composition. As stated by Roberts and Carswell (2021),

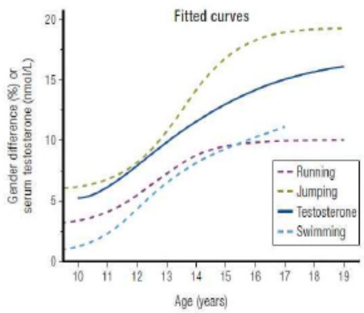
"No published studies have fully characterized the impact of [puberty blockers on] final adult height or current height in an actively growing TGD youth." (1680). Likewise, "[n]o published literature provides guidance on how to best predict the final adult height for TGD youth receiving GnRHa and gender- affirming hormonal treatment." (1681). Thus, the effect of prescribing puberty blockers to a male child before the onset of puberty on the physical components of athletic performance is largely unknown. There is not any scientific evidence that such treatment eliminates the pre-existing performance advantages that prepubertal males have over prepubertal females.

B. The rapid increase in testosterone across male puberty drives characteristic male physiological changes and the increasing performance advantages.

114. While boys exhibit some performance advantage even before puberty, it is both true and well known to common experience that the male advantage increases rapidly, and becomes much larger, as boys undergo puberty and become men. Empirically, this can be seen by contrasting the modest advantages reviewed immediately above against the large performance advantages enjoyed by men that I have detailed in Section II.

115. Multiple studies (along with common observation) document that the male performance advantage begins to increase during the early years of puberty, and then increases rapidly across the middle years of puberty (about ages 12-16). (Tonnessen 2015; Handelsman 2018 at 812-813.) Since it is well known that testosterone levels increase by more than an order of magnitude in boys across puberty, it is unsurprising that Handelsman finds that these increases in male

performance advantage correlate to increasing testosterone levels, as presented in his chart reproduced below. (Handelsman 2018 at 812-13.)



116. Handelsman further finds that certain characteristic male changes including boys' increase in muscle mass do not begin at all until "circulating testosterone concentrations rise into the range of males at mid-puberty, which are higher than in women at any age." (Handelsman 2018 at 810.)

117. Knox et al. (2019) agree that [i]t is well recognised that testosterone contributes to physiological factors including body composition, skeletal structure, and the cardiovascular and respiratory systems across the life span, with significant influence during the pubertal period. These physiological factors underpin strength, speed, and recovery with all three elements required to be competitive in almost all sports." (Knox 2019 at 397.) "High testosterone levels and prior male physiology provide an all-purpose benefit, and a substantial advantage. As the IAAF says, `To the best of our knowledge, there is no other genetic or biological trait encountered in female athletics that confers such a huge performance advantage.'" (Knox 2019 at 399.)

118. However, the undisputed fact that high (that is, normal male) levels of testosterone drive the characteristically male physiological changes that occur across male puberty does not at all imply that artificially *depressing* testosterone levels after those changes occur will reverse all or most of those changes so as to eliminate the male athletic advantage. This is an empirical question. As it turns out, the answer is that while some normal male characteristics can be changed by means of testosterone suppression, others cannot be, and all the reliable evidence indicates that males retain large athletic advantages even after long-term testosterone suppression.

V. The available evidence shows that suppression of testosterone in a male after puberty has occurred does not substantially eliminate the male athletic advantage.

119. The 2011 "NCAA Policy on Transgender Student-Athlete Participation" requires only that males who identify as transgender be on unspecified and unquantified "testosterone suppression treatment" for "one calendar year" prior to competing in women's events. In supposed justification of this policy, the NCAA's Office of Inclusion asserts that, "It is also important to know that any strength and endurance advantages a transgender woman arguably may have as a result of her prior testosterone levels dissipate after about one year of estrogen or testosterone-suppression therapy." (NCAA 2011 at 8.)

120. Similarly, writing in 2018, Handelsman et al. could speculate that even though some male advantages established during puberty are "fixed and irreversible (bone size)," "[t]he limited available prospective evidence . . . suggests that the advantageous increases in muscle

and hemoglobin due to male circulating testosterone concentrations are induced or reversed during the first 12 months." (Handelsman 2018 at 824.)

121. But these assertions or hypotheses of the NCAA and Handelsman are now strongly contradicted by the available science. In this section, I examine what is known about whether suppression of testosterone in males can eliminate the male physiological and performance advantages over females.

A. Empirical studies find that males retain a strong performance advantage even after lengthy testosterone suppression.

122. As my review in Section II indicates, a very large body of literature documents the large performance advantage enjoyed by males across a wide range of athletics. To date, only a limited number of studies have directly measured the effect of testosterone suppression and the administration of female hormones on the athletic performance of males. These studies report that testosterone suppression for a full year (and in some cases much longer) does not come close to eliminating male advantage in strength (hand grip, leg strength, and arm strength) or running speed.

Hand Grip Strength

123. As I have noted, hand grip strength is a well-accepted proxy for general strength. Multiple separate studies, from separate groups, report that males retain a large advantage in hand strength even after testosterone suppression to female levels.

124. In a longitudinal study, Van Caenegem et al. reported that males who underwent standard testosterone suppression protocols lost only 7% hand

strength after 12 months of treatment, and only a cumulative 9% after two years. (Van Caenegem 2015 at 42.) As I note above, on average men exhibit in the neighborhood of 60% greater hand grip strength than women, so these small decreases do not remotely eliminate that advantage. Van Caenegem et al. document that their sample of males who elected testosterone suppression began with less strength than a control male population. Nevertheless, after one year of suppression, their study population still had hand grip only 21% less than the control male population, and thus still far higher than a female population. (Van Caenegem 2015 at 42.)

125. Scharff et al. (2019) measured grip strength in a large cohort of male-to-female subjects from before the start of hormone therapy through one year of hormone therapy. The hormone therapy included suppression of testosterone to less than 2 nml/L "in the majority of the transwomen," (1024), as well as administration of estradiol (1021). These researchers observed a small decrease in grip strength in these subjects over that time (Fig. 2), but mean grip strength of this group remained far higher than mean grip strength of females—specifically, "After 12 months, the median grip strength of transwomen [male-to-female subjects] still falls in the 95th percentile for age-matched females." (1026).

126. Still a third longitudinal study, looking at teen males undergoing testosterone suppression, "noted no change in grip strength after hormonal treatment (average duration 11 months) of 21 transgender girls." (Hilton 2021 at 207, summarizing Tack 2018.)

127. In a fourth study, Lapauw et al. (2008) looked at the extreme case of testosterone suppression by studying a population of 23 biologically male individuals who had undergone at least two years of testosterone suppression,

followed by sex reassignment surgery that included "orchidectomy" (that is, surgical castration), and then at least an additional three years before the study date. Comparing this group against a control of age- and height-matched healthy males, the researchers found that the individuals who had gone through testosterone suppression and then surgical castration had an average hand grip (41 kg) that was 24% weaker than the control group of healthy males. But this remains at least 25% *higher* than the average hand-grip strength of biological females as measured by Bohannon et al. (2019).

128. Summarizing these and a few other studies measuring strength loss (in most cases based on hand grip) following testosterone suppression, Harper et al. (2021) conclude that "strength loss with 12 months of [testosterone suppression] . . . ranged from non-significant to 7%. . . . [T]he small decrease in strength in transwomen after 12-36 months of [testosterone suppression] suggests that transwomen likely retain a strength advantage over cisgender women." (Hilton 2021 at 870.)

Arm Strength

129. Lapauw et al. (2008) found that 3 years after surgical castration, preceded by at least two years of testosterone suppression, biologically male subjects had 33% less bicep strength than healthy male controls. (Lapauw (2008) at 1018.) Given that healthy men exhibit between 89% and 109% greater arm strength than healthy women, this leaves a very large residual arm strength advantage over biological women.

130. Roberts et al. have recently published an interesting longitudinal study, one arm of which considered biological males who began testosterone suppression and cross-sex hormones while serving in the

United States Air Force. (Roberts 2020.) One measured performance criterion was pushups per minute, which, while not exclusively, primarily tests arm strength under repetition. *Before* treatment, the biological male study subjects who underwent testosterone suppression could do 45% more pushups per minute than the average for all Air Force women under the age of 30 (47.3 vs. 32.5). *After* between one and two years of testosterone suppression, this group could still do 33% more pushups per minute. (Table 4.) Further, the body weight of the study group did not decline at all after one to two years of testosterone suppression (in fact rose slightly) (Table 3), and was approximately 24 pounds (11.0 kg) higher than the average for Air Force women under the age of 30. (Roberts 2020 at 3.) This means that the individuals who had undergone at least one year of testosterone suppression were not only doing 1/3 more pushups per minute, but were lifting significantly more weight with each pushup.

131. After two years of testosterone suppression, the study sample in Roberts et al. was only able to do 6% more pushups per minute than the Air Force female average. But their weight remained unchanged from their pre-treatment starting point, and thus about 24 pounds higher than the Air Force female average. As Roberts et al. explain, "as a group, transwomen weigh more than CW [cis-women]. Thus, transwomen will have a higher power output than CW when performing an equivalent number of push-ups. Therefore, our study may underestimate the advantage in strength that transwomen have over CW." (Roberts 2020 at 4.)

Leg Strength

132. Wiik et al. (2020), in a longitudinal study that tracked 11 males from the start of testosterone

suppression through 12 months after treatment initiation, found that isometric strength levels measured at the knee "were maintained over the [study period]."[11] (808) "At T12 [the conclusion of the one-year study], the absolute levels of strength and muscle volume were greater in [male-to-female subjects] than in . . . CW [women who had not undergone any hormonal therapy]." (Wiik 2020 at 808.) In fact, Wiik et al. reported that "muscle strength after 12 months of testosterone suppression was comparable to baseline strength. As a result, transgender women remained about 50% stronger than . . . a reference group of females." (Hilton 2021 at 207, summarizing Wiik 2020.)

133. Lapauw et al. (2008) found that 3 years after surgical castration, preceded by at least two years of testosterone suppression, subjects had peak knee torque only 25% lower than healthy male controls. (Lapauw 2008 at 1018.) Again, given that healthy males exhibit 54% greater maximum knee torque than healthy females, this leaves these individuals with a large average strength advantage over females even years after sex reassignment surgery.

Running speed

134. The most striking finding of the recent Roberts et al. study concerned running speed over a 1.5 mile distance—a distance that tests midrange endurance. Before suppression, the MtF study group ran 21% faster than the Air Force female average. After at least 2 year of testosterone suppression, these subjects still ran 12% faster than the Air Force female average. (Roberts 2020 Table 4.)

[11] Isometric strength measures muscular force production for a given amount of time at a specific joint angle but with no joint movement.

135. The specific experience of the well-known case of NCAA athlete Cece Telfer is consistent with the more statistically meaningful results of Roberts et al., further illustrating that male-to-female transgender treatment does not negate the inherent athletic performance advantages of a post-pubertal male. In 2016 and 2017 Cece Telfer competed as Craig Telfer on the Franklin Pierce University men's track team, being ranked 200th and 390th (respectively) against other NCAA Division 2 men. "Craig" Telfer did not qualify for the National Championships in any events. Telfer did not compete in the 2018 season while undergoing testosterone suppression (per **NCAA** policy). In 2019 Cece Telfer competed on the Franklin Pierce University *women's* team, qualified for the NCAA Division 2 Track and Field National Championships, and placed 1st in the women's 400 meter hurdles and placed third in the women's 100 meter hurdles. (For examples of the media coverage of this please see_https://www.washingtontimes.com/news/2019/jun/3/cece-telfer-franlclin-pierce-transgenderhurdler-wi/ last accessed May 29, 2020. https://www.newshub.co.nz/home/sport/2019/0^{6}/$_{a}$thletics-transgender-woman-cece-telfer-whopreviously-competed-as-a-man-wins-ncaa-track-championship.html (last accessed May 29, 2020.)

136. The table below shows the best collegiate performance times from the combined 2015 and 2016 seasons for Cece Telfer when competing as a man in men's events, and the best collegiate performance times from the 2019 season when competing as a woman in women's events. Comparing the times for the running events (in which male and female athletes run the same distance) there is no statistical difference between Telfer's "before and after" times. Calculating the difference in time between the male and female times, Telfer performed an

average of 0.22% *faster* as a female. (Comparing the performance for the hurdle events (marked with **H)** is of questionable validity due to differences between men's and women's events in hurdle heights and spacing, and distance for the 110m vs. 100 m.) While this is simply one example, and does not represent a controlled experimental analysis, this information provides some evidence that male-to-female transgender treatment does not negate the inherent athletic performance advantages of a postpubertal male. (These times were obtained from https://www.tfrrs.org/athletes/6994616/Franklin__Pierce/CeCe Telfer.html and https://www.tfrrs.org/athletes/5108308.html, last accessed May 29, 2020).

As Craig Telfer (male athlete)		**As Cece Telfer (female athlete)**	
Event	Time (seconds)	Event	Time (seconds)
55	7.01	55	7.02
60	7.67	60	7.63
100	12.17	100	12.24
200	24.03	200	24.30
400	55.77	400	54.41
55 H †	7.98	55 H†	7.91
60 H †	8.52	60 H†	8.33
110 H†	15.17	100 H†	13.41*
400 H‡	57.34	400 H‡	57.53**

* women's 3rd place, NCAA Division 2 National Championships
** women's 1st place, NCAA Division 2 National Championships
† men's hurdle height is 42 inches with differences in hurdle spacing between men and women
‡ men's hurdle height is 36 inches, women's height is 30 inches with the same spacing between hurdles

137. Similarly, University of Pennsylvania swimmer Lia Thomas began competing in the women's division in the fall of 2021, after previously competing for U. Penn. in the men's division. Thomas has promptly set school, pool, and/or league women's records in 200 yard freestyle, 500 yard freestyle, and 1650 yard freestyle competitions, beating the nearest female in the 1650 yard by an unheard-of 38 seconds.

138. In a pre-peer review article, Senefeld, Coleman, Hunter, and Joyner (doi: https://doi.org/10.1101/2021.12.28.21268483, accessed January 12, 2022) "compared the gender-related differences in performance of a transgender swimmer who competed in both the male and female NCAA (collegiate) categories to the sex-related differences in performance of world and national class swimmers" and observed that this athlete [presumably Lia Thomas based on performance times and the timing of this article] was unranked in 2018-2019 in the 100-yard, ranked 551st in the 200-yard, 65th in the 500-yard **32nd** in the 1650-yards men's freestyle. After following the NCAA protocol for testosterone suppression and competing as a woman in 2021-2022, this swimmer was ranked 94th in the 100-yard, 1st in the 200-yard, 1st in the 500-yard, and 6th in the 1650-yard women's freestyle. The performance times swimming as a female, when compared to swimming as a male, were 4.6% slower in the 100-yard, 2.6% slower in the 200-yard, 5.6% slower in the 500-yard, and 6.8% slower in the 1650-yard events than when swimming as a male. *It is important to note that these are mid-season race times and do not represent season best performance times or in a championship event where athletes often set their personal record times.* The authors concluded "...that for middle distance events (100, 200 and 400m or their imperial equivalents) lasting between about one and five minutes, the decrements in performance of the transgender woman swimmer are less than expected on the basis of a comparison of a large cohort of world and national class performances by female and male swimmers" and "it is possible that the relative improvements in this swimmer's rankings in the women's category relative to the men's category are due to legacy effects of testosterone on a number of physiological factors that can influence athletic performance."

139. Harper (2015) has often been cited as "proving" that testosterone suppression eliminates male advantage. And indeed, hedged with many disclaimers, the author in that article does more or less make that claim with respect to "distance races," while emphasizing that "the author makes no claims as to the equality of performances, pre and post gender transition, in any other sport." (Harper 2015 at 8.) However, Harper (2015) is in effect a collection of unverified anecdotes, not science. It is built around self-reported race times from just eight self-selected transgender runners, recruited "mostly" online. How and on what websites the subjects were recruited is not disclosed, nor is anything said about how those not recruited online were recruited. Thus, there is no information to tell us whether these eight runners could in any way be representative, and the recruitment pools and methodology, which could bear on ideological bias in their self-reports, is not disclosed.

140. Further, the self-reported race times relied on by Harper (2015) *span 29 years.* It is well known that self-reported data, particularly concerning emotionally or ideologically fraught topics, is unreliable, and likewise that memory of distant events is unreliable. Whether the subjects were responding from memory or from written records, and if so what records, is not disclosed, and does not appear to be known to the author. For six of the subjects, the author claims to have been able to verify "approximately half" of the self-reported times. Which scores these are is not disclosed. The other two subjects responded only anonymously, so nothing about their claims could be or was verified. In short, neither the author nor the reader knows whether the supposed "facts" on which the paper's analysis is based are true.

141. Even if we could accept them at face value, the data are largely meaningless. Only two of the eight study subjects reported (undefined) “stable training patterns,” and even with consistent training, athletic performance generally declines with age. As a result, when the few data points span 29 years, it is not possible to attribute declines in performance to asserted testosterone suppression. Further, distance running is usually not on a track, and race times vary significantly depending on the course and the weather. Only one reporting subject who claimed a “stable training pattern” reported “before and after” times on the same course within three years’ time,” which the author acknowledges would “represent the best comparison points.”

142. Harper (2015) to some extent acknowledges its profound methodological flaws, but seeks to excuse them by the difficulty of breaking new ground. The author states that, “The first problem is how to formulate a study to create a meaningful measurement of athletic performance, both before and after testosterone suppression. No methodology has been previously devised to make meaningful measurements.” (2) This statement was not accurate at the time of publication, as there are innumerable publications with validated methodology for comparing physical fitness and/or athletic performance between people of different ages, sexes, and before and after medical treatment, any of which could easily have been used with minimal or no adaptation for the purposes of this study. Indeed, well before the publication of Harper (2015), several authors that I have cited in this review had performed and published disciplined and methodologically reliable studies of physical performance and physiological attributes “before and after” testosterone suppression.

143. More recently, and to her credit, Harper has acknowledged the finding of Roberts (2020) regarding the durable male advantage in running speed in the 1.5 mile distance, even after two years of testosterone suppression. She joins with co-authors in acknowledging that this study of individuals who (due to Air Force physical fitness requirements) "could at least be considered exercise trained," agrees that Roberts' data shows that "transwomen ran significantly faster during the 1.5 mile fitness test than ciswomen," and declares that this result is "consistent with the findings of the current review in untrained transgender individuals" that even 30 months of testosterone suppression does not eliminate all male advantages "associated with muscle endurance and performance." (Harper 2021 at 8.) The Harper (2021) authors conclude overall "that strength may be well preserved in transwomen during the first 3 years of hormone therapy," and that [w]hether transgender and cisgender women can engage in meaningful sport [in competition with each other], even after [testosterone suppression], is a highly debated question." (Harper 2021 at 1, 8.)

144. Higerd (2021) "[a]ssess[ed] the probability of a girls' champion being biologically male" by evaluating 920,11 American high school track and field performances available through the track and field database Athletic.net in five states (CA, FL, MN, NY, WA), over three years (2017 — 2019),in eight events; high jump, long jump, 100M, 200M, 400M, 800M, 1600M, and 3200M and estimated that "there is a simulated 81%-98% probability of transgender dominance occurring in the female track and field event" and further concluded that "in the majority of cases, the entire podium (top of the state) would be MTF [transgender athletes]" (at xii).

B. Testosterone suppression does not reverse important male physiological advantages.

145. We see that, once a male has gone through male puberty, later testosterone suppression (or even castration) leaves large strength and performance advantages over females in place. It is not surprising that this is so. What is now a fairly extensive body of literature has documented that many of the specific male physiological advantages that I reviewed in Section II are not reversed by testosterone suppression after puberty, or are reduced only modestly, leaving a large advantage over female norms still in place.

146. Handelsman has well documented that the large increases in physiological and performance advantages characteristic of men develop in tandem with, and are likely driven by, the rapid and large increases in circulating testosterone levels that males experience across puberty, or generally between the ages of about 12 through 18. (Handelsman 2018.) Some have misinterpreted Handelsman as suggesting that all of those advantages are and remain entirely dependent—on an ongoing basis—on *current* circulating testosterone levels. This is a misreading of Handelsman, who makes no such claim. As the studies reviewed above demonstrate, it is also empirically false with respect to multiple measures of performance. Indeed, Handelsman himself, referring to the Roberts et al. (2020) study which I describe below, has recently written that "transwomen treated with estrogens after completing male puberty experienced only minimal declines in physical performance over 12 months, substantially surpassing average female performance for up to 8 years." (Handelsman 2020.)

147. As to individual physiological advantages, the more accurate and more complicated reality is reflected in

a statement titled "The Role of Testosterone in Athletic Performance," published in 2019 by several dozen sports medicine experts and physicians from many top medical schools and hospitals in the U.S. and around the world. (Levine et al. 2019.) This expert group concurs with Handelsman regarding the importance of testosterone to the male advantage, but recognizes that those advantages depend not only on *current* circulating testosterone levels in the individual, but on the "exposure in biological males to much higher levels of testosterone during growth, development, and throughout the athletic career." *(Emphasis added.)* In other words, both past and current circulating testosterone levels affect physiology and athletic capability.

148. Available research enables us to sort out, in some detail, which specific physiological advantages are immutable once they occur, which can be reversed only in part, and which appear to be highly responsive to later hormonal manipulation. The bottom line is that very few of the male physiological advantages I have reviewed in Section II above are largely reversible by testosterone suppression once an individual has passed through male puberty.

Skeletal Configuration

149. It is obvious that some of the physiological changes that occur during "growth and development" across puberty cannot be reversed. Some of these irreversible physiological changes are quite evident in photographs that have recently appeared in the news of transgender competitors in female events. These include skeletal configuration advantages including:

- Longer and larger bones that give height, weight, and leverage advantages to men;

- More advantageous hip shape and configuration as compared to women.

Cardiovascular Advantages

150. Developmental changes for which there is no apparent means of reversal, and no literature suggesting reversibility, also include multiple contributors to the male cardiovascular advantage, including diaphragm placement, lung and trachea size, and heart size and therefore pumping capacity.[12]

151. On the other hand, the evidence is mixed as to hemoglobin concentration, which as discussed above is a contributing factor to V02 max. Harper (2021) surveyed the literature and found that "Nine studies reported the levels of Hgb [hemoglobin] or HCT [red blood cell count] in transwomen before and after [testosterone suppression], from a minimum of three to a maximum of 36 months post hormone therapy. Eight of these studies. . . found that hormone therapy led to a significant (4.6%-14.0%) decrease in Hgb/HCT ($p<0.01$), while one study found no significant difference after 6 months," but only one of those eight studies returned results at the generally accepted 95% confidence level. (Harper 2021 at 5-6 and Table 5.)

152. I have not found any study of the effect of testosterone suppression on the male advantage in mitochondrial biogenesis.

Muscle mass

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[12] "[H]ormone therapy will not alter ... lung volume or heart size of the transwoman athlete, especially if [that athlete] transitions postpuberty, so natural advantages including joint articulation, stroke volume and maximal oxygen uptake will be maintained." (Knox 2019 at 398.)

153. Multiple studies have found that muscle mass decreases modestly or not at all in response to testosterone suppression. Knox et al. report that "healthy young men did not lose significant muscle mass (or power) when their circulating testosterone levels were reduced to 8.8 nmol/L (lower than the 2015 IOC guideline of 10 nmol/L) for 20 weeks." (Knox 2019 at 398.) Gooren found that "[i]n spite of muscle surface area reduction induced by androgen deprivation, after 1 year the mean muscle surface area in male-to- female transsexuals remained significantly greater than in untreated female-to-male transsexuals." (Gooren 2011 at 653.) An earlier study by Gooren found that after one year of testosterone suppression, muscle mass at the thigh was reduced by only about 10%, exhibited "no further reduction after 3 years of hormones," and "remained significantly greater" than in his sample of untreated women. (Gooren 2004 at 426-427.) Van Caenegem et al. found that muscle cross section in the calf and forearm decreased only trivially (4% and 1% respectively) after two years of testosterone suppression. (Van Caenegem 2015 Table 4.)

154. Taking measurements one month after start of testosterone suppression in male-to-female (non-athlete) subjects, and again 3 and 11 months after start of feminizing hormone replacement therapy in these subjects, Wiik et al. found that total lean tissue (i.e. primarily muscle) did not decrease significantly across the entire period. Indeed, "some of the [subjects] did not lose any muscle mass at all." (Wiik 2020 at 812.) And even though they observed a small decrease in thigh muscle mass, they found that isometric strength levels measured at the knee "were maintained over the [study period]." (808) "At T12 [the conclusion of the one-year study], the absolute levels of strength and muscle volume were greater in [male-to-female subjects] than in [female-to-

male subjects] and CW [women who had not undergone any hormonal therapy].” (808)

155. Hilton & Lundberg summarize an extensive survey of the literature as follows:

> “12 longitudinal studies have examined the effects of testosterone suppression on lean body mass or muscle size in transgender women. The collective evidence from these studies suggests that 12 months, which is the most commonly examined intervention period, of testosterone suppression to female typical reference levels results in a modest (approximately— 5%) loss of lean body mass or muscle size …
>
> “Thus, given the large baseline differences in muscle mass between males and females (Table 1; approximately 40%), the reduction achieved by 12 months of testosterone suppression can reasonably be assessed as small relative to the initial superior mass. We, therefore, conclude that the muscle mass advantage males possess over females, and the performance implications thereof, are not removed by the currently studied durations (4 months, 1, 2 and 3 years) of testosterone suppression in transgender women. (Hilton 2021 at 205-207.)

156. When we recall that “women have 50% to 60% of men’s upper arm muscle cross-sectional area and 65% to 70% of men’s thigh muscle cross-sectional area” (Handelsman 2018 at 812), it is clear that Hilton’s conclusion is correct. In other words, biologically male subjects possess substantially larger muscles than biologically female subjects after undergoing a year or even three years of testosterone suppression.

157. I note that outside the context of transgender athletes, the testosterone-driven increase in muscle mass and strength enjoyed by these male-to-female subjects would constitute a disqualifying doping violation under all league anti-doping rules with which I am familiar.

C. Responsible voices internationally are increasingly recognizing that suppression of testosterone in a male after puberty has occurred does not substantially reverse the male athletic advantage.

158. The previous very permissive NCAA policy governing transgender participation in women's collegiate athletics was adopted in 2011, and the previous IOC guidelines were adopted in 2015. At those dates, much of the scientific analysis of the actual impact of testosterone suppression had not yet been performed, much less any wider synthesis of that science. In fact, a series of important peer-reviewed studies and literature reviews have been published only very recently, since I prepared my first paper on this topic, in early 2020.

159. These new scientific publications reflect a remarkably consistent consensus: once an individual has gone through male puberty, testosterone suppression does not substantially eliminate the physiological and performance advantages that that individual enjoys over female competitors.

160. Importantly, I have found no peer-reviewed scientific paper, nor any respected scientific voice, that is now asserting the contrary—that is, that testosterone suppression can eliminate or even largely eliminate the male biological advantage once puberty has occurred.

161. I excerpt the key conclusions from important recent peer-reviewed papers below.

162. Roberts 2020: "In this study, we confirmed that … the pretreatment differences between transgender and cis gender women persist beyond the 12-month time requirement currently being proposed for athletic competition by the World Athletics and the IOC." (6)

163. Wiik 2020: The muscular and strength changes in males undergoing testosterone suppression "were modest. The question of when it is fair to permit a transgender woman to compete in sport in line with her experienced gender identity is challenging." (812)

164. Harper 2021: "[V]alues for strength, LBM [lean body mass], and muscle area in transwomen remain above those of cisgender women, even after 36 months of hormone therapy." (1)

165. Hilton & Lundberg 2021: "evidence for loss of the male performance advantage, established by testosterone at puberty and translating in elite athletes to a 10-50% performance advantage, is lacking. . . . These data significantly undermine the delivery of fairness and safety presumed by the criteria set out in transgender inclusion policies . . ." (211)

166. Hamilton et al. 2020, "Response to the United Nations Human Rights Council's Report on Race and Gender Discrimination in Sport: An Expression of Concern and a Call to Prioritize Research": "There is growing support for the idea that development influenced by high testosterone levels may result in retained anatomical and physiological advantages …. If a biologically male athlete self-identifies as a female, legitimately with a diagnosis of gender dysphoria or illegitimately to win medals, the athlete already possesses a physiological advantage that undermines fairness and

safety. This is not equitable, nor consistent with the fundamental principles of the Olympic Charter."

167. Hamilton et al. 2021, "Consensus Statement of the Federation Internationale de Medecine du Sport" (International Federation of Sports Medicine, or FIMS), signed by more than 60 sports medicine experts from prestigious institutions around the world: The available studies "make it difficult to suggest that the athletic capabilities of transwomen individuals undergoing HRT or GAS are comparable to those of cisgender women." The findings of Roberts et al. "question the required testosterone suppression time of 12 months for transwomen to be eligible to compete in women's sport, as most advantages over ciswomen were not negated after 12 months of HRT."

168. Outside the forum of peer-reviewed journals, respected voices in sport are reaching the same conclusion.

169. The **Women's Sports Policy Working Group** identifies among its members and "supporters" many women Olympic medalists, former women's tennis champion and LGBTQ activist Martina Navratilova, Professor Doriane Coleman, a former All-American women's track competitor, transgender athletes Joanna Harper and Dr. Renee Richards, and many other leaders in women's sports and civil rights. I have referenced other published work of Joanna Harper and Professor Coleman. In early 2021 the Women's Sports Policy Working Group published a "Briefing Book" on the issue of transgender participation in women's sports,[13] in which they reviewed

[13]https://womenssportspolicy.org/wp-content/uploads/2021/02/Congressional-Briefing-WSPWG-Transgender-Women-Sports-2.27.21.pdf

largely the same body of literature I have reviewed above, and analyzed the implications of that science for fairness and safety in women's sports.

170. Among other things, the Women's Sports Policy Working Group concluded:

- "[T]he evidence is increasingly clear that hormones do not eliminate the legacy advantages associated with male physical development" (8) due to "the considerable size and strength advantages that remain even after hormone treatments or surgical procedures." (17)
- "[T]here is convincing evidence that, depending on the task, skill, sport, or event, trans women maintain male sex-linked (legacy) advantages even after a year on standard gender-affirming hormone treatment." (26, citing Roberts 2020.)
- "[S]everal peer-reviewed studies, including one based on data from the U.S. military, have confirmed that trans women retain their male sex-linked advantages even after a year on gender affirming hormones. . . . Because of these retained advantages, USA Powerlifting and World Rugby have recently concluded that it isn't possible fairly and safely to include trans women in women's competition." (32)

171. As has been widely reported, in 2020, after an extensive scientific consultation process, the **World Rugby** organization issued its Transgender Guidelines, finding that it would not be consistent with fairness or safety to permit biological males to compete in World Rugby women's matches, no matter what hormonal or surgical procedures they might have undergone. Based on their review of the science, World Rugby concluded:

- "Current policies regulating the inclusion of transgender women in sport are based on the premise that reducing testosterone to levels found in biological females is sufficient to remove many of the biologically-based performance advantages described above. However, peer-reviewed evidence suggests that this is not the case."
- "Longitudinal research studies on the effect of reducing testosterone to female levels for periods of 12 months or more do not support the contention that variables such as mass, lean mass and strength are altered meaningfully in comparison to the original male-female differences in these variables. The lowering of testosterone removes only a small proportion of the documented biological differences, with large, retained advantages in these physiological attributes, with the safety and performance implications described previously."
- "… given the size of the biological differences prior to testosterone suppression, this comparatively small effect of testosterone reduction allows substantial and meaningful differences to remain. This has significant implications for the risk of injury …"
- "… bone mass is typically maintained in transgender women over the course of at least 24 months of testosterone suppression, ... Height and other skeletal measurements such as bone length and hip width have also not been shown to change with testosterone suppression, and nor is there any plausible biological mechanism by which this might occur, and so sporting advantages due to skeletal differences between males and females

appear unlikely to change with testosterone reduction.

172. In September 2021 the government-commissioned Sports Councils of the United Kingdom and its subsidiary parts (the five Sports Councils responsible for supporting and investing in sport across England, Wales, Scotland and Northern Ireland) issued a formal "Guidance for Transgender Inclusion in Domestic Sport" (UK Sport Councils 2021), following an extensive consultation process, and a commissioned "International Research Literature Review" prepared by the Carbmill Consulting group (UK Sport Literature Review 2021). The UK Sport Literature Review identified largely the same relevant literature that I review in this paper, characterizes that literature consistently with my own reading and description, and based on that science reaches conclusions similar to mine.

173. The UK Sport Literature Review 2021 concluded:

- "Sexual dimorphism in relation to sport is significant and the most important determinant of sporting capacity. The challenge to sporting bodies is most evident in the inclusion of transgender people in female sport." "[The] evidence suggests that parity in physical performance in relation to gender-affected sport cannot be achieved for transgender people in female sport through testosterone suppression. Theoretical estimation in contact and collision sport indicate injury risk is likely to be increased for female competitors." (10)
- "From the synthesis of current research, the understanding is that testosterone suppression for the mandated one year before competition will result in little or no change to the anatomical

differences between the sexes, and a more complete reversal of some acute phase metabolic pathways such as haemoglobin levels although the impact on running performance appears limited, and a modest change in muscle mass and strength: The average of around 5% loss of muscle mass and strength will not reverse the average 40-50% difference in strength that typically exists between the two sexes." (7)

- "These findings are at odds with the accepted intention of current policy in sport, in which twelve months of testosterone suppression is expected to create equivalence between transgender women and females." (7)

174. Taking into account the science detailed in the UK Sport Literature Review 2021, the UK Sports Councils have concluded:

- "[T]he latest research, evidence and studies made clear that there are retained differences in strength, stamina and physique between the average woman compared with the average transgender woman or non-binary person registered male at birth, with or without testosterone suppression." (3)
- "Competitive fairness cannot be reconciled with self-identification into the female category in gender-affected sport." (7)
- "As a result of what the review found, the Guidance concludes that the inclusion of transgender people into female sport cannot be balanced regarding transgender inclusion, fairness and safety in gender-affected sport where there is meaningful competition. This is due to retained differences in

strength, stamina and physique between the average woman compared with the average transgender woman or non-binary person assigned male at birth, with or without testosterone suppression." (6)

- "Based upon current evidence, testosterone suppression is unlikely to guarantee fairness between transgender women and natal females in gender-affected sports. . . . Transgender women are on average likely to retain physical advantage in terms of physique, stamina, and strength. Such physical differences will also impact safety parameters in sports which are combat, collision or contact in nature." (7)

175. On January 15, 2022 the American Swimming Coaches Association (ASCA) issued a statement stating, "The American Swimming Coaches Association urges the NCAA and all governing bodies to work quickly to update their policies and rules to maintain fair competition in the women's category of swimming. ASCA supports following all available science and evidenced-based research in setting the new policies, and we strongly advocate for more research to be conducted" and further stated "The current NCAA policy regarding when transgender females can compete in the women's category can be unfair to cisgender females and needs to be reviewed and changed in a transparent manner." (https://swimswam.com/asca-issues-statement-calling-for-ncaa-to-review-transgender-rules/; Accessed January 16, 2022.)

176. On January 19, 2022, the NCAA Board of Governors approved a change to the policy on transgender inclusion in sport and stated that "...the updated NCAA policy calls for transgender participation for each sport to

be determined by the policy for the national governing body of that sport, subject to ongoing review and recommendation by the NCAA Committee on Competitive Safeguards and Medical Aspects of Sports to the Board of Governors. If there is no N[ational]G[overning]B[ody] policy for a sport, that sport's international federation policy would be followed. If there is no international federation policy, previously established IOC policy criteria would be followed" (https://www.ncaa.org/news/2022/1/19/media-center-board-of-governors-updates-transgender-participation-policy.aspx; Accessed January 20, 2022.)

177. On February 1, 2022, because "...a competitive difference in the male and female categories and the disadvantages this presents in elite head-to-head competition ... supported by statistical data that shows that the top-ranked female in 2021, on average, would be ranked 536th across all short course yards (25 yards) male events in the country and 326th across all long course meters (50 meters) male events in the country, among USA Swimming members," USA Swimming released its Athlete Inclusion, Competitive Equity and Eligibility Policy. The policy is intended to "provide a level-playing field for elite cisgender women, and to mitigate the advantages associated with male puberty and physiology." (USA Swimming Releases Athlete Inclusion, Competitive Equity and Eligibility Policy, available at https://www.usaswimming.org/news/2022/02/01/usa-swimming-releases-athlete-inclusion-competitive-equity-and-eligibility-policy.) The policy states:

- For biologically male athletes seeking to compete in the female category in certain "elite" level events, the athlete has the burden of demonstrating to a panel of independent medical experts that:

- "From a medical perspective, the prior physical development of the athlete as Male, as mitigated by any medical intervention, does not give the athlete a competitive advantage over the athlete's cisgender Female competitors" and
- There is a presumption that the athlete is not eligible unless the athlete "demonstrates that the concentration of testosterone in the athlete's serum has been less than 5 nmol/L . . . continuously for a period of at least thirty-six (36) months before the date of the Application." This presumption may be rebutted "if the Panel finds, in the unique circumstances of the case, that [the athlete's prior physical development does not give the athlete a competitive advantage] notwithstanding the athlete's serum testosterone results (e.g., the athlete has a medical condition which limits bioavailability of the athlete's free testosterone)." (USA Swimming Athlete Inclusion Procedures at 43.)

Conclusions

The research and actual observed data show the following:

- At the level of (a) elite, (b) collegiate, (c) scholastic, and (d) recreational competition, men, adolescent boys, or male children, have an advantage over equally gifted, aged and trained women, adolescent girls, or female children in almost all athletic events;

- Biological male physiology is the basis for the performance advantage that men, adolescent boys, or male children have over women, adolescent girls, or female children in almost all athletic events; and

- The administration of androgen inhibitors and cross-sex hormones to men or adolescent boys after the onset of male puberty does not eliminate the performance advantage that men and adolescent boys have over women and adolescent girls in almost all athletic events. Likewise, there is no published scientific evidence that the administration of puberty blockers to males before puberty eliminates the pre-existing athletic advantage that prepubertal males have over prepubertal females in almost all athletic events.

For over a decade sports governing bodies (such as the IOC and NCAA) have wrestled with the question of transgender inclusion in female sports. The previous polices implemented by these sporting bodies had an underlying "premise that reducing testosterone to levels found in biological females is sufficient to remove many of the biologically-based performance advantages." (World Rugby 2020 at 13.) Disagreements centered around what the appropriate threshold for testosterone levels must be—whether the lOnmol/liter value adopted by the IOC in 2015, or the 5nmoVliter value adopted by the IAAF.

But the science that has become available within just the last few years contradicts that premise. Instead, as the UK Sports Councils, World Rugby, the FIMS Consensus Statement, and the Women's Sports Policy Working

Group have all recognized the science is now sharply "at odds with the accepted intention of current policy in sport, in which twelve months of testosterone suppression is expected to create equivalence between transgender women and females" (UK Sports Literature Review 2021 at 7), and it is now "difficult to suggest that the athletic capabilities of transwomen individuals undergoing HRT or GAS are comparable to those of cisgender women." (Hamilton, FIMS Consensus Statement 2021.) It is important to note that while the 2021 "IOC Framework on Fairness, Inclusion, and Non-Discrimination on the Basis of Gender Identity and Sex Variations" calls for an "evidence-based approach," that Framework does not actually reference any of the now extensive scientific evidence relating to the physiological differences between the sexes, and the inefficacy of hormonal intervention to eliminate male advantages relevant to most sports. Instead, the IOC calls on other sporting bodies to define criteria for transgender inclusion, while demanding that such criteria simultaneously ensure fairness, safety, and inclusion for all. The recently updated NCAA policy on transgender participation also relies on other sporting bodies to establish criteria for transgender inclusion while calling for fair competition and safety.

But what we currently know tells us that these policy goals—fairness, safety, and full transgender inclusion—are irreconcilable for many or most sports. Long human experience is now joined by large numbers of research papers that document that males outperform females in muscle strength, muscular endurance, aerobic and anaerobic power output, VO2max, running speed, swimming speed, vertical jump height, reaction time, and most other measures of physical fitness and physical performance that are essential for athletic success. The male advantages have been observed in fitness testing in children as young as 3 years old, with the male advantages increasing immensely during puberty. To ignore what we know to be true about males' athletic advantages over females, based on mere hope or speculation that cross sex hormone therapy (puberty blockers, androgen inhibitors, or cross-sex hormones) might neutralize that advantage, when the currently available evidence says it does not, is not science and is not "evidence-based" policy-making.

Because of the recent research and analysis in the general field of transgender athletics, many sports organizations have revised their policies or are in the process of doing so. As a result, there is not any universally recognized policy among sports organizations, and transgender inclusion policies are in a state of flux, likely because of the increasing awareness that the goals of fairness, safety, and full transgender inclusion are irreconcilable.

Sports have been separated by sex for the purposes of safety and fairness for a considerable number of years. The values of safety and fairness are endorsed by numerous sports bodies, including the NCAA and IOC. The existing evidence of durable physiological and performance differences based on biological sex provides a strong evidence-based rationale for keeping rules and policies for such sex-based separation in place (or implementing them as the case may be).

As set forth in detail in this report, there are physiological differences between males and females that result in males having a significant performance advantage over similarly gifted, aged, and trained females in nearly all athletic events before, during, and after puberty. There is not scientific evidence that any amount or duration of cross sex hormone therapy (puberty blockers, androgen inhibitors, or cross-sex hormones) eliminates all physiological advantages that result in males performing better than females in nearly all athletic events. Males who have received such therapy retain sufficient male physiological traits that enhance athletic performance vis-à-vis similarly aged females and are thus, from a physiological perspective, more accurately categorized as male and not female.

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Data Tables

Presidential Physical Fitness Results[14]

Curl-Ups (# in 1 minute)

	Male		Female			Male-Female % Difference	
Age	50th %ile	85th %ile	50th %ile	85th %ile	Age	50th %ile	85th %ile
6	22	33	23	32	6	-4.3%	3.1%
7	28	36	25	34	7	12.0%	5.9%
8	31	40	29	38	8	6.9%	5.3%
9	32	41	30	39	9	6.7%	5.1%
10	35	45	30	40	10	16.7%	12.5%
11	37	47	32	42	11	15.6%	11.9%
12	40	50	35	45	12	14.3%	11.1%
13	42	53	37	46	13	13.5%	15.2%
14	45	56	37	47	14	21.6%	19.1%
15	45	57	36	48	15	25.0%	18.8%
16	45	56	35	45	16	28.6%	24.4%
17	44	55	34	44	17	29.4%	25.0%

[14] This data is available from a variety of sources. including: https://gilmore.gysd.us/documents/Info/Forms/Teacher%20Forms/Presidentialchallengetest.pdf

Shuttle Run (seconds)

	Male		Female			Male-Female % Difference	
Age	50th %ile	85th %ile	50th %ile	85th %ile	Age	50th %ile	85th %ile
6	13.3	12.1	13.8	12.4	6	3.6%	2.4%
7	12.8	11.5	13.2	12.1	7	3.0%	5.0%
8	12.2	11.1	12.9	11.8	8	5.4%	5.9%
9	11.9	10.9	12.5	11.1	9	4.8%	1.8%
10	11.5	10.3	12.1	10.8	10	5.0%	4.6%
11	11.1	10	11.5	10.5	11	3.5%	4.8%
12	10.6	9.8	11.3	10.4	12	6.2%	5.8%
13	10.2	9.5	11.1	10.2	13	8.1%	6.9%
14	9.9	9.1	11.2	10.1	14	11.6%	9.9%
15	9.7	9.0	11.0	10.0	15	11.8%	10.0%
16	9.4	8.7	10.9	10.1	16	13.8%	13.9%
17	9.4	8.7	11.0	10.0	17	14.5%	13.0%

1 mile run (seconds)

	Male		Female			Male-Female % Difference	
Age	50th %ile	85th %ile	50th %ile	85th %ile	Age	50th %ile	85th %ile
6	756	615	792	680	6	4.5%	9.6%
7	700	562	776	636	7	9.8%	11.6%
8	665	528	750	602	8	11.3%	12.3%
9	630	511	712	570	9	11.5%	10.4%
10	588	477	682	559	10	13.8%	14.7%
11	560	452	677	542	11	17.3%	16.6%
12	520	431	665	503	12	21.8%	14.3%
13	486	410	623	493	13	22.0%	16.8%
14	464	386	606	479	14	23.4%	19.4%
15	450	380	598	488	15	24.7%	22.1%
16	430	368	631	503	16	31.9%	26.8%
17	424	366	622	495	17	31.8%	26.1%

Pull Ups (# completed)

Age	Male 50th %ile	Male 85th %ile	Female 50th %ile	Female 85th %ile	Age	Male-Female % Difference 50th %ile	Male-Female % Difference 85th %ile
6	1	2	1	2	6	0.0%	0.0%
7	1	4	1	2	7	0.0%	100.0%
8	1	5	1	2	8	0.0%	150.0%
9	2	5	1	2	9	100.0%	150.0%
10	2	6	1	3	10	100.0%	100.0%
11	2	6	1	3	11	100.0%	100.0%
12	2	7	1	2	12	100.0%	250.0%
13	3	7	1	2	13	200.0%	250.0%
14	5	10	1	2	14	400.0%	400.0%
15	6	11	1	2	15	500.0%	450.0%
16	7	11	1	1	16	600.0%	1000.0%
17	8	13	1	1	17	700.0%	1200.0%

Data Compiled from Athletic.Net

2021 National 3000 m cross country race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	691.8	728.4	Difference	607.7	659.8	Difference	608.1	632.6	Difference
2	722.5	739.0	#1 boy vs #	619.6	674.0	#1 boy vs #	608.7	639.8	#1 boy vs #
3	740.5	783.0	1 girl	620.1	674.7	1 girl	611.3	664.1	1 girl
4	759.3	783.5	5.0%	643.2	683.7	7.9%	618.6	664.4	3.9%
5	759.6	792.8		646.8	685.0		619.7	671.6	
6	760.0	824.1		648.0	686.4		631.2	672.1	
7	772.0	825.7	Average	648.8	687.0	Average	631.7	672.3	Average
8	773.0	832.3	difference	658.0	691.0	difference	634.9	678.4	difference
9	780.7	834.3	boys vs girls	659.5	692.2	boys vs girls	635.0	679.3	boys vs girls
10	735.1	844.4	6.2%	663.9	663.3	5.6%	635.1	679.4	6.3%

2021 National 3000 m cross country race time in seconds

Rank	5th grade Boys	5th grade Girls		6th grade Boys	6th grade Girls		7th grade Boys	7th grade Girls	
1	625.5	667.0	Difference	545.3	582.0	Difference	534.0	560.7	Difference
2	648.8	685.0	#1 boy vs #	553.2	584.3	#1 boy vs #	541.0	567.0	#1 boy vs #
3	653.5	712.9	1 girl	562.3	585.1	1 girl	542.6	581.8	1 girl
4	658.4	719.2	6.2%	562.9	599.8	6.3%	544.6	583.0	4.8%
5	675.3	725.2		571.5	612.9		546.0	595.0	
6	677.4	727.7		588.0	622.0		556.0	599.0	
7	677.6	734.0	Average	591.3	624.9	Average	556.0	604.3	Average
8	679.1	739.4	difference	593.0	626.0	difference	556.0	606.0	difference
9	686.4	739.4	boys vs girls	593.8	628.0	boys vs girls	558.6	606.8	boys vs girls
10	686.4	746.4	7.3%	594.1	645.6	5.8%	563.2	617.0	7.1%

2021 National 100 m Track race time in seconds

Rank	7-8 years old Boys	7-8 years old Girls		9-10 years old Boys	9-10 years old Girls		11-12 year old Boys	11-12 year old Girls	
1	13.06	14.24	Difference #1	10.87	12.10	Difference #1	11.37	12.08	Difference #1
2	13.54	14.41	boy vs # 1	10.91	12.24	boy vs # 1	11.61	12.43	boy vs # 1
3	13.73	14.44	girl	11.09	12.63	girl	11.73	12.51	girl
4	14.10	14.48	8.3%	11.25	12.70	10.2%	11.84	12.55	5.9%
5	14.19	14.49		11.27	12.75		11.89	12.57	
6	14.31	14.58		11.33	12.80		11.91	12.62	
7	14.34	14.69	Average	11.42	12.83	Average	11.94	12.65	Average
8	14.35	14.72	difference	11.43	12.84	difference	11.97	12.71	difference
9	14.41	14.77	boys vs girls	11.44	12.88	boys vs girls	12.08	12.71	boys vs girls
10	14.43	14.86	3.6%	11.51	12.91	11.1%	12.12	12.75	5.7%

2021 National 200 m Track race time in seconds

Rank	7-8 years old Boys	7-8 years old Girls		9-10 years old Boys	9-10 years old Girls		11-12 year old Boys	11-12 year old Girls	
1	24.02	28.72	Difference #1	21.77	25.36	Difference #1	20.66	25.03	Difference #1
2	24.03	28.87	boy vs # 1	22.25	25.50	boy vs # 1	22.91	25.18	boy vs # 1
3	28.07	29.92	girl	22.48	25.55	girl	23.14	25.22	girl
4	28.44	29.95	16.4%	22.57	25.70	14.2%	23.69	25.49	17.5%
5	28.97	30.04		22.65	26.08		23.84	25.78	
6	29.26	30.09		22.77	26.22		24.23	25.89	
7	29.34	30.27	Average	23.11	26.79	Average	24.35	26.03	Average
8	29.38	30.34	difference	23.16	26.84	difference	24.58	26.07	difference
9	29.65	30.41	boys vs girls	23.28	26.91	boys vs girls	24.59	26.10	boys vs girls
10	29.78	30.54	6.1%	23.47	26.85	13.1%	24.61	26.13	7.9%

2021 National 400 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	66.30	67.12	Difference #1	49.29	56.80	Difference #1	51.96	55.70	Difference #1
2	66.88	67.67	boy vs # 1	50.47	58.57	boy vs # 1	55.52	57.08	boy vs # 1
3	67.59	67.74	girl	52.28	60.65	girl	55.58	57.60	girl
4	68.16	68.26	1.2%	52.44	61.45	13.2%	55.59	57.79	6.7%
5	68.51	68.37		53.31	61.81		55.72	58.02	
6	69.13	71.02		53.65	62.03		55.84	58.25	
7	69.75	72.73	Average	53.78	62.32	Average	55.92	59.25	Average
8	69.80	73.25	difference	54.51	62.33	difference	57.12	59.27	difference
9	69.81	73.31	boys vs girls	55.84	62.34	boys vs girls	57.18	59.40	boys vs girls
10	70.32	73.48	2.4%	55.90	62.40	13.0%	57.22	59.49	4.2%

2021 National 800 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	152.2	157.9	Difference #1	120.8	141.4	Difference #1	127.8	138.5	Difference #1
2	155.2	164.6	boy vs # 1	124.0	142.2	boy vs # 1	129.7	143.1	boy vs # 1
3	161.0	164.9	girl	125.1	148.8	girl	130.5	144.2	girl
4	161.1	165.9	3.6%	125.6	151.3	14.5%	133.2	144.2	7.7%
5	161.2	168.5		126.5	151.6		136.2	144.9	
6	161.6	169.9		136.5	152.5		136.5	145.0	
7	161.8	171.5	Average	137.1	153.1	Average	136.7	145.2	Average
8	162.2	173.1	difference	138.5	153.7	difference	136.7	145.6	difference
9	165.3	173.4	boys vs girls	139.5	153.8	boys vs girls	137.0	145.6	boys vs girls
10	166.9	174.7	4.5%	140.2	154.2	12.6%	137.9	145.8	6.9%

2021 National 1600 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	372.4	397.6	Difference #1	307.4	319.3	Difference #1	297.3	313.8	Difference #1
2	378.3	400.9	boy vs # 1	313.7	322.2	boy vs # 1	298.4	317.1	boy vs # 1
3	378.4	405.6	girl	315.0	322.6	girl	307.0	319.9	girl
4	402.0	435.2	6.3%	318.2	337.5	3.7%	313.9	323.3	5.2%
5	406.4	445.0		318.4	345.2		319.2	325.3	
6	413.4	457.0		320.5	345.7		320.4	326.2	
7	457.4	466.0	Average	327.0	345.9	Average	321.1	327.0	Average
8	473.3	466.8	difference	330.3	347.1	difference	321.9	330.0	difference
9	498.3	492.3	boys vs girls	333.4	347.5	boys vs girls	325.5	331.1	boys vs girls
10	505.0	495.0	4.0%	347.0	355.6	4.7%	327.1	332.5	2.9%

2021 National 3000 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	794.2	859.9	Difference #1	602.3	679.2	Difference #1	556.6	623.7	Difference #1
2	856.3		boy vs # 1	644.9	709.7	boy vs # 1	591.6	649.5	boy vs # 1
3			girl	646.6	714.2	girl	600.8	651.6	girl
4			7.6%	648.2	741.9	11.3%	607.1	654.9	10.8%
5	No	No		648.4	742.7		609.1	662.9	
6	further	Further		652.8	756.6		611.5	664.1	
7	data	Data	Average	658.9	760.2	Average	615.7	666.3	Average
8			difference	660.1	762.5	difference	617.3	666.8	difference
9			boys vs girls	662.7	780.2	boys vs girls	618.4	673.2	boys vs girls
10			NA%	671.6	792.3	12.7%	620.6	674.4	8.2%

2021 National Long Jump Distance (in inches)

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	156.0	176.0	Difference #1	256.8	213.8	Difference #1	224.0	201.3	Difference #1
2	156.0	163.8	boy vs # 1	247.0	212.0	boy vs # 1	222.5	197.3	boy vs # 1
3	155.0	153.0	girl	241.0	210.8	girl	220.5	195.8	girl
4	154.3	152.0	-11.4%	236.3	208.8	20.1%	210.3	193.5	11.3%
5	154.0	149.5		231.5	207.0		210.0	193.3	
6	152.8	146.0		225.0	204.8		206.8	192.5	
7	151.5	144.5	Average	224.0	194.5	Average	206.0	192.3	Average
8	150.8	137.5	difference	224.0	192.5	difference	205.5	192.0	difference
9	150.5	137.0	boys vs girls	221.8	192.3	boys vs girls	205.0	191.3	boys vs girls
10		No	1.4%			13.2%			9.1%
		Further							
	150.5	Data		219.0	187.5		204.5	189.0	

2021 National High Jump Distance (in inches)

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	38.0	37.5	Difference #1	72.0	58.0	Difference #1	63.0	56.0	Difference #1
2	38.0	34.0	boy vs # 1	70.0	58.0	boy vs # 1	61.0	56.0	boy vs # 1
3	36.0	32.0	girl	65.8	57.0	girl	60.0	57.0	girl
4	36.0	32.0	1.3	62.0	56.0	24.1%	59.0	56.0	12.5%
5	35.8	32.0		62.0	56.0		59.0	56.0	
6	35.5			62.0	55.0		59.0	55.0	
7	34.0	No	Average	61.0	54.0	Average	59.0	54.0	Average
8	32.0	further	difference	60.0	54.0	difference	58.0	54.0	difference
9	59.0	Data	boys vs girls	59.0	No	boys vs girls	57.8	56.0	boys vs girls
10			21.6%		Further	12.5%			6.9%
	56.0			56.0	Data		57.8	56.0	

Appendix 2 — Scholarly Publications in Past 10 Years

<u>Refereed Publications</u>

1. Brown GA, Shaw BS, Shaw I. How much water is in a mouthful, and how many mouthfuls should I drink? A laboratory exercise to help students understand developing a hydration plan. Adv Physiol Educ 45: 589-593, 2021.
2. Schneider KM and Brown GA (as Faculty Mentor). What's at Stake: Is it a Vampire or a Virus? International Journal of Undergraduate Research and Creative Activities. 11, Article 4. 2019.
3. Christner C and Brown GA (as Faculty Mentor). Explaining the Vampire Legend through Disease. UNK Undergraduate Research Journal. 23(1), 2019. (*This is an on-campus publication.)
4. Schneekloth B and Brown GA. Comparison of Physical Activity during Zumba with a Human or Video Game Instructor. 11(4):1019-1030. International Journal of Exercise Science, 2018.
5. Bice MR, Hollman A, Bickford S, Bickford N, Ball JW, Wiedenman EM, Brown GA, Dinkel D, and Adkins M. Kinesiology in 360 Degrees. International Journal of Kinesiology in Higher Education, 1: 9-17, 2017
6. Shaw I, Shaw BS, Brown GA, and Shariat A. Review of the Role of Resistance Training and Musculoskeletal Injury Prevention and Rehabilitation. Gavin Journal of Orthopedic Research and Therapy. 1: 5-9, 2016
7. Kahle A, Brown GA, Shaw I, & Shaw BS. Mechanical and Physiological Analysis of

Minimalist versus Traditionally Shod Running. J Sports Med Phys Fitness. 56(9):974-9, 2016

8. Bice MR, Carey J, Brown GA, Adkins M, and Ball JW. The Use of Mobile Applications to Enhance Learning of the Skeletal System in Introductory Anatomy & Physiology Students. Int J Kines Higher Educ 27(1) 16-22, 2016
9. Shaw BS, Shaw I, & Brown GA. Resistance Exercise is Medicine. Int J Ther Rehab. 22: 233-237, 2015.
10. Brown GA, Bice MR, Shaw BS, & Shaw I. Online Quizzes Promote Inconsistent Improvements on In-Class Test Performance in Introductory Anatomy & Physiology. Adv. Physiol. Educ. 39: 63-6, 2015
11. Brown GA, Heiserman K, Shaw BS, & Shaw I. Rectus abdominis and rectus femoris muscle activity while performing conventional unweighted and weighted seated abdominal trunk curls. Medicina dello Sport. 68: 9-18. 2015
12. Botha DM, Shaw BS, Shaw I & Brown GA. Role of hyperbaric oxygen therapy in the promotion of cardiopulmonary health and rehabilitation. African Journal for Physical, Health Education, Recreation and Dance (AJPHERD). Supplement 2 (September), 20: 62-73, 2014
13. Abbey BA, Heelan KA, Brown, GA, & Bartee RT. Validity of HydraTrendTM Reagent Strips for the Assessment of Hydration Status. J Strength Cond Res. 28: 2634-9. 2014
14. Scheer KC, Siebrandt SM, Brown GA, Shaw BS, & Shaw I. Wii, Kinect, & Move. Heart Rate, Oxygen

Consumption, Energy Expenditure, and Ventilation due to Different Physically Active Video Game Systems in College Students. International Journal of Exercise Science: 7: 22-32, 2014

15. Shaw BS, Shaw I, & Brown GA. Effect of concurrent aerobic and resistive breathing training on respiratory muscle length and spirometry in asthmatics. African Journal for Physical, Health Education, Recreation and Dance (AJPHERD). Supplement 1 (November), 170-183, 2013

16. Adkins M, Brown GA, Heelan K, Ansorge C, Shaw BS & Shaw I. Can dance exergaming contribute to improving physical activity levels in elementary school children? African Journal for Physical, Health Education, Recreation and Dance (AJPHERD). 19: 576-585, 2013

17. Jarvi MB, Brown GA, Shaw BS & Shaw I. Measurements of Heart Rate and Accelerometry to Determine the Physical Activity Level in Boys Playing Paintball. International Journal of Exercise Science: 6: 199-207, 2013

18. Brown GA, Krueger RD, Cook CM, Heelan KA, Shaw BS & Shaw I. A prediction equation for the estimation of cardiorespiratory fitness using an elliptical motion trainer. West Indian Medical Journal. 61: 114-117, 2013.

19. Shaw BS, Shaw I, & Brown GA. Body composition variation following diaphragmatic breathing. African Journal for Physical, Health Education, Recreation and Dance (AJPHERD). 18: 787-794, 2012.

Refereed Presentations

1. Brown GA. Transwomen competing in women's sports: What we know, and what we don't. American Physiological Society New Trends in Sex and Gender Medicine conference. Held virtually due to Covid-19 pandemic. October 19 22, 2021, 2021.
2. Shaw BS, Boshoff VE, Coetzee S, Brown GA, Shaw I. A Home-based Resistance Training Intervention Strategy To Decrease Cardiovascular Disease Risk In Overweight Children Med Sci Sport Exerc. 53(5), 742. 68th Annual Meeting of the American College of Sports Medicine. Held virtually due to Covid-19 pandemic. June 1-5, 2021.
3. Shaw I, Cronje M, Brown GA, Shaw BS. Exercise Effects On Cognitive Function And Quality Of Life In Alzheimer's Patients In Long-term Care. Med Sci Sport Exerc. 53(5), 743. 68th Annual Meeting of the American College of Sports Medicine. Held virtually due to Covid-19 pandemic. June 1-5, 2021.
4. Brown GA, Escalera M, Oleena A, Turek T, Shaw I, Shaw BS. Relationships between Body Composition, Abdominal Muscle Strength, and Well Defined Abdominal Muscles. Med Sci Sport Exerc. 53(5), 197. 68th Annual Meeting of the American College of Sports Medicine. Held virtually due to Covid-19 pandemic. June 1-5, 2021.
5. Brown GA, Jackson B, Szekely B, Schramm T, Shaw BS, Shaw I. A Pre-Workout Supplement Does Not Improve 400 M Sprint Running or Bicycle Wingate Test Performance in

Recreationally Trained Individuals. Med Sci Sport Exerc. 50(5), 2932. 65th Annual Meeting of the American College of Sports Medicine. Minneapolis, MN. June 2018.

6. Paulsen SM, Brown GA. Neither Coffee Nor A Stimulant Containing "Pre-workout" Drink Alter Cardiovascular Drift During Walking In Young Men. Med Sci Sport Exerc. 50(5), 2409. 65th Annual Meeting of the American College of Sports Medicine. Minneapolis, MN. June 2018.

7. Adkins M, Bice M, Bickford N, Brown GA. Farm to Fresh! A Multidisciplinary Approach to Teaching Health and Physical Activity. 2018 spring SHAPE America central district conference. Sioux Falls, SD. January 2018.

8. Shaw I, Kinsey JE, Richards R, Shaw BS, and Brown GA. Effect Of Resistance Training During Nebulization In Adults With Cystic Fibrosis. International Journal of Arts & Sciences' (IJAS). International Conference for Physical, Life and Health Sciences which will be held at FHWien University of Applied Sciences of WKW, at Wahringer Giirtel 97, Vienna, Austria, from 25-29 June 2017.

9. Bongers M, Abbey BM, Heelan K, Steele JE, Brown GA. Nutrition Education Improves Nutrition Knowledge, Not Dietary Habits In Female Collegiate Distance Runners. Med Sci Sport Exerc. 49(5), 389. 64th Annual Meeting of the American College of Sports Medicine. Denver, CO. May 2017.

10. Brown GA, Steele JE, Shaw I, Shaw BS. Using Elisa to Enhance the Biochemistry Laboratory

Experience for Exercise Science Students. Med Sci Sport Exerc. 49(5), 1108. 64th Annual Meeting of the American College of Sports Medicine. Denver, CO. May 2017.

11. Brown GA, Shaw BS, and Shaw I. Effects of a 6 Week Conditioning Program on Jumping, Sprinting, and Agility Performance In Youth. Med Sci Sport Exerc. 48(5), 3730. 63rd Annual Meeting of the American College of Sports Medicine. Boston, MA. June 2016.

12. Shaw I, Shaw BS, Boshoff VE, Coetzee S, and Brown GA. Kinanthropometric Responses To Callisthenic Strength Training In Children. Med Sci Sport Exerc. 48(5), 3221. 63rd Annual Meeting of the American College of Sports Medicine. Boston, MA. June 2016.

13. Shaw BS, Shaw I, Gouveia M, McIntyre S, and Brown GA. Kinanthropometric Responses To Moderate-intensity Resistance Training In Postmenopausal Women. Med Sci Sport Exerc. 48(5), 2127. 63rd Annual Meeting of the American College of Sports Medicine. Boston, MA. June 2016.

14. Bice MR, Cary JD, Brown GA, Adkins M, and Ball JW. The use of mobile applications to enhance introductory anatomy & physiology student performance on topic specific in-class tests. National Association for Kinesiology in Higher Education National Conference. January 8, 2016.

15. Shaw I, Shaw BS, Lawrence KE, Brown GA, and Shariat A. Concurrent Resistance and Aerobic Exercise Training Improves Hemodynamics in Normotensive Overweight and Obese Individuals.

Med Sci Sport Exerc. 47(5), 559. 62nd Annual Meeting of the American College of Sports Medicine. San Diego, CA. May 2015.

16. Shaw BS, Shaw I, McCrorie C, Turner S., Schnetler A, and Brown GA. Concurrent Resistance and Aerobic Training in the Prevention of Overweight and Obesity in Young Adults. Med Sci Sport Exerc. 47(5), 223. 62nd Annual Meeting of the American College of Sports Medicine. San Diego, CA. May 2015.

17. Schneekloth B, Shaw I, Shaw BS, and Brown GA. Physical Activity Levels Using KinectTM Zumba Fitness versus Zumba Fitness with a Human Instructor. Med Sci Sport Exerc. 46(5), 326. 61st Annual Meeting of the American College of Sports Medicine. Orlando, FL. June 2014.

18. Shaw I, Lawrence KE, Shaw BS, and Brown GA. Callisthenic Exercise-related Changes in Body Composition in Overweight and Obese Adults. Med Sci Sport Exerc. 46(5), 394. 61st Annual Meeting of the American College of Sports Medicine. Orlando, FL June 2014.

19. Shaw BS, Shaw I, Fourie M, Gildenhuys M, and Brown GA. Variances In The Body Composition Of Elderly Woman Following Progressive Mat Pilates. Med Sci Sport Exerc. 46(5), 558. 61st Annual Meeting of the American College of Sports Medicine. Orlando, FL June 2014.

20. Brown GA, Shaw I, Shaw BS, and Bice M. Online Quizzes Enhance Introductory Anatomy & Physiology Performance on Subsequent Tests, But Not Examinations. Med Sci Sport Exerc. 46(5),

1655. 61st Annual Meeting of the American College of Sports Medicine. Orlando, FL June 2014.

21. Kahle, A. and Brown, G.A. Electromyography in the Gastrocnemius and Tibialis Anterior, and Oxygen Consumption, Ventilation, and Heart Rate During Minimalist versus Traditionally Shod Running. 27th National Conference on Undergraduate Research (NCUR). La Crosse, Wisconsin USA. April 11-13, 2013

22. Shaw, I., Shaw, B.S., and Brown, G.A. Resistive Breathing Effects on Pulmonary Function, Aerobic Capacity and Medication Usage in Adult Asthmatics Med Sci Sports Exerc 45 (5). 51602 2013. 60th Annual Meeting of the American College of Sports Medicine, Indianapolis, IN USA, May 26-30 3013

23. Shaw, B.S. Gildenhuys, G.A., Fourie, M. Shaw I, and Brown, G.A. Function Changes In The Aged Following Pilates Exercise Training. Med Sci Sports Exerc 45 (5). 51566 60th Annual Meeting of the American College of Sports Medicine, Indianapolis, IN USA, May 26-30 2013

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A complete CV is available at

https://www.unk.edu/academics/hperls/bio_pages/current-vita-gab.pdf

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF
WEST VIRGINIA
CHARLESTON DIVISION

B.P.J., by her next friend and
Mother, HEATHER JACKSON,

Plaintiff

vs. Case No. 2:21-CV-00316

WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official Capacity as State Superintendent, DORA STUTLER in her official Capacity as Harrison County Superintendent, PATRICK MORRISEY In his official capacity as Attorney General, and THE STATE OF WEST VIRGINIA,

Defendants.

Videotaped deposition of GREGORY BROWN, Ph.D., Volume I, taken on behalf of Plaintiff, with all participants appearing remotely, beginning at 7:02 a.m. and ending at 4:03 p.m. on Friday, March 25, 2022, before ALEXIS KAGAY, Certified Shorthand Reporter.

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[15]

GREGORY BROWN, Ph.D., having been administered an oath, was examined and testified as follows:

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[16]

EXAMINATION

BY MR. BLOCK:

Q Good morning, Dr. Brown. How are you today?

A I'm doing fine. Thank you. How are you today, Mr. Block?

Q I'm good. I'm good. This is our second time seeing each other virtually for a deposition, isn't it?

A It is. It is.

Q Well, could you state your name for the record, please.

A My name is Gregory Allen Brown.

Q And have you had your deposition taken before?

A. Yes, I have.

MR. FRAMPTON: Josh, real -- real quick, just before we get too far, I just want to memorialize for the record, are we proceeding under the same agreement that all objections except to form and scope are reserved?

MR. BLOCK: Yes. And -- and I'd like to actually also propose that, of course, any party is free to object on their own, but it is also not necessary for multiple parties to object to the same question that -- an objection from one defendant or **[17]** intervenor will preserve the objections for everyone else as well. Is that also acceptable?

MR. FRAMPTON: That -- that's acceptable to the intervenor.

MR. TRYON: This is David Tryon. That is acceptable to the State.

MS. GREEN: This is Roberta Green. That's acceptable to WVSSAC.

MR. CROPP: This is Jeffrey Cropp. That's acceptable to the Harrison County Board of Education and Dora Stutler.

MR. TAYLOR: This is Michael Taylor. That's acceptable for the State Board of Education and Superintendent Burch.

MR. BLOCK: Excellent.

BY MR. BLOCK:

Q So other than your deposition with me, have you had any other depositions taken?

A No, I have not.

Q All right. Great. So I'll just review with you some ground rules again, which you're -- you're probably familiar with, and I have three of them. You know, the first is that -- actually, it's **[18]** less applicable for a video deposition, but it's important that all of your responses be verbal instead of head nods so that we can have a -- a transcript of your responses. Does that sound good to you?

A Yes. Thank you.

Q Sure. The second is that we need to make sure not to speak over each other. So if you could wait for me to complete my question before answering and I'll wait for you to complete your answer before I ask another question. Does that sound fair?

A I'll do my best.

Q So will I. And the third is that, you know, as always, it's my job to ask questions that you understand. So if there's anything about my question you don't understand, I'm going to rely on you to explain to me that you don't understand it, and I will do my best to rephrase it. But if you answer the question, I'm going to assume that meant that you understood what I was saying, okay?

A Sounds fair.

Q Terrific. All right. How did you prepare for the **[19]** deposition today?

A Reviewed what I had written for my declaration, the expert report. I had a good breakfast, got a good night's sleep. I have met with attorneys for Alliance Defending Freedom and David Tryon to brief me on, you know, what happens in a deposition, what I should expect.

MR. FRAMPTON: I'm going to instruct the witness, you don't -- anything that we discussed is privileged. So you can certainly tell him that you met with us, but the substance of that discussion should not be told.

THE WITNESS: Okay.

BY MR. BLOCK:

Q Did -- in preparation for the deposition, did you review anything that was not cited in your report?

A Yes. Like previous exercise physiology textbooks, lots of other things that probably weren't cited in there, just in the course of general knowledge.

Q And -- and you -- you've reviewed those to refresh your understanding of them in preparation for today's deposition?

A Yes. And also in preparation for teaching my classes and those types of things. **[20]**

Q Did you conduct any additional research to prepare for today's deposition?

A Can you explain what you mean by "research"?

Q Well, I guess, did you look for new articles in the field or anything like that in preparation for the deposition?

A Yes. In preparation for the deposition, I have looked to see if there have been any relevant new publications, and I haven't come up with any that I haven't cited in the deposition.

Q Great. Have you been retained as an expert

witness before?

A Yes.

Q I want to get a complete list of all of the times you've been retained as an expert witness. So could you tell me, to the best of your recollection, the first time you were retained as an expert witness?

A That would be for the case of Soule versus the Connecticut Interscholastic Athletic Association (sic).

Q And who retained you for that case?

A Alliance Defending Freedom.

Q Great. What is the next case in which you were retained as an expert witness?

A The next case is Hecox versus Little in the **[21]** state of Idaho.

Q And who retained you as an expert witness in

that case?

A That was the Idaho attorney general's office.

Q And what's the next case where you were retained as an expert witness?

A The next case is in Florida, and I apologize, I cannot remember the names and initials on that versus State of Florida.

Q And what's the general subject of the litigation?

A Similar to this one, State of Idaho, as regarding a state law on women's participation in women's sports.

Q A Florida state law?

A Yes.

Q And who retained you in that case?

A Andy Bardos, if I remember correctly on his last name. I apologize if I don't get the pronunciation correctly. And that is -- they're working for the State of Florida.

Q Is there any other case in which you've been retained as an expert witness?

A I have agreed to serve as an expert witness in the state of Arkansas if there is a case that were to **[22]** come forth there.

Q Related to sports?

A Yes. Yeah, same topic.

Q But not as an expert in any other litigation in Arkansas about other types of legislation; right?

A That's correct.

Q Is there any other case in which you've been retrained as an expert witness?

A Just want to verify that I said them. So Soule versus CIAC, Idaho, Florida, Arkansas and then the current case.

Q Okay. How about in Tennessee, are you an expert witness in Tennessee?

A No.

Q Have you been retained as a nontestifying expert witness in connection with any litigation?

A No.

Q Okay. All right. So I'm going to just review with you some previous expert reports you filed. Actually, before I do that, have you filed an expert report yet in the Florida litigation?

A No.

Q Okay. All right. So -- so this is going to be the moment of truth. I'm going to attempt to move a document into Exhibit Share, and we'll see -- we'll see **[23]** how that -- that works. All right. All right. Let's see. Actually, first, I'm going to try to get your -- your current expert report into here. Just give me half a second.

A Take your time.

Q Yeah, no, I might need to take my time. All right. No, here's the one in your case. All right. Moving it into our "Marked Exhibits" folder. And in a moment, like when you refresh, you should hopefully see a document.

A So is the document 2022.02.23 Brown Expert Report PDF?

Q Yes. And -- and just --

MR. BLOCK: Lindsay, does that automatically get marked as a -- a sequential exhibit number?

MS. DUPHILY: It -- I -- I'll fix it. And I'll show you -- you need to mark it as a – introduce it as an exhibit. You just moved it.

MR. BLOCK: I just moved it. Okay. So sorry. How -- how do we --

MS. DUPHILY: I can -- I can correct it. Go ahead and continue, and I will correct it.

MR. BLOCK: Okay. And -- thanks. Will you be able to do that for the subsequent **[24]** ones, too? And sorry for my incompetence.

MS. DUPHILY: Why don't I just -- I will input the next ones and then show you on the break how to do it.

(Exhibit 64 was marked for identification by the court reporter and is attached hereto.)

MR. BLOCK: Terrific. Thank you so much.

BY MR. BLOCK:

Q All right. Do you recognize this document?

A Yes, I do.

Q What is it?

A It is my expert declaration for the case of B.P.J. versus West Virginia.

Q And when is it -- when is it dated?

A It states: "Executed on February 23, 2022."

Q And that's your signature next to it?

A Yes, that is.

Q Okay. So now I'm just going to take you through some previous reports that you filed. So if you hit refresh, you should see another document titled "Brown PI decl."

A Yes.

Q Great. Do you recognize that document?

A Yes, I do. **[25]**

Q What is it?

A That is my expert declaration in the case of Soule versus Connecticut Association of Schools.

Q Great. And when is that dated?

A Dated February 12th, 2020.

Q Terrific. Let me take a look at that. All right. Let me show you another one, I'm sorry.

MS. DUPHILY: Maybe -- maybe we should quickly, it's up to you --

MR. BLOCK: Yeah, let's do a little bit -- let's go off the record, and you can give me a tutorial, and then we can be -- save time.

THE VIDEOGRAPHER: We are off the record at 9:18 a.m.

(Recess.)

THE VIDEOGRAPHER: We are on the record at 9:21 a.m.

BY MR. BLOCK:

Q All right. Dr. Brown, during our break, we sort of recorrected and marked the exhibits we previously looked at. Could you, just for the record, look at the document marked Exhibit 64, please.

A All right. Exhibit 064. **[26]**

Q And what is that exhibit?

A That is my expert declaration for B.P.J. versus West Virginia.

(Exhibit 65 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q Terrific. And -- now, can you look at the document marked Exhibit 65, please.

A All right. 065.

Q And what is that --

A Yes --

Q What -- what -- what is that document?

A That is my declaration in the case of Soule versus Connecticut Association of Schools.

MR. BLOCK: Great. All right. And now I'm going to give you another document to look at in a minute. In your folder should be appearing a document marked Exhibit 66.

(Exhibit 66 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q Could you let me know when you see that document?

A Exhibit 066 - WV AG?

Q Yes. **[27]**

A And on the first page of that, it's got, in large bold capital letters, "Exhibit B"?

Q Uh-huh.

A Okay.

Q Could you go to the second page?

A Yes.

Q All right. And could -- do you recognize this document?

A Yes, I do.

Q And what is it?

A That is my expert declaration for the case of Hecox versus Little.

Q Terrific. And if you scroll down to – to near the end, which I -- if we can find the date on which that one was executed. It should be on page 69 of the PDF. Are you -- do you see it?

A I'm still scrolling.

Q All right. You can also type in "69" in the -- the -- the top box, if that make it easier too.

A Sorry. Sorry, I tried to type in "69," and I accidentally Google searched for that.

Q Oh, well. Have you gotten to it yet?

A Still scrolling.

Q All right. **[28]**

MS. DUPHILY: If you download these exhibits, you can also access them easier with your software.

MR. FRAMPTON: I think he's almost there.

THE WITNESS: All right. I see my signature page. Well, yeah, executed 3rd June 2020.

BY MR. BLOCK:

Q Terrific. And then for this litigation of B.P.J., at the PI stage, you also submitted a copy of this Hecox declaration; is that right?

A Yes.

MR. BLOCK: Okay. And then I want to show you another document in a second. So this document is going to be marked, as soon as I'm able to mark it, as Exhibit 67. Let me know when it's visible for you.

(Exhibit 67 was marked for identification by the court reporter and is attached hereto.)

THE WITNESS: All right. Exhibit 067 – Gregory Brown Male Athletic --

BY MR. BLOCK:

Q Yes.

A Yes.

Q What is this document?

A That is a "White Paper Concerning Male Physiological and Performance Advantages in Athletic **[29]** Competition and The Effect of Testosterone Suppression on Male Athletic Advantage."

Q And it's dated December 14th, 2021; correct?

A That is correct.

Q Now, this document was not prepared as an expert report in -- in any litigation, was it?

MR. FRAMPTON: Object to the form.

BY MR. BLOCK:

Q Why did you prepare this document?

A I was asked by Alliance Defending Freedom to prepare a white paper.

Q Okay. And what is a -- a white paper as opposed to an expert report?

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: White paper is often used by an

organization, a company, something like that, for gaining insight or information on a topic.

BY MR. BLOCK:

Q Okay. So did you -- what did you understand to be the -- the purpose of this white paper?

A My understanding was that this was for Alliance Defending Freedom and affiliated and interest organizations to be able to review the research that I summarize in that paper. **[30]**

Q Okay. And did you -- did you have an understanding that this white paper would be used for any lobbying purposes?

MR. FRAMPTON: Object to the form.

BY MR. BLOCK:

Q You can answer, if you understand.

A My understanding was that Alliance Defending Freedom could do it with what they wanted and people could ask them for it for purposes that people want to use it for.

Q But did you -- so did you know one way or another whether the -- the document would be used for purposes of lobbying?

A I assumed that it would be introduced to people who are interested in what the science says on the matter of transgender athletes competing in women's sports.

Q And those would include legislators?

A Yes.

Q Okay. And, in fact, you have testified in support of legislation to restrict the ability of transgender girls and women to participate in women's sports; is that right?

MR. TRYON: Objection --

MR. FRAMPTON: Object to the form. **[31]**

MR. TRYON: -- terminology.

MR. FRAMPTON: Josh, real quick, could we do our usual standing objection on terminology so that we don't have to jump in on that every time?

MR. BLOCK: You know -- yes. Yes, you can. I -- I will have some questions on that, and you can -- you -- you can -- if we could -- I'll give you that standing objection, but the witness has also used some of these terms himself in written reports, so I'm -- I want to have a little colloquy with him about that.

BY MR. BLOCK:

Q But -- but in the meantime, you -- you have in fact testified in support of legislation similar to the -- the legislation at issue in this case; is that right?

MR. FRAMPTON: Object to the form. Go ahead.

THE WITNESS: Yes, I have testified in front of legislative bodies regarding legislation clarifying the participation of biological females in women's sports.

BY MR. BLOCK:

Q The participation of biological females, or did you mean -- did you mean to say transgender females

or, to use your language, biological males? I just **[32]** want to know the -- want to make sure you spoke correctly.

A The legislation was to limit the participation in girls and women's sports to biological females.

Q Great. And so where -- which states did you testify in -- in support of legislation?

A I may not be able to remember all of them. I will give you my best recollection. Ohio, Pennsylvania, Texas, South Dakota, Maine, North Carolina are ones that I think I testified either in person or through Zoom.

Q And who asked you to testify in each of those states?

A That would vary from one state to the next.

Q Okay. So let -- let's take them one at a time. In Ohio, who asked you to testify?

A Center for Christian Virtue.

Q And in Texas, who asked you to testify?

A Texas Values, if I remember correctly, is their name.

Q And in North Carolina, who asked you to testify?

A I can't remember their name exactly, but it was something along North Carolina Family Values, **[33]** something like that.

Q In Pennsylvania, who asked you to testify?

A Pennsylvania Family Alliance, if I remember correctly.

Q And in Maine, who asked you to testify?

A That, I think, was Save Women's Sports.

Q And do you know whether the legislatures in any of those states received copies of your white paper?

A I do not know if they received copies of my white paper.

Q When you testified in those states, did you refer to any of the analysis or research you conducted in the white paper?

A I -- many of those were testified last year before I had completed the white paper.

Q So what about the ones that were after you had completed the white paper?

A After completing the white paper, I know I had referred to my previous expert declaration in Connecticut and Idaho. I don't remember if I referred specifically to the white paper.

Q So in Pennsylvania, you don't know if the Pennsylvania legislature had a copy of your white paper or not? **[34]**

A No. That was before I had written the white paper.

Q So when did you -- during what period of time did you write the white paper?

A Well, I started working on it essentially as soon as I had finished the declaration for Idaho, just as -- you know, trying to update as new research or new information became available. And so it was over the course of a year and a half, year and three-quarters that I was working on the -- the white paper.

Q And had ADF asked you to -- to create the right -- excuse me -- the white paper a year and a half before the publication date?

MR. FRAMPTON: Object to the form.

THE WITNESS: No. I was just updating the information so that I would be current on the topic.

BY MR. BLOCK:

Q And so when were you asked to -- to write down that information in the form of a white paper?

A Sometime this last fall. I can't remember. September, October, somewhere in those lines, but I cannot remember exactly.

Q Okay. Were you paid for -- to write the white paper?

A No, I was not. **[35]**

Q So you have disclosed in your report that your hourly rate for preparing your expert report; is that right?

A That is correct.

Q But is it fair to say that a substantial portion of the expert report was based on the white paper?

MR. FRAMPTON: Object to the form.

THE WITNESS: That would be fair to say that.

BY MR. BLOCK:

Q Okay. So to the extent that any of the work in the expert report was already conducted for the white paper, then that was essentially done for free; is that fair?

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: Yes, it would be fair to say that the white paper was not paid for, for my work on that, and so overlap between the white paper and the expert report was primarily volunteer work.

BY MR. BLOCK:

Q And when you first became interested in the topic of the participation of transgender people in sports, you were the person who reached out to ADF; is that right? **[36]**

A That is correct.

Q And why did you do that?

A I had seen a news report about the Soule versus Connecticut case and -- well, a -- a report. I guess I shouldn't say "news" because I can't remember where I saw it. And so I reached out to Alliance Defending Freedom to see if I could be of help.

Q So you -- you personally feel strongly about this issue; is that fair?

MR. FRAMPTON: Object to the form.

THE WITNESS: I don't know that I would characterize my interest as a feeling so much as an intellectual and professional interest.

BY MR. BLOCK:

Q Is there any other circumstance in which you've reached out to an organization to volunteer yourself as an expert source?

A Yes.

Q What -- can you tell me what those situations are?

A I have reached out to legislators in the state of Nebraska to state that I am an exercise physiologist and would be willing to help if they have questions on litigation in this -- or legislation in this area, not just trans women's -- transgender individuals in **[37]** sports, but relative to my professional expertise in exercise physiology.

Q Okay. Any other instance?

A I am trying to remember. I -- I can't remember others. They may have happened, where I reached out and did not get a response.

Q But sitting here today, you can't remember what those other instances were?

A That is correct.

Q Okay. And you -- you're not sure that there were other instances; is that right?

A That is correct.

Q All right. So that -- that's all my questions on that topic. I do have some questions just about terminology here. You know what the term "cisgender" means; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: Cisgender means a person whose gender identity aligns with their biology.

BY MR. BLOCK:

Q And you don't have any objection to using the word "cisgender," do you? **[38]**

A Yes, I do.

Q You've used the word "cisgender" in other publications, haven't you?

A I have.

Q Okay. Why did you use the word "cisgender" in those publications?

A Because it is a frequently used term in the - in this field, and so it is probably the appropriate term to use.

Q So why do you have an objection to using that term in the deposition if -- if that's the appropriate term to use?

MR. FRAMPTON: Object to the form.

THE WITNESS: I know of individuals who do not like the term "cisgender" because when it is applied in the term such as "cis male" or "cis female," they consider it to be infringing upon their identity as male or female and the "cis" is unnecessary.

BY MR. BLOCK:

Q Do you consider the word -- the term "cisgender male" to be infringing upon your identity as a male?

MR. FRAMPTON: Object to the form.

THE WITNESS: No, I do not. **[39]**

BY MR. BLOCK:

Q Okay. Who are the individuals that -- that you know that view the term "cisgender" as infringing on their own identity?

A I could not tell you every person I know that states that. I have colleagues and coworkers that have stated that to me in private conversations, family members that have stated that to me in private conversations. Even students have stated to me that they do not like being referred to as cisgender.

Q And have any of those people, to the best of your knowledge, been directly referred to as being cisgender?

A To my knowledge, yes, they have.

Q Okay. So -- but you -- you personally don't view the term "cisgender male" as infringing on your own identity; correct?

A That is correct.

Q Okay. So if I use the term "cisgender" during this deposition, you'll understand what I'm talking about; correct?

A Yes, I understand it is the term commonly used in this type of matter, legally and professionally.

Q Okay. And if -- if I ask you to clarify whether a particular statement that you made is **[40]** referring to cisgender males, you -- you would be able to clarify that for me; correct?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, it is my understanding that a cisgender male is an individual who is biologically male and their gender identity is male.

BY MR. BLOCK:

Q And you know what the term "transgender" means; right?

MR. FRAMPTON: Same objection.

THE WITNESS: Yes.

BY MR. BLOCK:

Q What does it mean?

A Transgender is for someone whose gender identity does not align with their biological sex.

Q And you don't have any objection to using the word "transgender" in this deposition, do you?

A No, I do not.

Q Okay. And you've used the word "transgender" in your own writings, haven't you?

A That is correct.

Q Okay. Do you know what the term "transgender woman" means?

MR. FRAMPTON: Same objection.

THE WITNESS: I get confused with transgender **[41]** woman sometimes because I'm not sure if that means a trans woman or someone who is transgender that identifies as a woman. Does that make sense?

BY MR. BLOCK:

Q Yeah. Well, so do you know what the term "trans woman" means?

A Yes, I do.

Q Okay. What -- what does the word "trans woman" mean to you?

A A trans woman is an individual who is biologically male but whose gender identity is that of a woman.

Q And you've used the term "trans woman" in your writings, haven't you?

A That is correct.

Q Okay. So if I ask you to clarify whether the people you refer to in a question are trans women, you'll be able to clarify that for me?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, I will do my best.

BY MR. BLOCK:

Q Okay. And do you know what the term "transgender girl" means?

A Same as with transgender woman, it is **[42]** sometimes confusing to me if they mean if this is a boy that identifies as girl or a girl that identifies as boy.

Q How about if I use the term "trans girl," will -- do you understand what that would mean?

A Yes, I understand "trans girl."

Q Okay. And what does trans girl mean to you?

A A trans girl is a juvenile/youth/child whose biological sex is male but who identifies as a girl.

Q Okay. You've been using the phrase "biological sex"; correct?

A That is correct.

Q What is your understanding of what the term "biological sex" means?

A So sex is a biological variable. Sex is determined at conception with the conferral of sex chromosomes.

Q And is it your understanding that "biological sex" refers to anything other than chromosomes?

A Yes.

Q So what else besides chromosomes does the term "biological sex" refer to?

A So if we are referring to a person who is a biological male, they would have sex chromosomes of male and their body system of organization, **[43]** anatomically and physiologically, would be around the production of small gametes, which means sperm.

Q And how would you refer to the biological sex of someone with complete androgen insensitivity syndrome?

MR. FRAMPTON: Object to the form.

THE WITNESS: My understanding of someone with complete androgen insensitivity syndrome is they are biologically male, but they are not receptive to androgens, but their body is still organized around the production of sperm.

BY MR. BLOCK:

Q And how would you refer to the biological sex of someone with XXY chromosomes?

A If I remember correctly

MR. TRYON: I would like to just object to the scope. Thank you.

MR. FRAMPTON: Objection; form, scope.

THE WITNESS: If I remember correctly, XXY is Turner syndrome, in which a person is biologically male. They have an extra X chromosome, but they are still male.

BY MR. BLOCK:

Q So you define biological sex as male if there **[44]** is a Y chromosome present?

MR. FRAMPTON: Object to the form, scope.

THE WITNESS: That is the beginning of sex determination, is if there is a Y or an X chromosome. BY MR. BLOCK:

Q Right. So as to -- to clarify, so as long as there's a Y chromosome, you, in your understanding of the term "biological sex," would view that person as being biologically male?

MR. FRAMPTON: Same objections, form and scope. Go ahead.

THE WITNESS: That is my understanding, yes.

BY MR. BLOCK:

Q Okay. And when -- do you have any opinions on whether a person with complete androgen insensitivity syndrome should be allowed to play on sports teams for girls and women?

MR. FRAMPTON: Objection; form and scope. Go ahead.

THE WITNESS: So situations such as complete androgen insensitivity syndrome is very debated in the sports science community right now on how best to handle those individuals and where they should participate in sports. **[45]**

BY MR. BLOCK:

Q And what's your opinion?

MR. FRAMPTON: Same objections.

THE WITNESS: So I have been retained as an expert witness in this matter primarily dealing with biological male and biological female and not as an expert on disorders or differences of sexual development. And so I would say I probably would not be the best person to offer a statement on where someone with CAIS should participate.

BY MR. BLOCK:

Q But you just testified earlier that you view someone with -- with CAIS as being a biological male, isn't that so?

A That is correct.

Q And so if you're providing expert testimony on the participation of biological males, wouldn't that include testimony about a biological male with – in your words -- with CAIS?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: If I had been asked to provide expert information on that matter, I could perhaps look more into it, but I have not been asked to provide expert witness, expert statement on where individuals with disorders/differences of sexual development should **[46]** participate.

BY MR. BLOCK:

Q Okay. So you -- you have no expert opinion on the participation of people with DSDs in sports for girls and women; right?

MR. FRAMPTON: Objection; form and scope. Go ahead.

THE WITNESS: In my declaration, there is a small statement in there about DSDs, and I will stand by that statement.

BY MR. BLOCK:

Q All right. Well, let's look to that. If you could turn to that -- that exhibit and -- and identify for me the statement about DSDs.

A Which exhibit number is that?

Q That's a good question. I think it's Exhibit Number -- separate windows are tough. I believe it's the first one up there, Exhibit 64. So it might be in paragraph 4 of your report, if you could look at that.

A All right. I am looking at paragraph 4.

Q Okay. Is this the reference to DSDs that you're -- that you were referring to just now?

A That is correct.

Q Okay. So the -- the first sentence – the **[47]** first two sentences of that paragraph say (as read):

"Although disorders of sexual development (DSDs) are sometimes confused with discussions of transgender individuals, the two are different phenomena. DSDs are disorders of physical development. Many DSDs are 'associated with genetic mutations that are now well known to endocrinologists and geneticists.'"

Did I read that correctly?

A Yes, you did.

Q Okay. And so that's the extent of your expert testimony about DSDs?

A That is correct.

Q Okay. Do you know if complete androgen insensitivity syndrome is associated with a genetic mutation?

MR. FRAMPTON: Object to the form.

THE WITNESS: I will stand by that statement which is a quote from the endocrinology -- Endocrine Society.

BY MR. BLOCK:

Q But sitting here today, you don't know whether CAIS is associated with a genetic mutation, do you?

[48] MR. FRAMPTON: Same objection.

THE WITNESS: I do not know off the top of my head.

BY MR. BLOCK:

Q Okay. So -- so to the best of your knowledge, does H.B. 3293 make any distinction between people with DSDs and people who are transgender?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: I would need to refresh my reading on that bill to see what it states on that matter.

BY MR. BLOCK:

Q So -- but the scope of your expert testimony, when you provide opinions about people who, in your language, are biological males, you are limiting your expert opinion to people who are biological males who -- who are either cisgender males or trans girls and trans women; is that right?

MR. FRAMPTON: Same objections.

THE WITNESS: Can you please restate the question for me?

BY MR. BLOCK:

Q Yeah. So -- so you're providing testimony about, quote, biological males; correct?

A Biological males and biological females. **[49]**

Q Okay. So in terms of biological males, the only biological males you're addressing in your testimony, to -- to use your phrase, biological males, are cisgender boys and men and trans girls and women, but not any biological males, in your language, that have DSDs; is that fair?

MR. FRAMPTON: Objection; form and scope. Go ahead.

THE WITNESS: Yes, I was not asked to offer expert opinion on differences or disorders of sexual development.

BY MR. BLOCK:

Q All right. Including people who you consider to be biological males who have DSDs; correct?

MR. FRAMPTON: Same objection.

THE WITNESS: That is correct.

BY MR. BLOCK:

Q Okay. Do you know what the term “sex assigned at birth” refers to?

A Yes, I understand the term “sex assigned at birth.”

Q Okay. So -- so if I use the term “sex assigned at birth,” you can understand what I'm saying?

A Yes, I can understand what you're saying.

Q Okay. Great. **[50]** I have some questions just about your education and research background, but, you know, I'd prefer not to belabor them by going through your CV line by line. So I'm going to ask you questions, and if you think you need to refer specifically to your CV, we can do that, but I'm hoping that's not necessary. So as part of your formal education, you never took any courses regarding transgender people; is that right?

A I did not take a course where the title of the course was “Transgender Individuals.”

Q Okay. And did you take a course where transgender individuals were discussed?

A Yes.

Q And how many courses?

A That would be difficult to say. To give a number, I mean, I would be speculating right now. It's been 20 years.

Q Do you -- do you have any specific recollection of any courses where transgender people were discussed?

A I am pretty sure that transgender individuals were discussed in the undergraduate Abnormal Psychology class I took. Very possibly in General Psychology. Possibly discussed in any of the numerous physiology **[51]** classes as an undergraduate or graduate student. Possibly in the endocrinology class as a graduate student.

Q This is all just possibly; right? You don't have a specific recollection?

A Just thinking, also some of the sociology classes may have included it. But, again, it might have; it might not have been. And also, whether that was a discussion that the instructor initiated or the students initiated, I couldn't testify at this point

Q Okay. You received your undergrad degree in

1997; right?

A That is correct.

Q Do you -- do you think it's -- it's plausible that you had a lot of discussions about transgender people from 1993 to 1997?

A Yes, it's very plausible.

Q Okay. Have you ever -- as part of your --obtaining any -- any of your degrees, did you ever conduct any research concerning transgender people?

A Can you clarify what you mean by "research"?

Q I -- I mean original research, where you have a hypothesis and you test it.

A So, no, I did not conduct any primary research on transgender individuals. **[52]**

Q Okay. Did you conduct any other form of research other than what you referred to as primary research?

A I probably looked for research papers or maybe saw research papers on transgender individuals. Again, it may have been as part of an assigned reading in a class, or it may have been something come across in other reading for general knowledge.

Q You're just saying that this could have happened, but you don't have a specific recollection of it, do you?

A That is correct. I did not write down in a diary when I would read a paper.

Q Well, no, but you -- sitting here today, you don't have any recollection of ever reading a paper on transgender people as part of obtaining your undergraduate, your Master's or your Ph.D. degrees; correct?

A I don't think that's what I said.

Q Well, so --

A I think I said I -- I might have. I didn't say that I did not.

Q Well, but you don't have any affirmative memory of doing so?

MR. FRAMPTON: Object to the form. **[53]**

THE WITNESS: What do you mean by "affirmative memory"?

BY MR. BLOCK:

Q Well, by -- by saying you might have, that --that's different to me than saying you remember doing it in some form, but don't remember the exact time or place. So I'm trying to clarify whether you remember doing it, but can't, you know, put your finger on exactly when it happened, or whether you're saying you can't rule out the possibility that you did it. So are you saying that you can't rule out the possibility that you did it?

A So I am saying that it's very likely that I had discussions in classes on transgender individuals. It's very likely that there was a paper that I read or more than one paper regarding transgender individuals, possibly even a textbook chapter.

Q Okay. And do you consider reading a textbook chapter or paper for class to be academic research?

A Reading a scholarly paper would be considered academic research as it could lead to something like a literature review, a meta-analysis, and it is an essential part of the research process.

Q Right. But you didn't do any reading as part of preparing for literature review or meta-analysis; **[54]** correct?

A I did not include any in my literature review or meta-analysis. I may have done reading as part of my Master's thesis and doctoral dissertation. I know for a fact, because of the topic of my Master's thesis and doctoral dissertation, I had to read very widely on steroid hormone, biogenesis and actions.

Q So we had a discussion about some of this two years ago. Do you think your memory about what -- your readings was more accurate two years ago or more accurate today?

MR. FRAMPTON: Object to the form.

THE WITNESS: I would say more accurate today because I have -- since you asked me this two years ago, I've thought about it more to remember, okay, did this happen in Abnormal Psychology, in Sports Psychology, something like that.

BY MR. BLOCK:

Q Okay. So I just want to be clear about a distinction between conducting reading as in a -- as a class assignment and conducting reading as part of your research process. All right? Does that distinction make sense to you?

A Yes. **[55]**

Q Okay. So you've -- you've talked about maybe reading a paper or a chapter as part of a class assignment; correct?

A Yes.

Q Okay. So in terms of reading as part of your own independent research process, do you have any recollection of doing any reading about transgender people as part of your own independent research process while obtaining your degrees?

A I don't have a specific recollection of doing that independently while reading my -- while performing my Master's and doctoral research, but, again, I might have.

Q Okay. So since receiving your doctorate until the time when you first reached out to ADF, have you -- had you ever conducted any research concerning transgender people?

A Once again, please clarify what you mean by "research."

Q All right. Well, let's do primary research.

A No, I had not done primary research of transgender individuals.

Q Had you ever conducted any literature review regarding transgender people?

A I have not formally written a literature **[56]** review.

Q Had you ever written a meta-analysis about transgender people?

A No, I had not performed a meta-analysis regarding transgender individuals.

Q Okay. So what other professional research might you have done regarding transgender people?

A Trying to keep up with the legislation in sports regarding the participation of transgender individuals and then on seeing the legislation, out of my own curiosity, looking to see what research was informing that legislation.

Q Okay. In terms of original research that you've done, have any of the subjects in your original research been transgender, to the best of your knowledge?

A To the best of my knowledge, none of any subjects have been transgender.

Q Okay. Have you worked with transgender people in any capacity?

MR. FRAMPTON: Object to the form.

THE WITNESS: I -- I think there are individuals at the university that are transgender that I have worked with on committees or other things. **[57]**

BY MR. BLOCK:

Q Okay. How many transgender people do you think you've met?

MR. FRAMPTON: Same objection.

THE WITNESS: I can think of two by name and others that I've met, but -- I've met a lot of people, and so to try and come up with a number that were transgender is going to be very, very difficult.

BY MR. BLOCK:

Q Have you ever appeared on any podcasts?

A Yes.

Q Which ones?

A I probably can't name all of them.

Q Okay.

A I can do my best.

Q Great.

A So there was a podcast Muscle for Life with --with Mike Matthews, I think. I was on the Megyn Kelly podcast. I was on Munk Debates podcast. I was on Governor Ricketts' podcast. There's another one out there that I remember the podcast. I don't remember the name of it.

Q Do you remember approximately when the Megyn Kelly podcast was?

A A little less than a year ago, if I remember **[58]** right.

Q And what was the topic of that podcast?

A That was regarding the participation of biological males in female sports.

Q And what was the Munk Debates podcast?

A That was also about biological males participating in female -- in women's sports.

Q And when -- when was that podcast?

A Last summer, maybe late last summer.

Q Okay. And when you refer to biological males in these podcasts, did you discuss at all people with DSDs?

A If we did, it was not a major topic of discussion.

Q Okay. So your -- your podcast with Governor Ricketts, that's on his show "The Nebraska Way"; is that -- is that correct?

A That is correct.

Q Okay. And you appeared on September 1st, 2021?

A I will trust you on the date on that. I don't remember myself.

Q All right. Does that sound around the time?

A That sounds like the right time period.

MR. BLOCK: Okay. Great. **[59]** So I'm going to introduce an exhibit marked 68 and if you can open it up. The concierge -- it's an -- it's a video clip, and the concierge is going to have to play it for us. But let me know what appears on -- on your screen before -- before I ask the concierge to -- to play it. Do you see a file?

(Exhibit 68 was marked for identification by the court reporter and is attached hereto.)

THE WITNESS: I see Exhibit 068 - Clip, space, 2005.

BY MR. BLOCK:

Q Okay. I'm going to have -- I'm going to ask the concierge to play the clip now. And it's -- it's a little bit over a minute long. I didn't want to – you to think that I've cut anything off here. And then after the clip plays, I'll ask you a few questions about it. Does that sound okay?

A Will the clip show up in the -- in this Zoom meeting, or is it going to be a different window?

Q It's going to show up as a screen share --

A Okay.

Q -- right now. **[60]** Can you see the screen share?

A Yes.

Q Great.

(Video clip played.)

MR. BLOCK: Thank you to the concierge.

BY MR. BLOCK:

Q Does -- does this video clip appear to be an accurate excerpt of your interview with Governor Ricketts?

A Yes, that's me.

Q Okay. Do you still agree with everything you said in that video clip?

MR. FRAMPTON: Objection; form and scope.

MR. TRYON: Objection; scope.

BY MR. BLOCK:

Q You can answer.

A Can you repeat your question, please?

Q Do you still agree with everything you said in that video clip?

A Yes, I do

Q Okay. You're not a mental health expert; right?

A That is correct.

Q You don't have any education or training that -- that would provide a basis for you to offer an **[61]** expert opinion on the proper healthcare for transgender youth, do you?

MR. FRAMPTON: Objection; form and scope. Go ahead.

THE WITNESS: No, I would not be called upon to offer treatment for transgender individuals.

BY MR. BLOCK:

Q But my question is, to offer an expert opinion on treatment for transgender individuals, you don't have any, you know, credentials that would allow you to provide an expert opinion on that topic, do you?

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: I have not been asked to offer an expert opinion on the psychological or psychiatric care of transgender individuals.

BY MR. BLOCK:

Q But my question is, do you have the credentials and training that would allow you to offer such an opinion, if you were asked?

MR. FRAMPTON: Same objection.

THE WITNESS: No, I do not have those credentials or degrees.

BY MR. BLOCK:

Q Okay. In this clip, you used the word **[62]** "transgenderism"; right?

A That is correct.

Q Is that a medical term?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: I'm not sure what you mean, is it a medical term?

BY MR. BLOCK:

Q What does transgenderism mean?

A An individual who is transgender.

Q Okay. In any of the -- the scholarly articles that you've read about transgender people, have any of them used the term "transgenderism"?

A I cannot recall, to answer that question, if they have or have not.

Q Okay. In the clip, you mentioned Ben Shapiro; correct?

A That is correct.

Q Who is Ben Shapiro?

A Ben Shapiro is an individual that does a lot of podcasts, news clips, news interviews, speaking at organizations on social and political matters.

Q Do you -- do you think he's a reliable source of authority on mental healthcare for transgender youth?

MR. FRAMPTON: Objection; form and scope. **[63]**

THE WITNESS: In the role that he is filling, I think Ben Shapiro is able to provide reliable information on what has been written in these matters.

BY MR. BLOCK:

Q Okay. And reliable enough that you – you thought it was worth repeating to the audience of the podcast; correct?

MR. FRAMPTON: Same objections.

THE WITNESS: That is correct.

BY MR. BLOCK:

Q Okay. In what context have you heard his opinions about transgender youth?

A Do you mean context or format?

Q Let's start with format.

A So in a number of videos and radio clips and seeing on the news, I have seen Ben Shapiro make statements regarding transgender individuals.

Q And has that affected your own opinion on these issues?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: No, I don't think what he has said has affected my opinion.

BY MR. BLOCK:

Q Has it affected your opinion on mental healthcare for transgender youth? **[64]**

MR. FRAMPTON: Same objection.

THE WITNESS: I don't think it has affected my opinion on healthcare for transgender youth.

BY MR. BLOCK:

Q Okay. Is new toy syndrome a medical term?

MR. FRAMPTON: Same objections.

THE WITNESS: No.

BY MR. BLOCK:

Q Okay. Do you think that receiving gender-affirming care is analogous to playing with a new toy?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: I'm sorry, can you state the – restate the question?

BY MR. BLOCK:

Q Yeah. Do you -- do you think transgender youth receiving gender-affirming care is analogous to a person playing with a new toy?

MR. FRAMPTON: Same objections.

THE WITNESS: In the context that I quoted Ben Shapiro, in that interview, it is a good analogy.

BY MR. BLOCK:

Q How is it a good analogy?

A As I explained in that, also as it was explained by Ben Shapiro, when people get a new toy, **[65]** they're often very happy with it, and then the newness wears off. That is drawn as an analogy to what has been demonstrated in scholarly literature about transgender individuals.

Q What scholarly literature?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: The research is cited on the SEGM web page.

BY MR. BLOCK:

Q What's SEGM?

A I may not be able to tell you precisely, but it is something like Society for Evidence-Based Gender Medicine.

Q And why have you been reading the SEGM web page?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: It is a good place to find information about transgender individuals to help make sure that I am staying current on the information in this area.

BY MR. BLOCK:

Q How is information about the mental healthcare of transgender individuals relevant to you in your work?

MR. FRAMPTON: Same objections. **[66]**

THE WITNESS: The mental healthcare is often associated with the use of either puberty blockers, testosterone suppression, estrogen administration, which then has physiological effects.

BY MR. BLOCK:

Q So -- so you read about -- well, I -- I guess, could you explain further? How -- how is utility of the mental healthcare relevant to your opinion about physiological issues and athletic advantages?

MR. FRAMPTON: Same objection, form and scope.

THE WITNESS: If an individual is being given a physiologically active medicine, such as a puberty blocker, such as testosterone suppression or administration of estrogen, that will affect their physiology, which then may or may not have an [e]ffect on their ability to compete in athletics. So it is important to know what is being done.

BY MR. BLOCK:

Q Does -- does the mental health impacts of those treatments matter in terms of the physiological effects?

A If the mental health treatment includes the administration of physiological substances, then it affects physiological responses.

Q Yeah, so, I guess, that's not really answering **[67]** my question. So you -- you -- you talked about how, in your opinion, the positive mental effects of gender-affirming care for some people would – are like a new toy, that they have a positive effect and then that positive mental health effect wears off, and my question is whether the -- the fact that you alleged that positive mental health effect would wear off has any implication for the physiological results of having taken that medication. Does that make sense?

MR. TRYON: Objection --

MR. FRAMPTON: Objection; form.

MR. TRYON: -- form.

THE WITNESS: I would ask you to try and break that question down a little more.

BY MR. BLOCK:

Q Sure.

A I'm not sure where you're going.

Q Sure. So the -- if -- if -- assuming that --taking it as an assumption, that puberty blockers and gender affirming hormones had no positive health effects for mental health, how would that assumption impact your opinion on the physiological effects of taking those medications? **[68]**

MR. FRAMPTON: Objection; form and scope. Go ahead.

THE WITNESS: Well, puberty blockers and testosterone suppression and estrogen administration are physiological active substances. What they do for mental health compared to what they do for athletic performance and physiological responses might be separate issues.

BY MR. BLOCK:

Q Okay. So if they're separate issues, why do you read about the mental health effects of taking those medications?

MR. FRAMPTON: Same objections.

THE WITNESS: I think I previously answered this question, to know what are the treatments that are being used that could then affect physiological responses to exercise.

BY MR. BLOCK:

Q Okay. So what other sources of information do you consult on the -- the mental health effects of puberty blockers and gender-affirming hormones?

MR. FRAMPTON: Objection; scope.

THE WITNESS: So I will find scholarly articles and read those to find information. A lot of the information, if I find it on a web page, I will **[69]** look to see if it is to a scholarly journal, scholarly article that's reputable, but then I can verify that the information on the web page is valid, at least based on what has been presented in scholarly literature. Of course, you see things in the news as well; right?

BY MR. BLOCK:

Q Is there any scholarly article that -- that likens gender-affirming care to a new toy?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: I could not say.

BY MR. BLOCK:

Q Okay. What scholarly articles, sitting here today, can -- can you think of having read on the topic of mental healthcare for transgender youth?

MR. FRAMPTON: Same objection; form and scope.

THE WITNESS: So there was a review on the effects of puberty blockers that was put out by Sweden, Karolinski Institute, and so I read that article and looked up a number of the articles that were referenced in there. Similar type of thing came out of Great Britain, their national health organization, something like that. And so I looked at a lot of those articles. I -- I have also, again, coming across some on **[70]** PubMed or Google Scholar. I've seen other articles looking at the effects of hormone treatment in transgender individuals and measures of mental health.

BY MR. BLOCK:

Q And can you remember any of the articles on PubMed or Google Scholar?

A I cannot remember them by author or title.

Q Okay. Have you read the Endocrine Society guidelines on providing gender-affirming care to transgender people?

A I --

MR. FRAMPTON: Objection; scope. Go ahead.

THE WITNESS: I have read the information on the web page. I have read the article. I cannot remember which journal it's published in.

BY MR. BLOCK:

Q Well, I'm sorry, what -- what -- what are you referring to when you say a web page and an article?

A So the Endocrine Society has a web page regarding the administration of puberty blockers and estrogen -- or testosterone suppression, estrogen administration for -- for transgender individuals. And so I have read through that web page, and there is an article associated with the information on that web **[71]** page that was published in a scholarly journal.

Q Okay. And -- and that -- that would be the - the -- the 2017 guidelines for care of people with gender dysphoria and gender incongruence?

A That is my recollection, yes.

Q When did you read that?

A Sometime in the past year.

Q So at the time of our past deposition, you hadn't read that yet; is that correct?

A As I recall, that is correct.

Q Okay. But -- but since then, you have read it?

A Yes. You seem to make a strong suggestion that I should read that.

Q Okay. Did you learn anything from reading it?

A Yes, I did.

Q What did you learn?

A I learned that the recommendations of the Endocrine Society for testosterone suppression result in much, much lower testosterone concentration than those recommended by world -- or, sorry, by world sport or by the Olympics.

Q Great. Just to close the loop, can you think of any other source of information or political commentator you've heard and talk about transgender **[72]** youth who you think provides a good description of the science?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: So I've cited a number of papers in my article -- or, sorry, in my expert declaration. So I've read those articles of scholars. As far -- as far as political commentary, it's all over the place these days, so it's hard to identify who has or has not opined on that.

Q All right. Do you -- I'm going to turn to a new line of questions. Do you need a break before then?

A Yeah, let's take five.

Q Okay. Great.

THE VIDEOGRAPHER: We are off the record at 10:22am.

(Recess.)

THE VIDEOGRAPHER: We are on the record at

10:29 a.m.

MR. BLOCK: Great.

BY MR. BLOCK:

Q I want to go back in time and ask you about the time that you first reached out to ADF on this issue of the participation of transgender athletes. Do you remember who you contacted at ADF? **[73]**

A I do not remember who I contacted.

Q And do you remember why you knew that ADF was the organization to contact?

A I saw a news clip or information online about the Soule versus CIAC case, and it identified Alliance Defending Freedom as representing Selina Soule.

Q Okay. And, you know, at the time you first contacted ADF, had you done any research on the -- the effects of puberty blockers or gender-affirming hormones on transgender people?

A Once again, what do you mean by "research"?

Q Have you -- had you read anything on the – on the physiological effects of gender-affirming care at the time you first reached out to ADF?

A Yes, I had.

Q What had you read?

A I had read some articles on the effects of gender-affirming hormone therapy, to use your terminology on that, on various physiological factors, such as muscle size or strength or muscle mass, those types of things.

Q You -- you had already read that research before you reached out to ADF?

A I had read some.

Q Okay. And had you read that research before **[74]** you saw the news item about the transgender runners in Connecticut?

A Yes.

Q Okay. So -- so you -- you had previously had occasion to read research on the effects of gender affirming hormones on muscle mass, and then you saw the news clip about the runners in Connecticut, and then you contacted ADF? That's the chronology of how it went?

MR. FRAMPTON: Objection; form.

THE WITNESS: Yes, that sounds like a correct timeline.

BY MR. BLOCK:

Q Okay. And what -- what would have prompted you to -- to do any research specifically on the effects of gender-affirming hormones before seeing the news item about transgender people in Connecticut?

A As I had mentioned previously, staying up to date on what the laws are or the rules, I guess would be a more appropriate way to say it, regarding the participation of transgender women in women's sports or trans women in women's sports. Student questions, asking about that. Particularly after 2019, when Cece Telfer won the 400-meter hurdles in Division II, because I had some students that were there and had **[75]** questions.

Q What do you mean, that were there?

A I have students that are student athletes that compete in Division II women's track and field and were at that national championship where Cece Telfer won the 400-meter hurdles.

Q And were those students upset that Cece Telfer had won?

MR. FRAMPTON: Form.

THE WITNESS: The students had questions and many of them stated questions such as how can that be fair.

BY MR. BLOCK:

Q So were they upset?

MR. FRAMPTON: Same objection.

THE WITNESS: I guess I would need more clarification on "upset."

BY MR. BLOCK:

Q So they didn't think it was fair?

A That would be correct.

Q And so in response to those student questions, you -- you started doing research; is that right?

A I had been looking it prior to the student questions, but in response to the student questions, I suppose you could say I tried to dig deeper. **[76]**

Q Okay. So what -- what -- how had you been looking into it before the student questions?

A Before the student questions, I would look at the policies as put out by the NCAA, put out by the N -- IOC and tried to look at research that informed those policies by searching Google Scholar, PubMed, reading news articles about it and see if they had links or information on research.

Q And what about Cece's participation did the students think were unfair?

A Cece is a biological male and was competing in women's sports.

Q And why did they think that was unfair?

A They thought it was unfair for a biological male to compete in women's sports.

Q And when you say you did earlier research on NCAA policy and the IOC, you know, what had prompted you to do that research?

A It's an important topic in sports, in my field. It's possible that the textbook I was using at the time had a statement on it.

Q Had you done any research on the participation of Caster Semenya in the IOC?

A I have read some news articles on Caster Semenya and probably heard some things on [77] podcasts about Caster Semenya.

Q Okay. But you didn't do any research about that?

A I -- again, more than news articles, I cannot recall a specific article that said this was Caster Semenya's medical condition in the scholarly literature.

Q Okay. But you were more interested in doing research on transgender athletes than on athletes like Caster Semenya; is that fair?

MR. FRAMPTON: Objection; form.

THE WITNESS: That would be fair to say.

BY MR. BLOCK:

Q Okay. And why is that?

A We are dealing with separate issues. Disorders of sexual development are not the same as a transgender individual.

Q And so why were you more interested in the participation -- researching the participation of transgender individuals as opposed to individuals with DSDs?

MR. FRAMPTON: Same objection.

THE WITNESS: The policies seem to, if I recall, state "transgender individuals." The student questions were about transgender individuals. The [78] stuff I was seeing in the news was about transgender individuals.

BY MR. BLOCK:

Q When did the topic of the participation of transgender individuals in -- in sports first come to your attention?

A That would be very challenging to say, but I would say sometime after 2004.

Q Why sometime after 2004?

A That seems to be the first IOC policy I remember that addressed transgender individuals.

Q And when did a transgender individual first participate in the Olympics?

A I don't know.

Q You have no idea?

A No.

Q Do you know if it was, like, before 2010?

A I don't know.

Q Okay. You have no -- do you have any knowledge or recollection of any transgender people participating in the Olympics?

A Would you consider the participation of Bruce Jenner to be a transgender individual participating in the Olympics?

Q About a -- a -- a transgender person competing **[79]** post transition.

A So I do know of someone that has done that.

Q Who?

A Laurel Hubbard.

Q Okay. Anyone before her?

A I cannot recall anyone before that.

Q Okay. When did you first -- when did you first become -- well, let me -- I'll -- I'll -- I'll come back to that.

When -- when is the first time a transgender person -- a transgender woman competed in women's tennis events?

A I -- I don't know.

Q You -- you have no idea?

A There's something I seem to recall of a situation that was in the '70s or '80s, but I can't recall off the top of my head more specifics.

Q Does the name Renee Richards refresh your recollection about it?

A So as you mention that, yes, the name Renee Richards playing tennis -- again, I couldn't, at this point in time, put it in a timeframe other than I think it was probably before I was even in college.

Q Okay. And when did you first become aware that that had happened? **[80]**

A Sometime in the past 15 or so years. In my readings, I remember seeing something about Renee Richards.

Q Okay. And did the readings -- what did the readings say about her?

A I can't recall at this point in time.

Q Okay. And did you have any feelings about whether it was fair for her to be participating in women's tennis in the '70s?

MR. FRAMPTON: Objection; form and scope. Go ahead.

THE WITNESS: I -- I would, once again, go back to my statement that if Renee Richards was a biological male, then biological males have advantages over biological females in sports.

BY MR. BLOCK:

Q Yeah, but I'm just -- I'm asking about, sir, when you formed an opinion about -- about Renee Richards, if you do -- if you did form an opinion about Renee Richards, like when you -- when you first heard about it, did you have an opinion about it being fair or unfair?

MR. FRAMPTON: Same objection.

MR. TRYON: Objection.

THE WITNESS: So I -- I think I answered that **[81]** when I stated that biological males should not be competing in women's sports.

BY MR. BLOCK:

Q Okay. So -- but you had that opinion the first time you heard about Renee Richards; right?

MR. FRAMPTON: Same objections.

THE WITNESS: Again, where I can't put in a specific timeframe when I first heard about Renee Richards, I can't say if Renee Richards influenced my opinion one way or another or what my opinion was before reading that article.

BY MR. BLOCK:

Q So did you have an opinion about the participation of transgender athletes in women's sports before you did further research on the topic?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: Well, as long as I can recall, sports has been separated. So you have sports for men, meaning biological men, and sports for women, meaning biological women, and that separation has been there. Again, as long as I can recall, my knowledge of anatomy and physiology, since I have been involved in study of anatomy and physiology as a student, indicates there are differences. [82]

BY MR. BLOCK:

Q Okay. And so -- so that was your -- that was your sort of baseline assumption before you conducted research, that -- that it would be unfair to allow a transgender woman to participate in women's sports?

MR. FRAMPTON: Objection --

MR. TRYON: Objection.

MR. FRAMPTON: -- form.

THE WITNESS: I think it would be fair to say that based on the experience that sports have been separated by sex and knowing of the differences between biological males and biological females, there's a --they should be separated on sex.

BY MR. BLOCK:

Q All right. Just going to -- going on to a -- a new topic now. In your report, you say that even before puberty, prepubertal boys outperform prepuberto --prepubertal girls in athletic competition; right?

A Yes, I state that in my report.

Q Okay. And you -- and you attribute those differences in performances to biological factors instead of social ones?

MR. FRAMPTON: Objection; form. You can --

[83] THE WITNESS: Yes, biological factors are the primary reason that boys outperform girls in athletic events.

BY MR. BLOCK:

Q Yeah, so -- but for prepubertal boys and prepubertal girls, you attribute their difference in performance to biological factors?

A That is correct.

Q Okay. What biological factors provide an advantage to prepubertal boys over prepubertal girls?

A Boys have more lean body mass, which includes more lean muscle mass, than girls. There are perhaps other factors that contribute to that more lean body mass and more muscle mass.

Q What does that -- what does that mean, there [are] other factors that contribute to the more lean body mass and lean muscle mass?

A Well, having a Y chromosome compared to being XX chromosome, there are a multitude of genes in muscles that respond to the Y chromosome differently than they do to X chromosomes.

Q And is there any research on how they respond before puberty?

A The research is focused on the fact that there is a difference in lean body mass before puberty. **[84]**

Q Okay. So besides --

A To the best of my knowledge.

Q Sorry, I didn't mean to cut you off. Besides lean body mass and lean muscle mass, are there any other physiological differences connected to athletic performance between boys and girls --

MR. FRAMPTON: Same objection.

BY MR. BLOCK:

Q -- before puberty?

A Yes. There are differences in overall growth between boys and girls, as evidenced by the CDC and the World Health Organization having separate growth charts for both male and female fetuses and for boys and girls.

Q But -- but in terms of physiological characteristics associated with athletic performance, what other physiological differences besides 10 percent difference in lean body mass and lean muscle mass?

MR. FRAMPTON: Objection; form:

THE WITNESS: I would say -- that is the one that we will focus on because that is the one that has been [very] well demonstrated. There has to be something else that contributes that lean body mass biologically. **[85]**

BY MR. BLOCK:

Q Okay. Do you -- but you can't think of any other measurable factor besides lean body mass that is tied to athletic performance advantages for prepubertal boys over prepubertal girls; right?

MR. FRAMPTON: Objection; form. Go ahead.

THE WITNESS: Well, the paper by Eiberg that's cited in my report demonstrated differences in VO2 max, even when controlled for lean body mass, it seemed like the boys' VO2 max was higher.

BY MR. BLOCK:

Q Okay. Did the McManis article also confirm those findings?

A I would need to look at the McManis article to refer. I cannot remember if McManis -- it was written after Eiberg, I think, but I cannot remember if they cite Eiberg.

Q Okay. Well, we might -- we might come back to that. The difference in lean body mass and lean muscle mass that you refer to in your report is a 10 percent difference?

MR. FRAMPTON: Objection; form. Go ahead. **[86]**

THE WITNESS: The 10 percent number is stated in the article by McManis.

BY MR. BLOCK:

Q Do you have any other knowledge of the difference besides 10 percent?

A I cite several articles demonstrating difference in body composition in children prepuberty. I would need to look at those articles to either calculate the difference myself or see if they specify the difference.

Q But in your report, you -- you quoted the 10 percent figure; correct?

A That is correct.

Q Okay. If you could turn to your report, which I believe is -- is Exhibit 46 -- 64. I got that flipped.

A All right.

Q Thank you. I'm going to point you to a specific paragraph in a second. Paragraph 42 on page 17.

A Sorry, the page numbering on the document is different than the page number that Acrobat --

Q No.

A -- is taking me to, so it will take me a second, sorry. **[87]**

Q Sure thing.

A All right. Paragraph 42.

Q You say (as read):

"No -- No single physiological characteristic alone accounts for all or any one of the measured advantages that men enjoy in athletic performance."

Do you see that?

A Yes, I do.

Q Okay. So does a difference in lean body mass account for all or any one of the measured advantages that men enjoy in athletic performance?

A Lean body mass is a major factor that provides men -- males with athletic advantages over females.

Q Does it -- does it alone account for all or any one of the measured advantages that men enjoy in athletic performance?

MR. FRAMPTON: Objection; form.

THE WITNESS: I think I've answered your question by stating it's a major factor, but not the only factor.

BY MR. BLOCK:

Q Is -- are there any studies about the -- a

difference -- about the effect of a 10 percent [88] difference in lean body mass on athletic performance?

A I'm going to say yes, I'm sure there's studies that are correlating lean body mass with performance.

Q But my question is a 10 percent difference in lean body mass.

MR. FRAMPTON: Objection; form.

THE WITNESS: Again, there are -- I -- I will say there are studies that are correlating percent lean body mass with athletic performance in all sorts of different events, and so that would include a 10 percent difference, along with other differences, probably.

BY MR. BLOCK:

Q You -- you don't cite anything in your report that purports to study the effect of a -- a 10 percent difference in lean body mass in athletic performance, do you?

MR. FRAMPTON: Same objection.

THE WITNESS: Can you clarify what you're trying to ask me there?

BY MR. BLOCK:

Q In your report, do you cite any studies reflecting what affect a difference in -- I'll say that again, sorry. Do you, in your report, cite any studies **[89]** measuring the effect of a 10 percent difference in lean body mass on athletic performance?

MR. FRAMPTON: Objection; form.

THE WITNESS: I don't recall citing any studies that specifically identify how much a 10 percent advantage enhances performance.

BY MR. BLOCK:

Q Okay. Thank you. Are you aware of any study proving that differences in athletic performance between prepubertal boys and girls are caused by biological factors and not social ones?

MR. FRAMPTON: Objection; form.

THE WITNESS: From a scientific standpoint, science does not prove.

BY MR. BLOCK:

Q Science does not prove what?

A Science doesn't prove anything from a scientific standpoint.

Q Well, do you have -- are there any articles that purport to exclude social factors as a cause of difference in performance between prepubertal boys and prepubertal girls?

A Yes. Eiberg.

Q How does that purport to exclude social **[90]** factors?

A So Eiberg measured six- to seven-year-old boys and girls, very objectively measured physical activity in those children, measured very objectively VO2 max in those children and body composition in those children and found that even for the children of the same amount of physical activity, boys have higher fitness.

Q And what -- what do you mean, even for children of the same physical activity?

A So boys and girls that engage in the same amount of physical activity -- running, jumping, whatever constitutes physical activity -- the boys had higher fitness.

Q So -- but does this mean physical activity in terms of what was measured, like for a particular event, or -- or physical activity in all aspects of their life?

A This was physical activity as measured by an accelerometer which measures the quantity and intensity of physical activity during the time period the accelerometer is worn.

Q Okay. So can you just explain to me how that can give you information about, you know, whether these boys and girls, as a general matter, like, were equally physically active, like, outside of the laboratory? **[91]**

A Sure. So an accelerometer is a small device that is typically worn on your belt, usually on your right hip, aligned over your knee, and then that accelerometer, because of the scientific engineering --okay, I'll call it voodoo magic, but that's not really the right way to say it. The way the accelerator works, it measures the movement of the body, and then it quantifies that movement as far as intensity. And then after your study period, you have the person wear the accelerometer for the period of time you want, typically free living, you put it on the children and ask them to wear it for a week or two weeks or however long, then you come back, you connect the accelerometer to the computer, it downloads the information from the accelerometer, gives you what are known as counts. And again, you can quantify those counts as sedentary, light, moderate or vigorous intensity physical activity. So between the two, you get an amount of physical activity, an intensity of physical activity for the given time period of study.

Q And so what -- what this study found is that people who were similarly -- like, just active during the period in which they were wearing this device, the boys were more physically fit than the girls? **[92]**

A Yes, for boys and girls with the same quantity of physical activity, same intensity, as equal as possible could be measured, the boys were more fit than the girls.

Q And how was fitness measured?

A Fitness was measured for body composition and VO2 max.

Q Got it. Did the study measure any athletic performances?

A This was not a study of competitive athletic performances.

Q Got it. So it just -- it was about body composition, meaning like percentage of fat? Is that what you meant by "body composition"?

A That would be a measure of how much of your body is fat, how much of your body is lean body mass.

Q Got it. And -- and VO2 is the other thing measured?

A So VO2 max is maximal aerobic capacity, which accounts for 30 to 40 percent of the performance in endurance-type activities.

Q Okay. So if what's being measured is the percentage of lean body mass and we already know that -- that prepubertal boys, on average, would have 10 percent more lean body mass than -- than girls, what **[93]** does the study add to that, in terms of translating that into an athletic advantage?

MR. FRAMPTON: Objection; form.

THE WITNESS: What the study is doing is quantifying and clarifying the differences between boys and girls that -- well, for the same amount of physical activity boys have a higher VO2 max than girls.

Q Anything else besides the VO2 max?

MR. FRAMPTON: Objection; form.

THE WITNESS: And again, body composition, which, again, lean body mass is another determinant of potential for athletic performance and performance in sorts.

BY MR. BLOCK:

Q But -- but that's just confirming something that we already know, that -- that [prepubertal] boys prepubertal boys have, on average, 10 percent more lean body mass?

MR. FRAMPTON: Objection; form.

THE WITNESS: If I recall, the study also validated that for the same body composition, the boys had a higher VO2 max. I would need to refer to the study to verify if that was in there.

Q Okay. Anything else that -- that you think purports to exclude social causes as a difference in **[94]** measured athletic performance --

MR. HAMPTON: Objection; form.

BY MR. BLOCK:

Q -- between prepubertal boys and prepubertal girls?

MR. FRAMPTON: Sorry, same objection. Go ahead.

THE WITNESS: So again, those papers that I cite showing the differences in body composition between prepubertal boys and prepubertal girls because lean body mass is a biological factor.

BY MR. BLOCK:

Q Right. But besides body composition, I'm talking about athletic performance. And is there anything else that purports exclude social causes for differences in athletic performance as opposed to body composition?

MR. FRAMPTON: Same objection.

THE WITNESS: To the best of my knowledge, there are no studies quantifying the effects of social causes on differences in athletic performance or physiological factors of athletic performance between boys and girls.

BY MR. BLOCK:

Q In preparation for your report, did you **[95]** conduct original research on the athletic performance of prepubertal boys and prepubertal girls?

A I have --

MR. FRAMPTON: Objection; form. Go ahead.

THE WITNESS: I have downloaded, as stated in my report, data from Athletic.net, looking at the performance of seven-and eight-year-old children, of nine- and ten-year-old children, which are presumed to be prepubertal, and not just the numbers in the report, but other data, I have analyzed it statistically, and the boys outperform the girls in all of the track events that I analyzed.

BY MR. BLOCK:

Q Have you tried to have your analysis published anywhere?

A The analysis is being presented at UNK Student Research Day Thursday of next week. After [the] presentation, the student author and I will probably explore publication opportunities.

BY MR. BLOCK:

Q All right. But you haven't so far?

A No, I have not submitted it for publication yet.

Q Okay. You've been writing on this topic in **[96]** the form of white papers and expert reports for over two years now; right?

A That is correct.

Q Have you ever attempted to submit any of your analysis for publication?

A I have not submitted these papers for publication.

Q But your -- have you ever, like, tried to submit your research on this topic in -- in general for publication?

MR. FRAMPTON: Objection; form.

THE WITNESS: So in general, do you mean differences between boys and girls?

BY MR. BLOCK:

Q I mean on the participation of transgender girls and women.

A So as stated in my declaration, I have the Physiology Educator (sic) Community of Practice blog post that I have written, that was reviewed prior to being published on the web, and I have the presentation I made at the American Physiological Society Sex and Gender conference.

Q Okay. Anything else?

A Those are the only two that I can remember that I have put out for public dissemination. **[97]**

Q Okay. And were -- were either of those two examples peer reviewed?

A They were both peer reviewed.

Q Okay. Have you had -- well, we'll look at -- we'll look at those in -- in a minute, but there's no other example of you attempting to submit work on this topic to a peer-reviewed publication?

A I have reached out to a journal editor about a possible letter to the editor, but the journal said they don't publish letters to the editor.

Q Okay. Why didn't you attempt to have your white paper, you know, published by a peer-reviewed journal?

A Well, quite honestly, because Emma Hilton, Tommy Lundberg, Joanna Harper and FIMS have all already published on this and have done a pretty good job reviewing the literature, so I'm not sure that another review of the literature is going to add to the scholarly knowledge.

Q What did the letter to the editor that you wanted to write say?

A I just asked the editor if they would accept a letter regarding the participation of trans women in women's sports.

Q What publications was that? **[98]**

A I cannot remember if it was Medicine & Science in Sports & Exercise or the Journal of Strength and Conditioning Research.

Q Okay. And did you say what the letter would opine about?

A No.

MR. FRAMPTON: Objection; form.

THE WITNESS: Sorry. I just asked if they would accept a letter on the topic.

BY MR. BLOCK:

Q Okay. Are you aware of any studies that specifically examine the athletic performance of prepubertal transgender girls?

MR. FRAMPTON: Objection; form.

THE WITNESS: I am not aware of any studies evaluating the performance of prepubertal biological gir- -- biological boys competing in girls' sports.

BY MR. BLOCK:

Q Okay. So let's -- we agreed before that if I say the term, you know, "trans girls," you understand what I'm saying; right?

A Yes. I just am speaking to make sure I'm clear to myself in what I'm saying.

Q Okay. So, you know, I -- I understand that **[99]** there's physical fitness data on -- on prepubertal boys versus prepubertal girls, and my question is, are you aware of any data that specifically breaks out prepubertal trans girls and reports on their performance?

A I am not aware of any data analyzing trans girls.

Q Okay. So are you aware of any data comparing the performance of prepubertal trans girls to prepubertal cis girls?

A I am not aware of any research on that topic.

Q Okay. If you could turn to page – sorry paragraph 114 of your report again.

A Yes, paragraph 114, page 37.

Q Okay. I have to pull it up, too. All right. And it -- it continues from page 37 to 38. You say (as read):

"While boys exhibit some performance advantages even before puberty, it is both true and" --

Sorry, my -- my PDF -- I'll read this again for the record. I apologize. (As read):

"While boys exhibit some performance advantages even before puberty, it is both true and well known to common **[100]** experience that the male advantage increases rapidly, and becomes much larger, as boys undergo puberty and become men. Empirically, this can be seen by contrasting the modest advantages reviewed immediately above against the large performance advantages enjoyed by men that I have detailed in Section II."

Did I read that right?

A It sure seemed like you read it word for word.

Q All right. Thanks, I did my best. So even though you contend that boys have a performance advantage before puberty, you believe those advantages are modest when compared with the large performance advantages resulting from puberty?

MR. FRAMPTON: Objection; form.

THE WITNESS: Yes, they are smaller than the advantages that occur after puberty.

BY MR. BLOCK:

Q Okay. And -- and "modest" was your word; right?

A Yes, "modest" was my word.

Q Okay. And do you think it's unfair for prepubertal boys and girls in elementary school to – **[101]** to play on coed or mixed teams?

MR. FRAMPTON: Objection; form, scope.

THE WITNESS: Before puberty, boys have athletic advantages compared to girls.

BY MR. BLOCK:

Q Do you think it's unfair for prepubertal boys and girls in elementary school to play on coed or mixed teams?

MR. FRAMPTON: Same objections.

THE WITNESS: I really haven't been retained as an expert witness to state fair or unfair in this matter as much as to provide the information and allow the policymakers to determine fair versus unfair.

BY MR. BLOCK:

Q Okay. So you're not, in your expert report, providing an opinion on whether it's fair for trans girls and women to compete on women's sports teams; is that right?

MR. FRAMPTON: Objection; form and scope. Go ahead.

THE WITNESS: In my expert report, I have done my best to focus on the known biological differences between males and females, how those known biological differences gives male an athletic advantage and how that athletic advantage is not erased by a transgender **[102]** identity or the use of puberty blockers, gender -- transgender hormones.

BY MR. BLOCK:

Q Okay. So you don't provide an expert opinion on whether the goals of fairness, safety and transgender inclusion are reconcilable?

MR. FRAMPTON: Objection; form.

THE WITNESS: If I recall correctly, I think I quote a source or two that state on that or perhaps paraphrase a source or two on what has been stated on that.

BY MR. BLOCK:

Q Okay. So -- so just to clarify the scope of the opinions you're offering, you are not presenting an expert opinion on whether it is fair or unfair for girls and women who are transgender to participate on girls and women's sports teams; correct?

MR. FRAMPTON: Objection; form.

THE WITNESS: I have tried to focus on the biological differences and how those differences provide male advantages and how those differences are not erased due to transgender identity or gender-affirming hormone therapy. I have tried to not give an opinion on fair versus unfair. **[103]**

BY MR. BLOCK:

Q Okay. And, you know, I apologize for being persnickety in the phrasing of the question, but I want to make sure that -- that -- that you're not answering about what you're focusing on. I want to know whether any evidence is going to be submitted in the form of an expert opinion by you regarding fairness of girls and women who are transgender participating in -- in girls and women's sports. So I'm just going to ask it again, and I would just appreciate a "yes" or "no" answer, if you're capable of giving it. Are you providing an expert opinion in this case regarding whether it is fair or unfair for girls and women who are transgender to compete on girls and women's sports teams?

MR. FRAMPTON: Objection; form, scope. Go ahead.

THE WITNESS: I don't think I can answer that as a yes-or-no question because the information demonstrates that there's an advantage for biological males. And so then we come to a question of fair, which is a very challenging metaphysical question that I would prefer others address. **[104]**

BY MR. BLOCK:

Q So you -- you are not an expert on whether it is fair or unfair for girls and women who are transgender to participate on girls and women's sports teams?

MR. FRAMPTON: Objection; form.

THE WITNESS: I'm not a sports philosopher in whom that field would fall into.

BY MR. BLOCK:

Q Right. Therefore, you are not providing an expert opinion on whether it is fair or unfair for girls and women who are transgender to participate on girls and women's sports teams?

MR. FRAMPTON: Same objection.

THE WITNESS: As I've said, I've done my best to try and stick to the data and not give my opinion on what is fair or unfair.

BY MR. BLOCK:

Q I'm sorry, Dr. Brown, this -- this really should be like a -- a simple question. Because when you say "focus" and "I've tried to," that -- that's just not answering my question. I just really need a question (sic) on whether evidence is going to be submitted in this case, from you, in the form of an expert opinion under Federal Rules of Evidence 702 on **[105]** whether or not it is fair or unfair for girls and women who are transgender to participate. Regardless of whether it's your focus, regardless of whether you're trying – what you're trying or not trying to do, I just need a "yes" or "no" answer on whether you are providing an expert opinion on the topic of fairness.

MR. FRAMPTON: Same objection.

THE WITNESS: So would you allow me a few minutes to review the conclusions to my declaration? Because I don't want to say something that is contradictory to what I have said in what is submitted as an expert declaration.

MR. BLOCK: All right. We can -- we can go off the record, if you would like to do that right now. Does counsel want to go off the record?

MR. FRAMPTON: No, we don't need to go off the record. If he wants to review something, he can review it.

MR. BLOCK: Well, I'm not taking time out from the deposition for him to review what -- what his expert opinions are in -- in this case. So, you know, if he wants to do it during a break, you know, you're welcome to, but you're not using my deposition time to answer a simple question. **[106]** I mean, this witness should know what he's providing an expert opinion on, so --

MR. FRAMPTON: And I think he's told you about three times now, but again, I don't need to argue that on the record.

BY MR. BLOCK:

Q But you know you're not providing an expert opinion on whether it's fair or unfair for prepubertal girls and boys in elementary school to play on coed or mixed sports teams?

A I think I've already answered that question with my statement about focusing on what the science is saying on who has advantages.

Q All right. Are you qualified to offer an expert opinion on fairness?

MR. FRAMPTON: Objection; form.

THE WITNESS: Who is a qualified expert to offer an opinion on fairness?

BY MR. BLOCK:

Q I don't know. Are you?

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: I think I can offer fairness as far as my understanding of what the policies and procedures are that are set to determine what is fair **[107]** in sports.

BY MR. BLOCK:

Q Your personal opinion; right?

MR. FRAMPTON: Same objection.

THE WITNESS: No. For instance, there are a lot of policies that specify the -- that use of performance-enhancing substances are unfair, in which that is something that I would teach in my sports – my sport nutrition class. Since I'm teaching it in a class, I've been judged by my peers to be an expert on that.

BY MR. BLOCK:

Q Okay. But are you qualified to offer an expert opinion on whether it's fair or unfair for girls and women who are transgender to compete in women's sports?

MR. FRAMPTON: Same objection.

THE WITNESS: Am I qualified? Well, the policies state that it is not fair. And so if I am following the policy, I suppose I am an expert in that.

BY MR. BLOCK:

Q I don't understand what that means.

A So when I teach in my classes, in my field, in my expertise, quite often we discuss and teach about the policies on what is fair participation or unfair **[108]** participation. Since I'm teaching it and I'm judged by my peers as an expert in it, then I would say I can give an expert opinion on it.

Q Who -- who are -- who -- who judges you as quali- -- what peers judge you as qualified to – to give an expert opinion on whether it's fair for girls and women who are transgender to compete in girls and women's sports?

A Well, my -- again, I've been accepted by my peers as an expert to present on this topic, on the participation and the physiological effects of transgender individuals.

Q Right. My question was about fairness. Have you been -- who, among your peers, have said that you are qualified to opine on the fairness of the participation of girls and women who are transgender in -- in girls and women's sports?

A My colleagues at the university I work at, administrators at the university I work at, they honor my opinion.

Q I thought that your opinion in this matter just reflects your own views, not the views of the university; is that right?

A That is correct.

Q Okay. So what do you mean by -- when you say **[109]** that the university honors your opinion?

A They allow me to express my opinion, and they recognize that it falls within my discipline and my field and the scope of my professional expertise.

Q How did they recognize that?

A They've told me.

Q Who has told you?

A The athletic director, the -- one of the senior vice chancellors, I can't remember her full title, another one of the vice chancellors for academic and student affairs.

Q Has any --

A Along -- along with some of my colleagues in the department.

Q Did the university tell you to testify in this case?

A The university did not tell me to or not to testify in this case.

Q Okay. Did any of the -- your -- your colleagues that honor your opinions, are any of them experts in fairness?

MR. FRAMPTON: Objection; form.

THE WITNESS: Well, one of them is a -- I guess his area would be sports sociology and sports psychology and does a lot of work in the area of **[110]** policies and procedures for sports, so I would say that he's probably an expert in fairness.

BY MR. BLOCK:

Q Have you been invited by any sort of professional policymaking organizations to participate in crafting policies?

A No, I have not.

Q Okay. Do you know whether West Virginia has any laws or policies regarding sex-separated sports for prepubertal children?

MR. FRAMPTON: Objection; form.

THE WITNESS: My understanding of the law that we're meeting about now does specify that you participate in sports based on biological sex.

BY MR. BLOCK:

Q Do you -- do you know whether West Virginia has any laws or policies regarding the participa- -- let me say this again. Do you know whether West Virginia has any laws or policies regarding sex-separated sports in elementary school?

MR. FRAMPTON: Objection; form.

THE WITNESS: If I recall correctly, this law applies to elementary school. **[111]**

BY MR. BLOCK:

Q Would your opinions in this case change if you were to learn that the law doesn't apply to elementary school?

MR. FRAMPTON: Objection to form.

THE WITNESS: No, my opinion would not change because there are biological differences between males and females that give males an inherent athletic advantage.

BY MR. BLOCK:

Q Do you think it's reasonable for a state to say that it wants sex-separated teams beginning in middle school, but not in elementary school?

MR. FRAMPTON: Objection; form.

THE WITNESS: I think it is reasonable since most of the time younger children's leagues are considered developmental and the children are not competing for prizes or honors. A lot of times that competition begins in middle or high school.

MR. BLOCK: Okay. That -- that's a great lead-in to the next exhibit. So if you would give me a second to make that happen.

(Exhibit 69 was marked for identification by the court reporter and is attached hereto.) **[112]**

BY MR. BLOCK:

Q All right. Soon appearing in your folder will be a document marked Exhibit 69. Let me know when that's available. Do you see it?

A Exhibit 69, Briefing Book, WSPWG?

Q Yes. And you cite to this document in your report; right?

A Yes, I think I do.

Q Okay. Great. If you could turn to footnote 2, I believe, footnote 2, page 8 of the document. Can you let me know when you get to that?

A Footnote 2, page 8 starts off with the word "endocrinologists."

Q Yes.

A Yes.

Q Okay. If you look at what that footnote 2, like, refers to, in the third paragraph, beginning with "at the same time." Do you see in the text "at the same time"?

A Sorry.

Q Yeah. Sure. The third paragraph from the top of the page begin- -

A Oh, sorry. Sorry. Yes, I've got it. **[113]**

Q Yeah. The second sentence of that paragraph, it says (as read):

"Because the onset of male puberty — normally around ages 11 - 12 in boys — is the physical justification for separate sex sport..."

And then that's what triggers the footnote 2; correct?

A Yes.

Q Okay. And then footnote 2 says (as read):

"Endocrinologists explain that puberty in boys should start between ages 9-13 and in girls between ages 8-12; that puberty usually takes 4-5 years to complete so that 95% of boys will have started puberty by age 13. This timing is consistent with the formal position of the Women's Sports Foundation providing that '[p]rior to puberty, females and males should compete with and against each other on coeducational teams.'"

Did I read that correctly?

A Yes, you read that correctly.

Q Okay. And then it cites to a document from **[114]** the Women's Sports Foundation; correct?

A Yes.

Q Did you read that document?

A I cannot recall specifically if I've read that or not. I think I probably did, but I can't recall.

Q Okay. And so you understand that it's the position of the Women's Sports Foundation that prior to puberty, females and males should complete with and against each other on coeducational teams?

A Well, that is what is stated in this document.

Q Okay. Do you feel like you -- do you feel that you are qualified to offer an expert opinion on the fairness of elementary school kids participating on coeducational teams?

MR. FRAMPTON: Objection; form.

THE WITNESS: I think I can offer information on the differences in -- the -- the biological differences between boys and girls and how that gives boys an advantage in athletics.

BY MR. BLOCK:

Q Do you think the Women's Sports Foundation is a better source of information than you on what benefits prepubertal girls in athletic participation?

MR. FRAMPTON: Objection; form.

THE WITNESS: Can you rephrase that question? **[115]**

BY MR. BLOCK:

Q Yeah, yeah. Who -- who -- who do you think is a better source of authority on -- on -- on -- on what is in the best interest of prepubertal girls when it comes to athletics, you or the Women's Sports Foundation?

MR. FRAMPTON: Objection; form.

THE WITNESS: I think this may be a situation where I don't agree with the Women's Sports Foundation.

BY MR. BLOCK:

Q Okay. If you go back to -- to your report, on page 4, page 4 of your report. It's not in numbered paragraphs yet. And this is Exhibit 64, I believe.

A Okay. Page 4 where I have "Overview"?

Q Yes.

A All right.

Q In the first bullet point, you say (as read):

"At the level of (a) elite, (b) collegiate, (c) scholastic, and (d) recreational competition, men, adolescent boys, or male children, have an advantage over equally aged, gifted, and trained women, adolescent girls, or female children in almost all athletic events." **[116]**

Is that right?

A That is correct.

Q Okay. So do you think that – that prepubertal boys and prepubertal girls should not be playing in competition with each other in recreational events?

MR. FRAMPTON: Objection; form.

THE WITNESS: I think if they are competing for prizes, for awards, the boys have an advantage.

BY MR. BLOCK:

Q And, therefore, they should not be competing against each other for prizes and awards?

MR. FRAMPTON: Objection; form, scope.

THE WITNESS: I would say that if we are -- yeah, the boys should not be competing against the girls if they're competing for prizes and awards.

BY MR. BLOCK:

Q Do you think that in the case of transgender girls and women after puberty, do you think they should not be allowed to play on recreational teams with cisgender girls and women?

MR. FRAMPTON: Objection; form, scope.

THE WITNESS: I have concerns about the safety of cisgender girls and women competing against biologically male -- sorry -- trans women. **[117]**

BY MR. BLOCK:

Q Do you think that cisgender girls and women should be allowed to play on football teams with biological boys?

MR. FRAMPTON: Objection; form, scope.

THE WITNESS: If the girls are informed of the risks, then the girls should be able to make an informed choice on that matter.

BY MR. BLOCK:

Q So you don't think it's the -- the – safety reasons should prohibit cisgender girls and women from playing football with cisgender boys?

MR. FRAMPTON: Same objection.

THE WITNESS: If the girls would like to play on the boys' team and they and their parents make an informed choice that they're willing to accept those risks, then I think that is up to them to choose.

BY MR. BLOCK:

Q Okay. And -- and do you think that cisgender girls and women should be allowed to play on wrestling teams with cisgender boys and men?

MR. FRAMPTON: Same objection.

THE WITNESS: I would say the same statement, if they are aware of the inherent risks and recognize the advantages that males have, they can make that **[118]** choice.

BY MR. BLOCK:

Q Going back to recreational competition, do you think that transgender girls and women should not be allowed to play recreational sports on girls and women's teams if the sport is a noncontact or collision sport?

MR. FRAMPTON: Same objection.

THE WITNESS: If it is a women's league, then that should be limited to biological women.

BY MR. BLOCK:

Q Even if they're not competing for prizes?

MR. FRAMPTON: Same objection.

THE WITNESS: Can I walk through this for just

a minute?

BY MR. BLOCK:

Q Sure.

A Oh. So if women are signing up for a women's recreational league, I think they do so with the expectation they will be playing -- and even if it's not competing for prizes, but they are competing -- with other women. And so introducing a trans woman is not fair to the women that have said that they are competing against biological women.

Q Why isn't it fair if they're not competing for **[119]** prizes?

MR. FRAMPTON: Same objection.

THE WITNESS: Well, if they are competing -- even if it's not prizes, they are competing.

BY MR. BLOCK:

Q What if they're just -- just participating together for recreational purposes?

MR. FRAMPTON: Objection; form.

THE WITNESS: Then I think that the cisgender women still need to be fully informed of whether there will be trans women or not, and then they could make their choice on a recreational pickup game type of play.

BY MR. BLOCK:

Q Okay. If -- how about riflery, should transgender girls and women be allowed to play on a recreational riflery league with cisgender girls and women?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: Once again, if they are just out shooting for fun and they're not competing and the recognition is that it is not exclusively a women's event. All of those need to be considered.

BY MR. BLOCK:

Q Do you think transgender girls and women have **[120]** an athletic advantage over cisgender girls and women when it comes to riflery?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: Yes, I do think that transgender girls and women have an advantage over cisgender girls and women because you still have to hold the rifle, you still have to feel the recoil, and a larger individual will have less felt recoil.

BY MR. BLOCK:

Q So in terms of recreational activities, if a policy said that transgender girls and women can't compete in, you know, championship competition but can compete on recreational teams with cisgender girls and women and that policy is well known, is it your position that transgender girls and women should still, you know, not be allowed to compete on the – to participate on those recreational teams with cisgender girls and women?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: It's kind of a long, complicated question. Can you simplify it for me?

BY MR. BLOCK:

Q Well, your -- your answer on recreational teams was that you want the cisgender people to be informed that a transgender person might be there. **[121]** So my question is, assuming that they're informed, do you still think that transgender girls and women should not be allowed to participate on recreational teams with cisgender girls and women?

MR. FRAMPTON: Objection; form, scope.

THE WITNESS: So if the governing policies for that recreational league indicate that transgender girls and women can compete there and if it doesn't violate some type of law that would regulate the funding for that recreational league and if the women -- if everyone is fully informed of who they will be playing with in this recreational league, then that would be okay for the trans women to participate in that league.

BY MR. BLOCK:

Q But you think that the cisgender girls and women would need to be specifically notified that there is an identifiable trans participant on the team as opposed to just knowing that as a matter of policy there might be one?

MR. FRAMPTON: Same objection.

THE WITNESS: My experience tells me that a lot of women would like to know that.

BY MR. BLOCK:

Q Why? **[122]**

A Because --

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: Because they want to know who they're competing against and because of our longstanding policy of sex-segregated sports, they want to know if they're playing on a coed team or a sex segregated team.

BY MR. BLOCK:

Q When you say your experience tells you that women would like to know that, what experience?

A Talking with friends and family members, students, colleagues, those types of things.

MR. BLOCK: So I -- I am going to another section. I'm happy to continue going, unless you need a -- a break.

THE WITNESS: I need a bathroom break.

MR. BLOCK: Sure. See you in five minutes.

THE WITNESS: All right. Thanks.

THE VIDEOGRAPHER: We are off the record at 11:36 a.m.

(Recess.)

THE VIDEOGRAPHER: We are on the record at 11:47 a.m.

MR. BLOCK: Great. **[123]**

BY MR. BLOCK:

Q Dr. Brown, during the break, did you have a chance to review your expert report to determine whether you're offering an opinions on fairness?

MR. FRAMPTON: Objection; form.

THE WITNESS: I didn't take advantage of that time to look at that.

MR. BLOCK: Okay. I'm going to mark another exhibit here. So this -- this exhibit, which will appear shortly, is going to be marked as Exhibit 70.

(Exhibit 70 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q Please let me know when it's up on your screen.

A All right. Exhibit 70, 070 - 2021.

Q Yes. Can you tell me -- well, first of all, have you ever seen this document?

A You know, I can't promise that I have seen this document.

Q Okay. What does -- this is a document -- I've got to scroll back up to page 1 of this document myself. This document is a transcript of hearings in -- in the Pennsylvania house of representatives on **[124]** H.B. 972, Fairness in Women's Sports Act. Is that -- do you agree that's what this document appears to be?

A Yes, that appears to be a transcript of a hearing on that.

Q Okay. And that hearing was on August 4th, 2021; correct?

A That's what it says.

Q Okay. And do you remember providing testimony as part of this hearing?

A I do remember providing testimony for that.

Q Okay. Terrific. If you can go to page 15.

A Sorry. It's loading slowly. As I scroll, I have to wait for the page to load.

Q Yeah. No, I -- I appreciate that.

A Okay. Page 15?

Q Yes.

A Starts off "Biological sex confers"?

Q Yeah.

A Okay.

Q "Biological" -- I'm just going to read it into the record. (As read):

"Biological sex confers inherent athletic advantages to human males **[125]** compared to human females such that even before puberty, males have 10 percent more muscle mass, less body fat, larger hearts and lungs, denser bones, and other anatomical and physiological traits that give males inherent athletic advantages over comparably aged and trained females."

Did I read that right?

A Yes.

Q And do you recall giving that testimony?

A Yes.

Q Is it true that -- that prepubertal boys have denser bones than prepubertal girls?

A I would need to look back at my research that --you know, the papers that I've read to see on that.

Q Okay. Is it -- is it true that prepubertal boys have larger hearts and lungs than prepubertal girls?

A They have larger lungs. And again, I would want to refer back to my research on the larger hearts.

Q Okay. Now, if you go to page 16.

A Okay.

Q Actually, go to page 17, line 3. **[126]** You say (as read):

"And a male to female individual will never experience nor need to learn how to cope with menstrual-cycle challenges, whereas 50 to 71 percent of female athletes expressed concerns that their menstrual cycle may influence their physical performance."

Did I read that right?

A Yes, you did.

Q So is it your testimony that one advantage that transgender girls and women have over cisgender girls is that they don't have to worry about their menstrual cycle concerns?

MR. FRAMPTON: Objection to the form and scope. Go ahead.

THE WITNESS: Yes, that is what I said in this situation in Philadelphia.

BY MR. BLOCK:

Q Okay. Do you --

A Sorry, Harrisburg.

Q Okay. Are you offering that opinion in this case?

A I did not include that opinion in my written **[127]** statement for this case.

Q Okay. Are you offering that opinions now in this case?

A I would offer that opinions now.

Q Okay. And -- so do you think that cisgender girls who are not menstruating have an advantage over cisgender girls who do menstruate?

MR. FRAMPTON: Objection; form, scope.

THE WITNESS: So the research regarding the effects of the menstrual cycle on athletic performance are very difficult and very confusing and some instances so --show that phase of the menstrual cycle influence a performance, some do not. But as I stated there, depending on which survey you're looking at, 50 to 71 percent of female athletes are concerned that their menstrual cycle will negatively impair their performance.

BY MR. BLOCK:

Q Okay. Do you think we should have separate teams for girls and women who menstruate and girls and women who don't?

MR. FRAMPTON: Same objection.

THE WITNESS: No, I do not.

BY MR. BLOCK:

Q Why not? **[128]**

A Because they're all biologically female.

Q Even though some of them would have the advantage of not having to worry about their menstrual cycle; is that right?

MR. FRAMPTON: Same objection.

THE WITNESS: Again, what -- can you pleasen rephrase that? There were some questions – some statements in there that were more absolute than I'm comfortable answering.

BY MR. BLOCK:

Q Okay. So despite the fact that cisgender girls and women who don't menstruate don't have to worry about how their menstrual cycle will affect athletic performance, you think that it's still fair for girls and women who menstruate to participate on the same sports teams as girls and women who don't menstruate; correct?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: So when you're talking about menstruate, I want to make sure we're on the same page here. Do you mean they have lost having their menstrual cycle? **[129]**

BY MR. BLOCK:

Q I -- you know, I -- some -- that -- that could be one thing. Some -- some girls and women who are cis don't have a menstrual cycle. So for whatever reason, a cisgender girl and women who do not menstruate, should they be playing on different teams from girls and women who do menstruate?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: So loss of the menstrual cycle is generally a negative connotation for a woman in terms of athletic performance. It would indicate somewhere progressing on the female athlete triad. And so they're still biological women. They should still be on the women's team.

BY MR. BLOCK:

Q So is it really relevant one way or another whether or not someone is menstruating to their athletic performance?

MR. FRAMPTON: Same objection.

THE WITNESS: Again, 50 to 71 percent of female athletes are concerned that their menstrual cycle will influence their physical athletic performance.

BY MR. BLOCK:

Q So is it relevant to their athletic **[130]** performance whether or not someone is menstruating?

MR. FRAMPTON: Same objection.

THE WITNESS: For some women, it is. For some women, it is not.

BY MR. BLOCK:

Q In your report, you refer, several times, to something called "puberty blockers"; right?

A Yes.

Q Okay. So I want to make sure that we're using the same terminology when we're using that phrase. When I use the phrase "puberty blockers," I'm referring to gonadotropin-releasing hormone analogues. Is that consistent with your understanding of the term "puberty blockers"?

A I know the gonadotropin-releasing hormone. I cannot remember if the word is "analogues" or "antagonists" or "agonists."

Q Okay. So GR- --

A GnR- -- yes.

Q I'm sorry, can you say that again?

A Yeah. G-N-R-H-As. And again --

Q So --

A -- I cannot remember specifically what the A stands for.

Q So -- so it's your understanding that the term **[131]** "hormone blockers" refers to GnRHa's; correct?

A Puberty blockers.

Q Sorry. Puberty blockers. It's your understanding that the term "puberty blocker" refers to the GnRHa's; correct?

A That is correct.

Q Okay. Great. If we go to paragraph 110 of your report -- again, that's Exhibit 64. Let me know when you're -- when you get there.

A Paragraph 110 is what I'm headed for?

Q Yep.

A All right. Paragraph 110, page 36.

Q Great. So in paragraph 110, you say -- if you go, like -- one, two, three, four -- five lines down, after the parenthetical number 9, you say (as read):

"While it is outside my expertise, my understanding is that current practice with regard to administration of puberty blockers is similar in the United States."

I think you're referring to as in the UK; is that correct?

A Yes.

Q Okay. And then you say (as read): **[132]**

"Tanner stages 2 and 3 generally encompass" -

You say "an range," but I think you mean "a range" -- sorry -- "a age range" -- no, I messed that up. I'll say that again. I apologize for inserting an error into your -- your sentence.

You say (as read):

"Tanner stages 2 and 3 generally encompass an age range from 10 to 14 years old, with significant differences between individuals."

And then you go on to say that you're not aware of research directly addressing the implications for athletic capability of the use of puberty blockers. So, you know, my question is, when you wrote that paragraph, did you think it -- did you consult the Endocrine Society guidelines that we had previously discussed?

MR. FRAMPTON: Objection to form.

THE WITNESS: I cannot recall if I specifically looked at the Endocrine Society guidelines as I was writing that. As I -- as I said, "as I recall," I think, is the wording I used.

BY MR. BLOCK:

Q Okay. Did you make any effort to determine **[133]** what the -- the practice in the United States is with regard to administering puberty blockers?

MR. FRAMPTON: Objection; form. Go ahead. THE WITNESS: Well, there's the Endocrine Society guidelines, but those are not specific to the United States, if I recall, and so I –

BY MR. BLOCK:

Q Right.

A -- don't know of a specific United States policy compared to the UK policy. I think it's more of a this is the policy.

Q Yeah, got it. But did you make any effort to determine what the practice is in the United States?

A I'm -- yes, I know I did look into it.

Q How? How did you look into it?

A Reading scholarly literature on the topic to see what it says. Looking at web pages on the topic.

Q So -- so you read scholarly literature and web pages on the topic and you couldn't determine whether the practice in the United States is to administer puberty blockers at Tanner II versus Tanner III?

MR. FRAMPTON: Objection; form.

THE WITNESS: As I said there, my -- that is **[134]** outside my scope of my expertise, and so I don't want to be construed as saying this is the policy. So I was trying to make sure that I was not giving specific medical advice on when someone should be administering puberty blockers.

BY MR. BLOCK:

Q If you submitted an article to a peer-reviewed journal and it included a sentence saying "while it is outside my expertise, my understanding is that," you know, and then the sentence continued, do you think that type of statement would be accepted in a peer-reviewed article?

A It would need to be taken in the context of the type of article. And some reviewers would find it acceptable because -- acknowledging what I don't know, and others would say perhaps not.

Q Do you think that your expert report in this case should be held to the same standards that a peer reviewed article would be held to?

MR. FRAMPTON: Objection; form, scope.

THE WITNESS: No, this is not held in the same standards of a peer-reviewed article.

BY MR. BLOCK:

Q Why not? **[135]**

Q So why -- why should it not be held to the same standards?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: Once again, this is written for a different audience. This is not written for the other experts in the field. This is written to provide information to policymakers and in a legal situation like this.

BY MR. BLOCK:

Q Well, but do you think that the – regardless of the style in which something is written, do you think the same underlying rigor should be required for an expert report as a peer-reviewed article?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: No, an expert report is not going to be held to the same rigor as a peer-reviewed article.

BY MR. BLOCK:

Q Okay. So you -- do you think that the opinions expressed in an expert report don't have to be as reliable as the opinions expressed in a peer-reviewed article?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: The opinions in an expert report need to be accurate, they need to be correct. **[136]**

BY MR. BLOCK:

Q Yeah, but that wasn't my question. Can you answer my question, please?

A Can you restate my your question, please?

MR. BLOCK: Could the reporter read back my question?

THE REPORTER: Yes.

(Record read.)

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: Generally, in a peer-reviewed article, you are not providing opinions; you are summarizing literature. And that's primarily what I've done here, is summarize literature.

BY MR. BLOCK:

Q Do you think the accuracy of the -- of your summaries in an expert report should be held to the same standard as the accuracy of summaries in a peer-reviewed article?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: The information needs to be correct, accurate, truthful.

MR. BLOCK: Can you read back my question, Reporter?

(Record read.)

MR. FRAMPTON: Objection; form and scope. **[137]** THE WITNESS: I thought I answered that by saying it needs to be accurate and correct and truthful.

BY MR. BLOCK:

Q Can you answer the question? I -- I asked – give me a "yes" or "no" answer, please.

MR. FRAMPTON: Same objection.

THE WITNESS: I don't know that this is really a yes-or-no question.

BY MR. BLOCK:

Q Are there different standards of accuracy for an expert report than for a peer-reviewed article?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: They both need to be accurate and correct. The writing style is so phenomenally different.

BY MR. BLOCK:

Q All right. But they -- but the accuracy needs to be the same; correct?

MR. FRAMPTON: Same objection.

THE WITNESS: Yes, they need to be accurate and correct.

BY MR. BLOCK:

Q Okay. Is it fair to say that you did not **[138]** approach the task of writing this report with the same analytical rigor that you would have approached the task of writing a peer-reviewed article?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: That would not be a correct statement.

BY MR. BLOCK:

Q Okay. Would you be comfortable submitting the opinions that you expressed in this report in a peer-reviewed article?

A Yes, I would be comfortable submitting them in a peer-reviewed article.

Q Okay. If we could go back to your report, to paragraph 111. So your report is Exhibit 64.

A So paragraph 111 starts "Tack et al."

Q Yes, it does. It says (as read):

"Tack et al. (2018) observed that in 21 transgender-identifying biological males, administration of antiandrogens for 5-31 months (commencing at 16.3 ± 1.21 years of age)" –

And then I think it says "age" again in parentheses. Or -- or is that just in my copy? I'm sorry. I -- this is the second time I've -- I've **[139]** introduced an error into your words, so I will start that over again.

(As read):

"111. Tack et al. (2018) observed that in 21 transgender-identifying biological males, administration of antiandrogens for 5-31 months (commencing at 16.3 ± 1.21 years of age) resulted in nearly, but not completely, halting of normal age-related increases in muscle strength."

Okay. Did I read that correctly?

A Yes, you did.

MR. BLOCK: All right. Sorry for the error the first time around. So I'm going to introduce an exhibit now. Okay. And so this exhibit, when it -- when it pops up in your folder, will be marked Exhibit 71.

(Exhibit 71 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q Can you please let me know when you see it.

A All right. Exhibit 71.

Q All right. Is that -- is this the Tack **[140]** article that you are referring to?

A Yes, it is.

Q Okay. Great. So do you think this article is relevant to the discussion about whether transgender girls who receive puberty blockers have an athletic advantage over cisgender girls?

A Yes, I think it is relevant.

Q Okay. Now, if you remember the conversation we had a few minutes ago, we agreed that puberty blockers [refers] to -- refers to GnRHa's; correct?

A That is correct.

Q Okay. Did any of the transgender girls in the study receive GnRHa's?

A Not as I recall.

Q In fact, the transgender girls in the study actually received a different type of hormone medication called progestins; isn't that right?

A That is correct.

Q So this isn't actually a study about puberty blockers, is it?

MR. FRAMPTON: Objection; form.

THE WITNESS: I never said this was a study about puberty blockers. **[141]**

BY MR. BLOCK:

Q Why did you include this paragraph in a discussion about the effects of puberty blockers?

A Well, I clarified, in this paragraph, that the were using antiandrogens. Because as the authors have stated on page 2148 (as read):

[“]This will contribute to determining the place of GnRHa and progestins, respectively, in the pharmacological treatment of trans youth and to improving our knowledge on the long-term effects of these interventions, as has been suggested recently.[“]

And then they cite a source.

Q So in paragraph 110 of your report, you begin a discussion about the effects of puberty blockers on athletic performance; correct?

A Let me refer back to -- just to make sure we've got the right paragraph number there. Paragraph 110. Yes, that paragraph does bring up the idea of puberty suppression and puberty blockers.

Q Okay. And then in paragraph 111, you discuss this article by Tack; correct? **[142]**

A That is correct.

Q And then in paragraph 112, you say (as read):

“Klaver et al. (2018 at 256) demonstrated that the use of puberty blockers did not eliminate the differences in lean body mass between biological male and female teenagers.”

Correct?

A That is correct.

Q And then paragraph 113, again, begins with the words “the effects of puberty blockers”; isn't that right?

A That is correct.

Q Okay. So paragraph 110, 112 and 113 are all discussing the effects of puberty blockers; correct?

A Yes.

Q And -- but paragraph 111, which is in between 110 and 112, is describing a study that does not involve puberty blockers; correct?

MR. FRAMPTON: Objection; form.

THE WITNESS: That's correct.

BY MR. BLOCK:

Q Do you think that someone reading your report could form the false impression that this article in fact discusses puberty blockers when in reality it **[143]** doesn't?

MR. FRAMPTON: Objection; form.

THE WITNESS: If someone is reading it and pays attention to the statement of antiandrogens, they would know that those are not puberty blockers.

BY MR. BLOCK:

Q Do you -- I thought you said recently that this report is not meant for an audience of experts in the field; right?

MR. FRAMPTON: Objection; form.

THE WITNESS: That is correct.

BY MR. BLOCK:

Q Okay. So do you think a lay audience, not of experts in the field, would immediately understand that antiandrogens are different from puberty blockers in the context of this discussion?

MR. FRAMPTON: Objection; form.

THE WITNESS: So that's a difficult question for me to answer because as I read through it, I notice paragraph 110, puberty blockers, 112, -13, -14, all specifically state puberty blockers, 111 states antiandrogens. As I read that, as a critical thinker, I would then say, well, why does this say antiandrogens rather than puberty blockers and what -- learn the difference. **[144]**

BY MR. BLOCK:

Q So why does a paragraph in your report, in the middle of discussing puberty blockers, talk about antiandrogens at all?

A Because, to the best of my knowledge, that is the only research that is out there on the effects of transgender hormone treatment in teenagers on muscle strength.

Q I see. But wouldn't it be better to include that article in the subsequent sections of your report that discuss the effect of suppressing testosterone?

MR. FRAMPTON: Objection; form.

THE WITNESS: I think this is a matter of opinion. I think it fits well because this is focusing on transgender youth.

BY MR. BLOCK:

Q Oh, okay. So your -- your testimony is this section of the article is supposed to address the topic of transgender youth in general and not the topic of puberty suppression. Is that your testimony?

A No. My testimony is this is about transgender youth, including puberty suppression, and what we know on the topic of transgender youth and how it would affect athletic performance.

Q I see. Let's go to the beginning of this **[145]** section, which is several pages up. It's a long section. But the section begins on page 28 of your report. 23 on the bottom pagination, 28 of the PDF. And paragraph 68.

A All right.

Q Okay. So beginning with paragraph 68, you are discussing -- oh, sorry. I -- can we just go a little further down, to subsection A? I skipped over it myself. So this is actually paragraph 71.

A Okay.

Q Thank you. So subsection A (as read):

"Boys exhibit advantages in athletic performance even before puberty."

Did I correctly read that that's the subsection?

A Yes, that is correct.

Q Okay. And then, you know, if you -- if you continue scrolling, you can take your time, it's a bunch of paragraphs on, you know, physiological characteristics before puberty, athletic performance before puberty; correct?

A Yes.

Q All right. And if you keep -- keep scrolling, I think all the way until we get to -- I -- I believe **[146]** it's paragraph 110.

A Yes.

Q All right. So for all these paragraphs until 110, you've been discussing characteristics of boys before puberty; correct?

A Yes. The athletic differences and physiological differences between biolo- -- between boys and girls before puberty.

Q Okay. And then in paragraph 110, you say (as read):

"For the most part, the data I review above relate to pre-pubertal children. Today, we also face the question of inclusion in female athletics of males who have undergone 'puberty suppression.'"

Isn't that right?

A Yes.

Q Okay. So what connects paragraph 110 to everything that came before it, as I understand it, is that it's supposed to provide information on athletic performance and advantages of what you call biological males who have not experienced endogenous, typically male, puberty yet; correct?

MR. FRAMPTON: Objection; form. **[147]**

THE WITNESS: Yes, so if I understand what you're referring to there, there's a lot of paragraphs there about the differences between males and females before puberty.

BY MR. BLOCK:

Q Right. Okay. And so -- and what thematically connects that to puberty blockers is that – the argument is that girls who are transgender and on puberty blockers never experience, typically, male puberty; correct?

MR. FRAMPTON: Same objection. Objection to form.

THE WITNESS: Can you state that again, please?

BY MR. BLOCK:

Q Yeah. So transgender girls on hormone blockers never experience, typically, male puberty if they begin the blockers at stage Tanner II; is that right?

MR. FRAMPTON: Objection; form, scope.

THE WITNESS: That is my understanding.

BY MR. BLOCK:

Q Okay. And so that's thematically what connects the discussion of prepubertal kids to the discussion of trans girls on puberty blockers; correct? **[148]**

MR. FRAMPTON: Objection; form.

THE WITNESS: So what you're saying is there's kind of a rough transition there?

BY MR. BLOCK:

Q Well, I -- I'm saying that -- I'm just asking why are they in the same subsection that discusses biological males before puberty?

A Well, because the puberty blockers would halt puberty. That is the purpose of them.

Q Exactly. So this then leads to my question of why do you then have a paragraph discussing antiandrogens administered, you know, near the end of puberty?

MR. FRAMPTON: Objection; form.

THE WITNESS: Because that is the only information we have on teenagers and how their gender treatment of hormones would be influenced. If you look at some of those previous tables and the tables in the appendix that go along with that, they go up to 17-year-old children.

BY MR. BLOCK:

Q Right. But the -- the subsection is talking ability prepubertal children; right?

MR. FRAMPTON: Objection; form.

THE WITNESS: That is the primary focus of **[149]** that subjection, yes.

BY MR. BLOCK:

Q Okay. And the -- the teenagers discussed in the Tack study are not prepubertal teenagers; correct?

A That's correct. They are mid-prepubertal.

Q All right. Well, now let's look at paragraph 112 of your report which discusses a 2018 study by Klaver. Is that your understanding of how to pronounce the name Klaver?

A Yes, that is my understanding of how to pronounce the name. Thanks for asking.

MR. BLOCK: Okay. Great. And please feel free to correct me if I pronounce anyone else's name incorrectly. All right. I'm going to introduce an exhibit. This exhibit, when it appears on your screen, is going to be marked as Exhibit 72.

(Exhibit 72 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q Please let me know when it's visible.

A Exhibit 072 - Klaver - Early Hormonal Treatment...

Q Right. And is this the article that you're **[150]** referring -- that you are referring to in paragraph 112?

A I think so. Without double-checking between my references cited, I -- I think this is the same article.

Q Okay. Is it your understanding that the people in this study received puberty blockers at the beginning of Tanner II?

A As I recall, they received puberty blockers, and I cannot recall the Tanner stage. I remember it giving the ages.

Q Okay. What -- what age?

A Average age of fourteen and a half, if I remember correctly.

Q Okay. And is fourteen and a half typically the beginning of Tanner stage II?

A Not typically.

Q Okay. So if you go to page 254 of the Klaver study --

A 2-5-4, yes.

Q All right. 2-5-4. And if you look at the column that says "Transwomen," it says (as read): "Age at start of GnRHa, 14.5 ± 1.8." Is that right? **[151]**

A Yes.

Q Okay. And so accord- -- so with those figures, that means that the earliest that any of the trans girls in the study received puberty blockers was at age 12.7; correct?

A Do you want me to take the time to do the math

on that?

Q Well, 14.5 minus 1.8 is 12.7, but --

A So that's only one standard deviation. That only accounts for, basically, a third of the individuals below and above that age. So take out another 1.8 to get two standard deviations away.

Q Got it.

A And you take they way that 1.8 again to encompass the whole 99.99 percent.

Q Oh, okay. So what's your understanding of the youngest age at which someone -- the girls in the study receive puberty blockers, just -- if you can do it or -- without --

A Just eyeball it. I'll say 10.7.

Q Okay. Thank you. But the average age is 14.5; right?

A That is the average age, yes.

Q Okay. Great. Now, you see in paragraph 112 of your report, **[152]** which -- let me pull it up directly so I don't misread it again. Paragraph 112 of your report, the first sentence you say (as read):

"Klaver et al. (2018 at 256) demonstrated that the use of puberty blockers did not eliminate the differences in lean body mass between biological male and female teenagers."

Did I read that right?

A I'm still getting to 112, sorry. That -- that -- that sounds correct, but I'm not --

Q Right.

A -- there to verify. All right. Now I'm at 112.

Q Okay. I'll read it again. (As read):

"Klaver et al. (2018 at 256) demonstrated that the use of puberty blockers did not eliminate the differences in lean body mass between biological male and female teenagers."

Did I read that sentence right?

A Yes.

Q Okay. And then it says (as read): **[153]**

"Subsequent use of puberty blockers combined with cross-sex hormone use (in the same subjects) still did not eliminate the differences in lean body mass between biological male and female teenagers."

Is that right?

A Yes.

Q Okay. Great. Did Klaver report any findings on percentage of body fat?

A Let me look. Yes.

Q And -- and what were the findings on – on body fat?

A Just looking at it to make sure I'm reading these correctly. So it gives -- this is table -- or, sorry, figure 2. At the top of figure 2, there is percent body fat presented.

Q Yep. And the first part of that graph, page 256, table 2, shows the percent body fat of the trans women being virtually the same as the body fat of the cis women; correct?

A Sorry, how do you zoom on this Exhibit Share? **[154]** It's a tiny graph on my screen.

MS. DUPHILY: If you take your mouse on to the bottom and push, you should be able to see a plus and a minus to make it look bigger.

THE WITNESS: Okay. Ah, there we are. All right. Sorry, it's taking me a minute to zoom in on that.

MR. BLOCK: Sure thing.

THE WITNESS: Okay. So to make sure we're looking at the same figure, the trans women are shown in the solid line, the trans men are shown in the light gray line, the cis men are shown in the dotted line, and the cis women are shown in the hash line; correct?

BY MR. BLOCK:

Q Correct.

A Okay. So the percent body fat in the trans women and the percent body fat in the cis women, the lines overlap at the part indicated as “Start CHT.”

Q Okay. So that indicates that by the time the trans women in the study had begun CHT, their percentages of body fat overlapped with the percentages of body fat for cis women; right?

A That is correct.

Q Okay. And is body fat -- percentage of body fat a factor in athletic advantage? **[155]**

A Yes, it is. Having excess body fat is considered a disadvantage.

Q Okay. So why didn’t you mention this finding in your summary of the Klaver study?

A Because I mentioned the next part of the figure demonstrating that there was not elimination of the difference in lean body mass.

Q No, I understand that, but why did you just report on the lean body mass and not the body fat finding?

MR. FRAMPTON: Objection; form.

THE WITNESS: Because lean body mass is a more important determinant of athletic performance.

BY MR. BLOCK:

Q I see. Does your report ever say that lean body mass is a more important determinant?

MR. FRAMPTON: Objection; form.

THE WITNESS: I have stated multiple times in there that lean body mass is a determinant of athletic performance, and I've stated that -- and I have stated that excess body fat is a disadvantage.

BY MR. BLOCK:

Q Okay. But my question is, do you state that lean body mass is a more important determinant?

MR. FRAMPTON: Objection; form. **[156]**

THE WITNESS: I don't recall where I specified which is more or least important in --

MR. BLOCK: Okay.

THE WITNESS: -- in regards to body composition.

BY MR. BLOCK:

Q Okay. You have a whole section in your report on the subject of body fat percentage; correct?

A Again, I would have to look to see if it's a whole section, if we're talking about a couple paragraphs, a couple of pages or whatnot, but, yes, I talk about body composition.

Q Okay. And you don't cite this study when you discuss body composition related to fat; correct?

A So I'm -- you're saying that I'm not citing Klaver in my previous discussions of body composition as a determinant of athletic performance?

Q In your discussion of the role of body fat in the -- as a determinant of athletic performance, you never cite to the findings of this Klaver article; correct?

A I -- I don't think so. I think these are the only paragraphs where I cite the Klaver articles, and we're talking specifically about with the puberty blockers. **[157]**

Q I see. So -- but you -- you cite a finding of the Klaver article that you think is -- supports your view, but you don't cite a finding of the Klaver article that cuts against your view. Is that a fair statement?

MR. FRAMPTON: Objection; form.

THE WITNESS: Yes, I would say that it's fair to say that I don't cite Klaver on the differences in percent body fat.

BY MR. BLOCK:

Q Okay. So you testified earlier that you think that an expert report needs to be held to the same standards of accuracy as a peer-reviewed article; right?

A Yes, that is correct.

MR. FRAMPTON: Objection --

THE WITNESS: Oh, sorry.

BY MR. BLOCK:

Q So do -- do you think your -- your paragraph about Klaver is an accurate summary of the article in its entirety?

MR. FRAMPTON: Objection; form.

THE WITNESS: The paragraph is not intended to be a summary of the article in its entirety. **[158]**

BY MR. BLOCK:

Q Okay. The paragraph is -- is just intended to pick out the portions of the article that support your argument; is that right?

MR. FRAMPTON: Objection; form.

THE WITNESS: The paragraph is intended to demonstrate that biological males retain athletic advantages.

BY MR. BLOCK:

Q Well, the -- the article doesn't say anything about athletic advantages; correct?

A I do not recall that the article uses the word

"athletic advantages."

Q All right. If you go to -- if you look at page 255 of the Klaver article. So I think that's, like, one page before the -- the -- where we were looking.

A You're looking at table 2?

Q No. I'm -- I am just looking at the -- the - the text of it.

A Okay.

Q If you look at the first full sentence in the text that begins with "As a result."

A Okay.

Q Do you see that? **[159]**

A Yes, I do.

Q All right. It says (as read):

"As a result of these changes, in young adult transwomen at age 22" --

Excuse me. (As read):

"As a result of these changes, in young adult transwomen at 22 years of age, SDS for WHR, body fat, and LBM showed greater similarity to ciswomen than to cismen."

Did I read that correctly?

A Yes, you read that correctly.

Q Okay. And do you mention that finding in your report?

A I do not think I quote that in my report.

Q Okay. All right.

MR. BLOCK: It's 1:30 -- can we go off the record?

THE WITNESS: Is that okay with you going off the record?

MS. DUPHILY: Kimberlee, are you there?

THE WITNESS: Nope.

MS. DUPHILY: We're going off the record at approximately 1:32 p.m. [Sic]

(Recess.) **[160]**

THE VIDEOGRAPHER: We are on the record at 12:38 p.m.

MR. BLOCK: Okay. Great.

BY MR. BLOCK:

Q I'd like to move on from the topic of puberty blockers and ask a few questions about trans women who suppress circulating levels of testosterone after puberty. Can we turn to page 56 of your report?

A Come on. Waiting for it to load. All right. So page 56 by the page numbers; correct?

Q Correct.

A All right. I'm there.

Q Great. So if you go to the third bullet point, you say (as read):

"The administration of androgen inhibitors and cross-sex hormones to men or adolescent boys after the onset of male puberty does not eliminate the performance advantage that men and adolescent boys have over women and adolescent girls in almost all athletic events."

Did I read that right? **[161]**

A Yes, you did.

Q Okay. Great. Have you read the expert reports that – the expert reports that Dr. Safer submitted in this case?

A Yes, I read the reports by Dr. Safer.

Q All right. You read both the initial and the rebuttal reports?

A Yes.

Q Okay. Isn't it fair to say that the effects of male to female hormone treatment on important determinants of athletic performance still remain largely unknown?

MR. FRAMPTON: Object to form.

THE WITNESS: Sorry, I blanked out there for a second after the objection. There are still a lot of questions. There are still a lot of questions.

MR. BLOCK: Okay. So I'd like to show you another exhibit. And we have to mark it as such. All right. This is going to hopefully appear on your screen as Exhibit 73.

(Exhibit 73 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q Can you let me know when -- when you see it? **[162]** All right. Exhibit 073 - Brown Blog Post.

Q Yes. Do you recognize what this document is?

A Yes.

Q What is it?

A That is my blog post for the Physiology Educators Community of Practice about The Olympics, sex, and gender in the physiology classroom.

Q Okay. What -- what is the Physi- - Physiology Educators Community of Practice blog?

A So this is a blog sponsored by the American Physiological Society and their -- specifically their educators' interest group -- it probably has a different name than that, but that's what it is – just sharing information for other teachers in physiology, typically geared towards college-level educators.

Q And is there a submission process?

A Yes, there is.

Q What -- what is that submission process? A Well, you have to contact the person that runs the blog post and say you are interested. They connect you, then, to the editor for Advances in Physiology Education who then asks what you would like to blog on and lets you know of available times, and then once you agree on that, you'll submit it. And then, once again, the editor reviews it, someone else associated also **[163]** reviews it prior to being put up on the web.

Q Okay. And so did you reach out with your interest in -- in submitting something?

A Yes, I did.

Q You weren't invited to submit something; correct?

A I did receive an in- -- an e-mail inviting to submit to the Peacock blog, and I e-mailed back and said, yes, I'm interested.

Q And did -- were you invited to submit something on the topic of transgender women participating in sports?

A The invitation was not specific on what I was -- would be blogging on.

Q And was it an invitation to you individually, or was it an invitation to a larger group?

A I think both, honestly. There is an invitation that goes out, periodically, to the larger group of published a paper in Advances in Physiology Education and received an invitation to me.

Q Okay. And so did this blog go through a revision process after you first submitted it?

A There was one round of revisions, if I remember correctly.

Q Okay. And do you remember what feedback you **[164]** got during the revision process?

A The feedback was very positive, and I was told that this is an extremely important topic that needs to be presented. And I really think the feedback was relevant to the -- the -- the graph that I had in there to ensure that I had appropriate copyright permission or whatever permission to have that reproduced.

Q Okay. Great. This blog post doesn't discuss prepubertal children; right?

A Sorry, I'm just reviewing it to see. I don't recall that it discusses prepubertal children.

Q And the blog also doesn't discuss trans girls and women who received puberty blockers and never went through endogenous puberty; right?

MR. FRAMPTON: Objection to the form.

THE WITNESS: I don't recall discussing that in there, and I'm not seeing it, as I look at the blog post.

BY MR. BLOCK:

Q Okay. So if you can just go to page 2, and if you go to the first full paragraph on page 2, beginning with the -- the second sentence, do you --

A Yes. **[165]**

Q -- see that?

A Yes, I do.

Q Okay. So the second sentence there says (as read):

"It is also important to note that the effects of male-to-female hormone treatment on the important determinants of athletic performance remain largely unknown."

Did I read that right?

A Yes, you did.

Q Okay. Do you still agree with that statement?

A Yes, I still agree with that statement.

Q And so you think it's important to note that the effects remain largely unknown; correct?

MR. FRAMPTON: Objection; form.

THE WITNESS: Yes. Prior to allowing biological males to compete in female sports, we should have a better understanding of how that process would influence competition.

BY MR. BLOCK:

Q Okay. So in your expert report, do you ever note that the effects of male to female hormone treatment on important determinants of athletic performance advantage remain largely unknown? **[166]**

A I could look and see, but I think I say -- state something in my conclusion where there are still a lot of variables that have not been measured.

BY MR. BLOCK:

Q Okay. In this paragraph that I was reading from, I'm just going to go into the next one. It says (as read):

"Measurements of VO2max in transwomen using direct or indirect calorimetry are not available." Did I read that right, even if I didn't pronounce it correctly?

A Yes.

Q Okay.

A "Calorimetry" is how I say it because it kind of flows when you say it fast.

Q Okay. That makes sense. Do you ever note in your expert report that measurements of VO2 max in trans women using direct or indirect calorimetry are not available?

A Once again, I would need to refer back to my report in the conclusions to see if I had included that in there.

Q Do you think it would make sense to have included that in there? **[167]**

MR. FRAMPTON: Objection; form.

THE WITNESS: Yes, I think it would make sense to include that in there, but it also -- like I said, I cannot recall if I did or did not.

BY MR. BLOCK:

Q Okay. Well, let's -- well, let's look at your report on -- so if you begin on page 39 of your report. A All right.

Q All right. So this is -- Roman numeral V says (as read):

"The available evidence shows that suppression of testosterone in a male after puberty has occurred does not substantially eliminate the male athletic advantage."

Right? That -- that's what section Roman numeral V says; correct?

A That is correct.

Q Okay. And then subsection A on that page talks about (as read):

"Empirical studies find that males retain a strong performance advantage even after lengthy testosterone suppression."

Correct? **[168]**

A Correct.

Q All right. Then on 40, there's a subsection that says, "Hand Grip Strength."

A Okay.

Q Okay. And if you -- apologies. You know, I -- I should have directed you to page 46, subsection B of that. So if you can just skip ahead to 46.

A Okay. Page 46.

Q Great. Thank you. So subsection B says (as read):

"Testosterone suppression does not reverse important male physiological advantages."

Right?

A Yes.

Q Okay. And then if you turn the page, on 47, at the -- page 47, at the bottom, there's a little discussion on cardiovascular advantages; right?

A Yes.

Q All right. And where would VO2 -- where would the discussion of VO2 max go? Would that be in the "Cardiovascular Advantage" section or in a different subsection of this discussion?

MR. FRAMPTON: Object to the form. **[169]**

THE WITNESS: It would probably belong in the cardiovascular advantages.

BY MR. BLOCK:

Q Okay. So do you see, just in this subsection, a discussion of the fact that measurements of VO2 max in trans women using direct or indirect calorimetry are not available?

A I have not directly made that statement.

Q Okay. And if -- toggling back over to – to Exhibit 73, your blog post, after that statement I just read, you say (as read):

"Measurements of muscle strength in standard lifts (e.g. bench press, leg press, squat, deadlift, etc.) in transwomen are not available."

Is that correct?

A That is correct.

Q All right. Do you disclose that information in your expert report?

MR. FRAMPTON: Objection to the form.

THE WITNESS: In my expert report, I talk about the measurements of strength that have been conducted.

BY MR. BLOCK:

Q But you do not discuss the measurements of **[170]** strength that have not been conducted; correct?

MR. FRAMPTON: Objection to the form.

THE WITNESS: I'm scrolling up to see if I have some statement in there about, you know, specific measurements. Here again, no, I do not specifically state that those measurements have not been conducted.

BY MR. BLOCK:

Q Okay. And then in the next sentence of the blog post, you say (as read):

"Nor have there been evaluations of the effects of male-to-female hormone therapy on agility, flexibility, or reaction time."

Is that right?

A That is correct.

Q Okay. And you do not, in your report, say anything about whether -- about the effects of hormone therapy on agility, flexibility or reaction time, do you?

MR. FRAMPTON: Objection to the form.

THE WITNESS: On page 39, I state that only a limited number of studies have directly measured the effect of testosterone suppression and the administration of female hormones on the athletic **[171]** performance of males. And so then I go through those studies which, you know, by default, then says those other things have not been studied.

BY MR. BLOCK:

Q Okay. But you do discuss agility, flexibility and reaction time when you're discussing the advantages of cisgender men over cisgender women; right?

A Yes.

Q Okay. But then you don't have -- well, let me just read the next part of the -- the blog post. (As read):

"There has been no controlled research evaluating how male-to-female hormone treatment influences the adaptations to aerobic or resistance training."

Is that correct?

A That is correct.

Q And again, that's not something you mention in your report; correct?

MR. FRAMPTON: Objection to the form.

THE WITNESS: It is indirectly stated with my statement about limited number of studies.

BY MR. BLOCK:

Q Okay. And then the final sentence in that paragraph is (as read): **[172]**

"And there are only anecdotal reports of the competitive athletic performance of transwomen before and after using male-to-female hormone treatment."

Is that right?

A That is correct.

Q Okay. So it's fair to say that when you discuss Cece Telfer in your report, that's an example of one of the anecdotal reports you refer to in this sentence; correct?

A That's correct.

Q Okay. So the discussion of Cece Telfer and Lia Thomas and Andraya Yearwood and Terry Miller, those are, to use your words from the blog post, quote, only anecdotal reports; correct?

MR. FRAMPTON: Objection to the form. Go ahead.

THE WITNESS: If I may state, in my declaration, I do cite a prepublished study by Michael Joyner that is evaluating -- or, sorry, Senefeld and Joyner that is evaluating Lia Thomas. But yes, those -- those would primarily be anecdotal reports. **[173]**

BY MR. BLOCK:

Q Okay. If you go to the second sentence in the final paragraph, you say, (as read):

["]In the end, whether it is safe and fair to include transgender athletes and athletes with DSD in women's sports comes down to a -- to a few facts that can be extrapolated, lots of opinions, and an interesting but complicated discussion.["]

Did I read that right?

A I'm sorry, where were you reading that from?

Q Yeah, it's the -- it's the second sentence in the last paragraph of your blog post.

A Okay. There.

Q Okay. I'll read it again. (As read):

["]In the end, whether it is safe and fair to include transgender athletes and athletes with DSD in women's sports comes down to a few facts that can be extrapolated, lots of opinions, and an interesting but complicated discussion.["]

Is that right?

A That is correct. **[174]**

Q And you still agree with that statement?

A Yes.

Q Okay. What do you -- what do you mean by "interesting but complicated discussion"?

A Well, as I was writing this for fellow educators, this could be a very complicated discussion because of -- this could be a very heated topic.

Q Okay. So when you say that there -- "a few facts that can be extrapolated, lots of opinions, and an interesting but complicated discussion," were you referring at all to the underlying substance being interesting but complicated?

MR. FRAMPTON: Objection to the form.

THE WITNESS: Yeah, I'm not sure what you mean by "underlying substance."

BY MR. BLOCK:

Q Yeah, is the discussion of whether -- aside from something being heated, is -- is the -- this topic complicated?

MR. FRAMPTON: Objection to the form.

THE WITNESS: Yes, this is a complicated topic.

BY MR. BLOCK:

Q Okay. So if we go to your report again -- let's see -- on page 57 of your report. **[175]**

A All right. Page 57.

Q So if you look just at the paragraph beginning with the word "but."

A Okay. All right.

Q All right. You say -- you know, actually, instead, let's go a few sentences above that, so in the middle of the previous paragraph beginning with – the sentence beginning with "instead." Do you see that?

A I'm sorry, which --

Q So this is about five -- five lines from the top.

A Okay. Yes. It says, "Instead, the IOC"?

Q Yeah. So this says --

A Okay.

Q -- (as read):

["]Instead, the IOC calls on other sporting bodies to define criteria for transgender inclusion, while demanding that such criteria simultaneously ensure fairness, safety, and inclusion for all. The recent – recently updated NCAA policy on transgender participation also relies on other sporting bodies to establish criteria **[176]** for transgender inclusion while calling for fair competition and safety. But what we currently know tells us that these policy goals fairness, safety, and full transgender inclusion—are irreconcilable for many or most sports.["]

Did I read those sentences correctly?

A Yes, you did.

Q Okay. How come -- why, in your blog post, did you not say that the goals of fairness, safety and full transgender inclusion are irreconcilable?

MR. FRAMPTON: Objection to the form.

THE WITNESS: The purpose of the blog post was to stimulate discussions in classroom while providing a little bit of guidance, but not advocate for a specific position within a classroom.

BY MR. BLOCK:

Q Why didn't you say in your expert report that whether it is safe and fair to include transgender athletes and athletes with DSD in women's sports comes down to a few facts that can be extrapolated, lots of opinions, in an interesting but complicated discuss?

MR. FRAMPTON: Objection to the form. **[177]**

THE WITNESS: I think that a reasonable person would come to those conclusions after reading all -- how many pages of my report?

BY MR. BLOCK:

Q Okay. So it's your expert testimony that whether it is safe and fair to include trans girls and women on girls and women's sports teams comes down to a few facts that can be extrapolated, lots of opinions and an interesting but complicated discussion?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, I will stand by that statement in my blog post.

MR. BLOCK: Okay. Great. So I'm going to now ask a few questions about your other, you know -- your other publication or submission on this topic. Let me just move it into the actual exhibits. Let's see. So I – this is a PowerPoint document. It's going to marked as Exhibit 74, although I am not sure that it is actually going to work, showing up, so please let me know if it actually shows up for you.

(Exhibit 74 was marked for identification by the court reporter and is attached hereto.)

THE WITNESS: All right. I see Exhibit 074. **[178]**

MR. BLOCK: Okay. And I think we're going to need some assistance in how -- how do we zoom in again, Concierge?

MS. DUPHILY: You just hold your mouse over the bottom of the image, and you'll see the positive and negative-looking glasses at the bottom, and you can -- there's a menu. Do you see that?

MR. BLOCK: Mouse over the image?

MS. DUPHILY: You want to click on it when you're --

MR. BLOCK: All right.

MS. DUPHILY: Did you do it?

MR. FRAMPTON: With the witness, we're not getting that.

MS. DUPHILY: Hold on a minute. Let me see.

MR. TRYON: Yeah, this is Dave Tryon. I've seen that on other exhibits, but this one, it's not showing up for me.

MR. BLOCK: If you're able to download a copy –

MS. DUPHILY: Yeah, you're probably better off downloading this because it's a PowerPoint.

BY MR. BLOCK:

Q Have you been able to download it, Dr. Brown? **[179]**

A It appears that my computer is trying to update PowerPoint at this very moment.

Q Okay.

MR. BLOCK: So why don't we -- can we go off the record, please?

MR. FRAMPTON: It looks like it's nearly --

THE VIDEOGRAPHER: We are off the record at 1:04 p.m.

(Recess.)

THE VIDEOGRAPHER: We are on the record at 1:05 p.m.

MR. BLOCK: Thanks.

BY MR. BLOCK:

Q So is this a presentation that you authored, Dr. Brown?

A Yes, it is.

Q And the title of this presentation is "Transwomen Competing in Women's Sports: What We Know, and What We Don't"; is that right?

A That is correct.

Q Okay. And what conference did you submit this presentation to?

A This was the American Physiological Society Sex and Gender conference, if I remember the title correctly. **[180]**

Q Yeah. If I -- if I said it was called "The New Trends in Sex and Gender Medicine" conference, does that sound accurate to you?

A Yes.

Q Okay. And am I right that the conference took place from October 19th to October 22nd?

A That sounds correct.

Q Okay. Did you attend any meetings or panel discussions as part of this conference?

A So this was a virtual conference for everyone.

Q Uh-huh.

A And so, yes, I sat in on discussions and panel discussions and presentations and such.

Q Okay. Did you sit in on the panel discussion at this conference titled "New Trends in Transgender Medicine"?

A I honestly can't remember if I sat in and attended that or not.

Q Okay. You have no recollection one way or the other?

A Yeah, I -- there was a lot of meetings, a lot of presentations and a lot of discussions, so I can't say exactly which ones I was in and which ones I was not.

Q Do you think it would have been informative to **[181]** attend that presentation?

A Yes.

MR. FRAMPTON: Objection to the form.

THE WITNESS: Sorry.

MR. FRAMPTON: Go ahead.

BY MR. BLOCK:

Q You can answer.

A Yes, it -- it would have been informative.

Q Okay. And do you think it would have been at least as relevant to your research as Ben Shapiro?

MR. FRAMPTON: Object to the form.

THE WITNESS: It's possible that I had a conflicting obligation that made it so I'm not able to attend. Again, I know that I did with all of them, I wasn't able to attend every single session I wanted because of other obligations.

BY MR. BLOCK:

Q I see. But -- but my question is, would – it would be a more reliable source of information than Ben Shapiro, was my question.

MR. FRAMPTON: Object to the form.

THE WITNESS: I guess that would depend on what we're asking, Ben Shapiro is -- is speaking about and where he is citing his sources versus what is being discussed in that discussion. **[182]**

BY MR. BLOCK:

Q Okay. Now, would -- would this presentation quali- -- would -- could this be prescribed as a poster presentation?

A Yes.

Q Okay. Does your CV identify it as a poster presentation?

A I don't think my CV discriminates on my various academic presentations, as to what format they were presented in.

Q Okay. So it's not your regular practice to denote whether a presentation is specifically a poster presentation?

A That is correct.

Q Okay. All right. What was the review process for submitting this?

A So I -- I was encouraged by an editor from the American Journal of Physiology to submit to this, after having read my blog post. I submitted it, paid the abstract submission fee, like any other professional conference, and awaited for acceptance of the abstract.

Q And what -- were there edits to the abstract sent back to you?

A No. They don't edit the abstracts.

Q Okay. All right. **[183]** If you go to the bottom right-hand corner of this presentation, there's a box titled "What we don't know"; right?

A Correct.

Q Okay. And then -- and this box says, "What We Don't Know," and then the first bullet is "No controlled training studies with male-to-female hormone use"; correct?

A Correct.

Q Okay. And -- and again, as we discussed before, that -- that statement is not in your expert report; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: That statement is not verbatim in my expert report.

BY MR. BLOCK:

Q And then the second bullet point is "No measurements of changes in VO2max, running economy, lactate threshold, anaerobic power (e.g. Wingate test), vertical jump, 1-Repetition Maximum (e.g. bench press, leg press, squat, deadlift), or many other common determinants of athletic performance"; correct?

A That is correct.

Q And that information in that bullet point is not included in your expert report; correct? **[184]**

MR. FRAMPTON: Object to the form.

THE WITNESS: Again, in my expert report, I state that there is limited evaluation. I don't make that statement exactly.

BY MR. BLOCK:

Q Okay. How come this poster presentation doesn't say that the policy goals of fairness, safety and full transgender inclusion are irreconcilable for many or most sports?

MR. FRAMPTON: Object to the form.

THE WITNESS: This poster was put together and presented before the recent IOC or NCAA adjustments, stating that that was a requirement. And again, the poster is summarizing the science of what we know and what we do not know.

BY MR. BLOCK:

Q So would you feel comfortable making the statement to a -- a peer-reviewed publication that the policy goals of fairness, safety and full transgender inclusion are irreconcilable?

A Yes, I would feel very comfortable saying that in a peer-reviewed pol- -- publication or presentation.

Q Can you tell me your understanding of what this case is about?

MR. FRAMPTON: Object to the form. **[185]** Go ahead.

THE WITNESS: So the State of West Virginia, like about currently 11 other states, if I recall, passed a law to limit participation in women's sports to biological women. In this case, a young trans girl has retained some lawyers and filed a lawsuit asking to be able to participate in girls sports. The judge has given an injunction specifically for the plaintiff, but not halting the law overall.

BY MR. BLOCK:

Q And do you -- so the -- the plaintiff's name is -- is Becky. Do you oppo- -- do you think Becky should not be allowed to participate on her middle school cross-country team?

MR. FRAMPTON: Object to the form and scope.

THE WITNESS: So my understanding is the plaintiff is biologically male, so a trans girl, who wants to compete on girls sports.

BY MR. BLOCK:

Q Yes. And -- and so what's the answer to my question?

A So --

MR. FRAMPTON: Same objections. **[186]**

THE WITNESS: So if we were to follow the law, then the plaintiff should not be participating in girls' sports.

BY MR. BLOCK:

Q Yeah, but it's your -- is it your expert opinions that Becky should not be participating in the girls' cross-country team at her middle school?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: So my expert statement, expert declaration, is not meant to make judgments on an individual basis, but overall policy and law.

BY MR. BLOCK:

Q Okay. Well, so you -- you made a distinction between the fact that the injunction is -- applies only to Becky and not to the -- the statute on its face, and so I'm just trying to figure out whether your expert opinion is only about other applications of the statute to people beyond Becky or whether you are also offering expert testimony with respect to the specific issue of Becky's as-applied challenge.

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: I've not made any statements that I'm aware of specific to an individual plaintiff in this case or -- I don't think in any of the cases. **[187]**

BY MR. BLOCK:

Q Okay. So you're not offering an expert opinions in this case with regard to whether Becky, as an individual, should be allowed to participate on her girl's cross-country team in middle school?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: I'm offering an expert opinion based on what the science says and what we know overall regarding differences between males and females and how those differences are affected by transgender hormone use.

BY MR. BLOCK:

Q Okay. And are you offering any opinion on whether Becky, as an individual, has any athletic advantages compared to cisgender girls?

MR. FRAMPTON: Objection; form and scope.

THE WITNESS: I'm not making statements specific to Becky. I am talking about boys and girls overall.

BY MR. BLOCK:

Q Okay. And it's possible that Becky, as an individual, as opposed to people with a male sex assigned at birth overall -- let me just rephrase that. It's possible that Becky, as an individual, may not have any athletic advantages compared with **[188]** cisgender girls; right?

MR. FRAMPTON: Object to the form and scope.

THE WITNESS: Based on the information I have read, the information cited in my expert report, if we are comparing the plaintiff to a similarly aged trained and gifted girl, the plaintiff, as a biological male, will have athletic advantages.

BY MR. BLOCK:

Q Well, that -- that raises questions for me. I -- I -- I guess my understanding of your report was that you were discussing average group-based differences between males and females; right?

A If you look at my --

MR. FRAMPTON: Objection; form. Go ahead.

THE WITNESS: If you look at my report, I -- I provide information on individuals in the 10th percentile, individuals in the 50th percentile, individuals in the 90th percentile, and state multiple times if we compare equally trained, gifted and talented same-age individuals, the males have an advantage.

BY MR. BLOCK:

Q Well, what do you mean by "gifted"?

A There are many gifts that could help a person **[189]** be a better athlete than others, whether --

Q So --

A -- whether it is something biological, whether that is something with family support.

Q Okay. But -- so when -- when you're discussing the physiological characteristics that, on average, make cisgender boys have better outcomes in athletic performance than cisgender girls, you're not saying that every single cisgender boy has physiological characteristics that make -- that give them an advantage over the average cisgender girl of the same age and training, are you?

MR. FRAMPTON: Object to the form.

THE WITNESS: When we look at the data, if you compare comparably gifted aged and trained males and females, the males have an advantage.

BY MR. BLOCK:

Q Yeah, but you're -- you're smuggling in the word "gifted" here, and you're including these physiological characteristics as meaning gifted, it sounds like. I'm trying to isolate your testimony about physiological advantages, okay? And so it's possible there's -- there's plenty of boys that are shorter than girls; right? **[190]**

A Yes, there are some boys that are shorter than some girls.

Q Yes. So not -- not every -- and there are some boys that are shorter than the average girl of the same age; correct?

A Yes, there are some boys that are shorter than the average girl.

Q Okay. So not -- not every -- so even if males, on average, are taller than females, on average, not every male is gifted with greater height than the average girl of the same age; right?

A 50 percent of men are taller than 90 percent of women.

Q Yeah. And I know you're -- you're -- you're making a statement, though, that that doesn't answer my question. And so I'm taking that as -- is the answer to my question "correct"?

A Could you restate the question, please?

Q Yes. Not every boy is taller than the average cisgender woman; right? Let me switch from boys to gir- -- to a woman. Not every cisgender boy is taller than the average cisgender girl of the same age; correct?

A If I can -- I'm -- I'm just a little confused here because you are comparing an absolute of every boy **[191]** with average.

Q Yes, I -- I -- I am. I -- I'm saying that it is entirely possible that there's an individual that is not taller than the -- an individual who is a boy that is not taller than the average girl, the mean -- or the mean height of girls of the same age; right?

A Yes. So if you look at the distribution curves for body height, boys on the shorter end of the distribution curve may be shorter than girls in the average of the distribution curve.

Q And -- and the same is true for speed; right?

A If I may, I would actually like to refer back to the graphs by Gabe Higgard so we could look and see where the slowest boys are relative to the 50th percentile for the girls in those competitions.

Q Okay. We can -- so we -- I appreciate that. We can refer back to that later. Are -- are you familiar at all with Becky's athletic performance?

A No. I know nothing of Becky's athletic performance.

Q Okay. And you -- as we said before, you are not providing expert testimony about her as an individual; correct?

A Right. I'm providing testimony on overall **[192]** what we would see if we compare equal, as much as possible, males to females.

Q And is it your understanding of -- of this law that it prevents girls who are transgender from participating on the same sports teams as cisgender girls?

MR. FRAMPTON: Object to the form and scope.

THE WITNESS: My understanding is, yes, this states that people should participate in sports based -- based on their biological sex.

BY MR. BLOCK:

Q Right. And, therefore, transgender girls should not be allowed to participate on the same sports team as cisgender girls; correct?

MR. FRAMPTON: Same objection.

THE WITNESS: Just going to rephrase that. So trans girls should not be competing with cis girls, yes.

BY MR. BLOCK:

Q Okay. Thank you. And you think H.B. 3293 -- well, let me say, do you know what I'm talking about when I refer to H.B. 3293?

A I know we're talking about H.B. I don't remember the number. I will assume that it is the law **[193]** in West Virginia.

Q Okay. Great. You think H.B. 3293 is justified by science; right?

MR. FRAMPTON: Object to the form and scope.

THE WITNESS: Yes, I do.

BY MR. BLOCK:

Q Okay. And you think it's justified by science even though it applies to trans girls who, as a result of puberty blockers and gender-affirming hormones, never go through endogenous puberty; right?

MR. FRAMPTON: Same objections.

THE WITNESS: Yes.

BY MR. BLOCK:

Q And you think H.B. 3293 is justified by science even though it applies to trans girls and women who go through endogenous puberty and then take medication to lower their levels of circulating testosterone; right?

MR. FRAMPTON: Same objections.

THE WITNESS: Yes.

BY MR. BLOCK:

Q Okay. And you think H.B. 3293 is justified by science even though it applies the same categorical rule to all sex-separated sports instead of creating **[194]** different standards for different sports; is that right?

MR. FRAMPTON: Same objections.

THE WITNESS: Yes.

BY MR. BLOCK:

Q Okay. I would like to direct your attention to paragraph 8 of your report. Let me know when you're there.

A It is on page 7, under item II, "Biological men"?

Q Yes.

A Okay.

Q Okay. Make sure I'm there myself. Okay. So I'm just going to read this to you, beginning with the second sentence. (As read):

"I cited many" --

Actually, I'll begin with the first sentence. Sorry. You say (as read):

"Nevertheless, these differences have been extensively studied and measured. I cited many of these studies in the first paper on this topic that I prepared, which was submitted in litigation in January 2020. **[195]** Since then, in light of current controversies, several authors have compiled valuable collections or reviews of data extensively documenting this objective fact about the human species, as manifest in almost all sports, each of which I have reviewed and found informative.["]

Did I read that correctly so far?

A Yes, you did.

Q Okay. Thanks. And you say (as read):

"These include Coleman (2020), Hilton & Lundberg (2021), World Rugby (2020), Harper (2021), Hamilton

(2021), and a 'Briefing Book' prepared by the Women's Sports Policy Working Group (2021).["]

Did I read that right?

A Yes.

Q Okay. And if you -- if you could look at the --that list that you gave, and I'd like you to -- to tell me -- and I -- and I will write it down -- which of those sources support excluding transgender girls and women from sports if they have had puberty **[196]** blockers and gender-affirming hormones and, as a result, have not gone through endogenous puberty.

MR. FRAMPTON: Object to the form.

THE WITNESS: Can you please rephrase that question? It was just kind of long.

BY MR. BLOCK:

Q Yeah, sure. So I -- I'm talking about trans girls who have been on puberty blockers and, as a result, not experienced endogenous puberty. Which of the sources identified in paragraph 8 support excluding those trans girls who are on puberty blockers from participating in girls and women's sports?

MR. FRAMPTON: Object to the form.

THE WITNESS: I cannot recall right now which or if any of those papers discuss specifically puberty blockers.

BY MR. BLOCK:

Q Okay. So -- so you can't recall whether any of those papers discuss puberty blockers at all. Is that what you're saying?

A I'm saying I cannot recall if they advocate for preventing people who have used puberty blockers from participating in girls' sports. **[197]**

Q Okay. Can you recall if any of them advocate in favor of allowing girls who use puberty blockers to participate in girls and women's sports?

A Well, as we discussed earlier, the Women's Sports Policy Working Group has a statement about that, and I think World Rugby has a statement about that.

Q Okay. Any others?

A I can't recall from the others.

Q Okay. So just in terms of what you can recall, at least two of them advocate in favor of allowing trans girls on puberty blockers to participate and you can't recall if any of the others support excluding girls who are transgender?

MR. TRYON: Objection.

MR. FRAMPTON: Same objection. Form.

THE WITNESS: So I can't recall specifically. I think Hilton and Lundberg have some mention on that topic, but again, I can't recall without referring back to the paper to look.

BY MR. BLOCK:

Q Okay. And so which of the sources cited in this paragraph advocate in favor of excluding trans girls and women who go through puberty and then suppress testosterone?

MR. FRAMPTON: Objection; form. **[198]** Go ahead.

THE WITNESS: I think that is Hilton and Lundberg and World Rugby and Harper and Hamilton and the Women's Sports Policy Working Group.

BY MR. BLOCK:

Q Okay. So it's Hilton and Lundberg and Harper and World Rugby and Women's Sports Policy Working Group?

A And, I think, Hamilton.

Q Okay. You think that those five sources advocate in favor of excluding transgender girls and women from participating on girls and women's sports team if they have gone through endogenous puberty and then lowered their levels of circulating testosterone?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, I think those all indicate that women deserve to compete in a protected category.

BY MR. BLOCK:

Q Okay. And then which of the sources cited in paragraph 8 advocate in favor of having a categorical rule that apply to all sports instead of differentiating based on what sport is at issue?

MR. FRAMPTON: Object to the form.

THE WITNESS: So World Rugby is speaking specifically about rugby; and, therefore, I would not **[199]** expect it to talk too much about other sports. If I recall correctly, Hamilton states specifically that women deserve to compete in a protected category, which implies all sports. Hilton and Lundberg advocate for sex segregation of sports, and, as far as I know, it's for all sports. And Harper indicates that trans women have a retained athletic advantage compared to cisgender women.

BY MR. BLOCK:

Q And so just to clarify, my question isn't whether or not there should be separation in those -- in all sports; the question is whether or not there should be the same rules for excluding transgender girls and women in all sports.

MR. FRAMPTON: Objection; form.

THE WITNESS: I guess you'll need to rephrase the question because I thought I answered it.

BY MR. BLOCK:

Q Yeah. So IOC used to have a single standard that applied to all sports. They then changed their policy so that individual standards could be crafted for different sports. H.B. 3293 has a single standard that applies **[200]** to all sports. My question is which of the sources support having a single standard that applies to all sports instead of having individual standards crafted to different sports.

MR. FRAMPTON: Objection to the form.

THE WITNESS: I would need to review each of them to be specific and certain. So going off of memory, Hilton and Lundberg, Hamilton, Women's Sport (sic) Policy Working Group, again, as I recall, without looking at them specifically, state that it should be categorical women's sports and men's sports.

MR. BLOCK: Okay. Can we go off the record for a second?

MR. FRAMPTON: Sure.

THE VIDEOGRAPHER: We are off the record at 1:32 p.m.

(Recess.)

THE VIDEOGRAPHER: We are on the record at 2:08 p.m.

BY MR. BLOCK:

Q Good afternoon, Dr. Brown.

A Mr. Block, how are you doing?

Q I -- I'm good. Okay. So, you know, we -- just before the **[201]** break, we had just a series of questions about some of the sources quoted in your report, and I'm trying to just pull back, again, the – the paragraph where this was discussed. This is paragraph 8, page 7, from your expert report, you know, marked Exhibit 64.

A Yes.

Q And, you know, we -- we had a series of questions about them. And if you recall, my questions focused on three features of H.B. 3293. One is the fact that it excludes trans girls and women even if they've had blockers. Two is that it includes trans girls and women if they've gone through puberty and suppressed their testosterone. And three is that it has an across the board rule. And I asked you a series of questions about those elements of it, and now I'm going to turn to looking at the sources cited in paragraph 8, with an eye towards those elements. So that's not a question for you; that's just to orient you for the next couple of questions.

MR. BLOCK: So if you could look in your exhibit file, Exhibit 75, that should be a PDF of Coleman -- of the first Coleman article. Coleman 2020.

(Exhibit 75 was marked for identification.) **[202]**

THE WITNESS: Yes. By Doriane Coleman and Michael Joyner and Donna L.

BY MR. BLOCK:

Q Yes. All right. So if we look at that article – if you could turn to page 130 of her article. Let me know when you're there. It's near the end.

A Still scrolling. Almost there. All right. Page 130. Duke Journal of Gender and Law Policy, Volume 27:69, 2020.

Q Yep. Okay. Now, just to preface this, you know, this article uses the phrase "category affirming" and "category defeating." Are you familiar with those terms?

A If I remember correctly, category affirming applies to male and female. Is that correct?

Q So my understanding, which I'll represent to you, is that category affirming means that the participation is consistent with the purposes of having a female category, and category defeating means allowing someone to participate would sort of defeat the purpose of having a female category. So if – does that ring a bell at all for you?

A Yes, it does. It does. **[203]**

Q Okay. So if you look at the -- the paragraph beginning "In high school" --

A Uh-huh.

Q -- "In high school intramural." Do you see that?

A Yes, I do.

Q Okay. So it says (as read):

"In high school intramural, junior varsity, and regular season play, where institutional goals are primarily related to health and fitness and to the development of social skills, unconditional inclusion of gender diverse students according to their gender identity rather than their sex will usually be category affirming."

Do you see that?

A I do.

Q Okay. So that sentence indicates that it would be consistent with the female category according to Coleman 2020 to have -- to allow trans girls to participate in intramural, junior varsity and regular season play without any medical interventions whatsoever. Do you agree? **[204]**

MR. FRAMPTON: Object to the form.

THE WITNESS: I'm looking at the sentence after that, however, which has some exceptions, which would include invitational and postseason opportunities.

BY MR. BLOCK:

Q Yes. Is it your understanding that H.B. 3293 is limited to excluding trans girls from invitational and postseason opportunities?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, it is my understanding that the law in West Virginia states that biological females only compete in female sports.

BY MR. BLOCK:

Q Right. But not just -- not just the invitational and postseason opportunities of female sports; right?

MR. FRAMPTON: Same objection.

THE WITNESS: Yes, it is my understanding that it is all parts of the sports.

BY MR. BLOCK:

Q Right. So the H.B. 3293 does not allow trans girls to participate on girls' teams in the regular season play of sports; correct?

MR. FRAMPTON: Object to the form. **[205]**

THE WITNESS: I will trust your interpretation on that.

BY MR. BLOCK:

Q Would you support a policy of allowing trans girls to participate in regular season play?

MR. FRAMPTON: Object to the form and scope.

THE WITNESS: Inasmuch as biological males have inherent athletic advantages over biological females, I think the category should be retained.

BY MR. BLOCK:

Q Yeah, I know. I'm -- I'm sorry, I really just need like a clear answer to my questions. This article draws a distinction between allowing trans girls to play in regular season play versus in postseason opportunities. I'm just trying to get an answer from you about whether you agree with that distinction or not. So --

MR. FRAMPTON: Objection to the form that misstates the article.

MR. BLOCK: Okay.

BY MR. BLOCK:

Q So --

MR. FRAMPTON: You can go ahead and answer.

BY MR. BLOCK:

Q So do you think that trans girls should not be **[206]** allowed to play on girls' teams for regular season play?

MR. FRAMPTON: Object to the form. Go ahead.

THE WITNESS: I think that whether it's regular season, preseason, postseason, males have inherent athletic advantages; therefore, we should protect women's sports and men's sports.

BY MR. BLOCK:

Q So -- so that's a yes?

MR. FRAMPTON: Same objection.

THE WITNESS: I think you could take that as yes.

BY MR. BLOCK:

Q Thank you. All right. Then if you go down, continuing in the article, the paragraph that says – let me find this. All right. The paragraph above that begins with "where combined." (As read):

["]Where combined teams or practices coupled with sex segregated competition cannot be – cannot accomplish institutional goals, the accommodations approach detailed in Part IIIC4 should be adopted."

[207] And that cross references a section that I don't think we need to turn to for purposes of this question, but let me know if you disagree. Then the -- then the paragraph continues, so -- (as read):

"This will be the case" - - Meaning the accommodations approach should be adopted. (As read):

-- "in circumstances where sex segregated teams and events remain necessary to secure parity of opportunity for females. Where the accommodations approach is adopted, trans students will train and compete consistent with their gender identity so long as their inclusion can be relevantly conditioned. The NCAA transgender policy is illustrative of a hormonal condition in this category; others that do not require medicalization— such as handicaps, offsets, and quotas— exist as more appropriate models for the high school sports space.["] **[208]**

Do you see that?

A Yes, I see that.

Q Okay. So am I correct in saying that this article points to the NCAA transgender policy as illustrative of a model of allowing trans girls to participate so long as their inclusion can be relatively – relevantly conditioned?

MR. FRAMPTON: Object to the form.

THE WITNESS: And I'm unclear what they mean by "relevantly conditioned," so I don't know how I can answer that.

BY MR. BLOCK:

Q Okay. Why do you think they're citing the NCAA transgender policy?

A This is the old NCAA policy, not the current NCAA policy, and the old NCAA policy did have a statement about testosterone suppression.

Q So -- and so they are citing testosterone suppression as an example of an accommodations approach that should be used in circumstances for sex-segregated teams and events remain necessary to secure parity of opportunity for females; right?

MR. TRYON: Objection.

MR. FRAMPTON: Object to the form.

THE WITNESS: And again, what -- I'm still not **[209]** sure what you're asking me here.

BY MR. BLOCK:

Q Sure. I'm -- I'm asking, does this article support a policy of -- of excluding trans girls and women from all female athletic events, even if they suppress testosterone after puberty?

MR. FRAMPTON: Same objection.

THE WITNESS: As I read it, this article is kind of confusing on that.

MR. BLOCK: Okay. All right. I'll -- I'll leave that article at that. Let's next look at the Hilton and Lundberg article, which I will cue up for you. For some reason, Exhibit Share is being slow.

(Exhibit 76 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q Okay. This should pop up on your exhibit list as Exhibit 76.

A All right. Exhibit 076 - Hilton – Transgender Women...?

Q Yes.

A Okay.

Q So, you know, we discussed this, you know, as -- you -- you cited this as an exam- -- as, **[210]** potentially, an example of an article supporting a categorical rule across sports; correct?

A That is correct.

Q Okay. And you cited this, potentially, as an example of an article supporting an exclusion of trans girls and women even if they've suppressed testosterone; right?

MR. FRAMPTON: Same -- object to the form.

THE WITNESS: Yes.

BY MR. BLOCK:

Q Okay. Great. So let's look on page 211 of this article. Let me know when you're there.

A All right. Yep, page 211.

Q Great. All right. Sorry. One second. All right. If you look on the right-hand column, the second -- the third sentence there, where it begins, "It is also," do you see that?

A So page 211, right-hand column?

Q Second full paragraph, third sentence.

A Yes. "It is also important to recognize..."

Q Yeah. So that says (as read):

"It is also important to recognize the performance in most sports may be influenced by factors outside muscle **[211]** mass and strength, and the balance between inclusion, safety and fairness therefore differs between sports."

Do you see that?

A Yes.

Q Okay. Does that refresh your recollection at all about whether or not this article advocates for a single across-the-board rule?

MR. FRAMPTON: Object to the form.

THE WITNESS: It doesn't make a clear statement one way or the other, necessarily.

BY MR. BLOCK:

Q Okay. So let's continue reading. If you go to the final full paragraph.

A Okay.

Q The second sentence beginning with "regardless."

A Okay.

Q Okay. It says (as read):

"Regardless of what the future will bring in terms of revised transgender policies, it is clear that different sports differ vastly in terms of physiological determinants of success, which may create safety considerations **[212]** and may alter the importance of retained performance advantages. Thus, we argue against universal guidelines for transgender athletes in sport and instead propose that each individual sports federation evaluate their own conditions for inclusivity, fairness and safety."

Do you see that?

A Yes, I do.

Q Okay. So is it fair to say that this article, they state that they argue against universal guidelines for transgender athletes in sport?

MR. FRAMPTON: Object to form.

THE WITNESS: Yes, that would be a correct statement based on what is written right there.

BY MR. BLOCK:

Q Okay. So based on what is written right there, they do not support a single categorical rule that applies equally to all sporting events; correct?

MR. FRAMPTON: Same objection.

THE WITNESS: Based on that sentence, that is correct.

BY MR. BLOCK:

Q Okay. Let's go to page 209 of this. **[213]** At the top of the page, on the left-hand column.

A Okay.

Q Okay. The paragraph beginning -- I mean, not the paragraph. The sentence beginning with the word "however." Do you see that --

A Yes.

Q -- right in the middle of that first paragraph? All right. It says (as read):

"However, given the plausible disadvantages with testosterone suppression mentioned in this section, together with the more marginal male advantage in endurance-based sports, the balance between inclusion and fairness is likely closer to equilibrium in weight-bearing endurance-based sports compared with strength-based sports where the male advantage is still substantial.["]

Do you see that?

A Yes, I do.

Q All right. So -- and feel free to read more **[214]** of that paragraph of which this is an excerpt, but is it fair to say that the authors of this article are saying there is a substantial advantage for strength-based sports for transgender women who suppress testosterone, but when it comes to -- when it comes to weightbearing endurance-based sports, the balance between inclusion and fairness is likely closer to equilibrium?

MR. FRAMPTON: Object to the form.

MR. TRYON: Objection.

THE WITNESS: I think you need to take that particular statement in context of the other information presented in this article in which the authors clearly demonstrate a 10 to 13 percent advantage in endurance performance for males compared to females relative to the 30 to 60 percent -- I guess I could look up at the table and tell you exactly the percent -- that they're showing for advantage in strength-based sports. And then if you look at the para- -- the sentence right above what you've quoted, they mention about unknown effects on vari- -- a number of the determinants of endurance performance. And so I really can't say too much beyond that that is kind of a speculative statement. **[215]**

BY MR. BLOCK:

Q I see. So if you look on page 208, there's a discussion about -- on the right-hand column, there's a discussion about hemoglob- -- hemoglobin levels being reduced with once testosterone is suppressed; correct?

A Yes. Second paragraph down, page 208, starts "Circulating hemoglobin."

Q Right. And if you -- and then if you look at the next paragraph, it also says (as read):

"The typical increase in body fat noted in transgender women may also be a disadvantage for sporting activities (e.g. running) where body weight (or fat distribution) presents a marginal disadvantage."

Right?

A Correct.

Q Okay. All right. I'll leave it at that article. We already -- you mentioned the World Rugby policies, and you already noted that World Rugby allows girls and women -- trans girls and women to -- I guess I'll start over. You already mentioned that World Rugby allows trans women to participate in women's rugby if they've **[216]** had puberty blockers and, therefore, not experienced endogenous puberty; right?

MR. FRAMPTON: Object to form. Go ahead. I'm sorry. I couldn't tell if you finished the question. Go –

MR. FRAMPTON: But objection. Go ahead and answer.

THE WITNESS: All right. That is my understanding of what World Rugby has stated.

BY MR. BLOCK:

Q Okay. So you don't need me to put on the screen a -- a copy of the World Rugby policy to -- to point out that provision, do you?

A I would ask you to put it on the screen so we can evaluate if they cite any sources to make that statement.

Q Sure. Let's put that -- let's put it on the screen. One second.

MS. DUPHILY: Did you say you wanted to put something on the screen or --

MR. BLOCK: No, I'll take -- I'll take care of it. I'm just looking up which specific one I want to put up. **[217]** MS. DUPHILY: Okay.

(Exhibit 77 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q All right. So this is going to pop up as marked as Exhibit 77. Let me know when you see it.

A All right. Exhibit 077 - World Rugby Transgender...?

Q Yes. All right. And you see it says, “Can transgender women play rugby?” right?

A Yes.

Q Okay. And the first bullet point says (as read):

“Transgender women who transitioned pre-puberty and have not experienced the biological effects of testosterone during puberty and adolescence can play women’s rugby (subject to confirmation of medical treatment and the timing thereof).[”]

Right?

A Yes, I see that.

Q Okay. The third bullet point also says (as read):

“Transgender women can play **[218]** mixed-gender non-contact rugby.”

Right?

A Yes.

Q Okay. And if we -- scroll down. Do you know -- do you know if World Rugby at all talks about any advantages for -- between boys and girls before puberty?

A I don’t recall this document from World Rugby evaluating differences between boys and girls prepuberty.

Q Can you recall any document from World Rugby evaluating that?

A Sitting here right now, I cannot recall that World Rugby has evaluated and cited sources on differences before puberty or the effect of puberty blockers on those differences.

Q Okay. All right. So that's -- that's World Rugby. So we can put that down as not supporting a policy of excluding trans girls and women from participating in girls and women's sports if they've had puberty blockers; correct?

MR. FRAMPTON: Object to the form.

THE WITNESS: I think it's important that that's specific to rugby. **[219]**

BY MR. BLOCK:

Q I -- I understand. But the -- the answer to my question is correct; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: Isn't that what I said?

BY MR. BLOCK:

Q No. You -- you've made a different statement, so I -- I just -- I need you to answer my question before you make a different statement. So it's fair to say that -- that World Rugby -- this World Rugby policy does not support excluding trans girls and women from girls and women's teams in rugby if they have been on hormone blockers and not experien- -- puberty blockers and not experienced endogenous puberty; correct?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, that is correct, as you stated, the World Rugby statement is about rugby.

(Exhibit 78 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q Okay. All right. Now let's look at the Harper 2021 article. All right. This is going to appear on your screen as Exhibit 78. Please let me know once you have **[220]** it.

A All right. Exhibit 078 - Harper.

Q All right. See if I can grab -- all right. So if you go to page 7. Let me know when you're there.

A All right. Page 7 of 9.

Q Yeah. So if you look at the first full paragraph, beginning with "in contrast," do you see that?

A Yes.

Q Okay. It says (as read):

"In contrast to strength-related data, blood cell findings revealed a different time course of change. After 3-4 months on GAHT" -- which is gender-affirming hormone therapy -- "the HCT or Hgb levels of transwomen matched those of cisgender women, with levels remaining stable within the 'normal' female range for studies lasting up to 36 months."

Do you see that?

A Yes, I do.

Q Okay. And then if you look at the bottom of the paragraph, so that's the top of the second column, it says (as read): **[221]**

"Given this, and that the changes in Hgb/HCT follow a different time course than strength changes, sport-specific regulations for transwomen in endurance versus strength sports may be needed."

Do you see that?

A Yes, I see that.

Q Okay. So is this Harper article advocating for a single categorical rule that doesn't distinguish between endurance sports and strength sports?

MR. FRAMPTON: Object to the form.

THE WITNESS: That would appear to be correct.

BY MR. BLOCK:

Q Okay. Now, if you look at the bottom right, so the last paragraph, bottom right of page 7, it says (as read):

"Although the data we present are meaningful, the effects of GAHT on these parameters, or indeed athletic performance in transgender people who engage in training and competition, remain unknown."

Do you see that?

A Yes. **[222]**

Q Okay. Great. And then if we move down -- actually, never mind. I'll come -- I'll come back to this article. I -- I have one more to quote for you, and then I'll come back to this article. If you go to page 8, at the very end, the second to last sentence.

A Is that the one that starts "Whether transgender"?

Q Yes. It says (as read): ["]Whether --

A Okay.

Q (As read):

"Whether transgender and cisgender women can engage in meaningful sport, even after gender-affirming hormone therapy, is a highly debated question. However, before this question can be answered with any certainty, the intricacies and complexity of factors that feed into the development of high-performance athletes warrant further investigation of attributes beyond those assessed herein."

Do you see that? **[223]**

A I see that.

Q Okay. So do the authors of this article believe that the information they present here allows a policy maker to determine with any certainty whether] transgender and cisgender women can engage in meaningful sport after GAHT?

MR. FRAMPTON: Object to the form.

MR. TRYON: Objection.

THE WITNESS: The authors state that that question cannot be answered.

BY MR. BLOCK:

Q Okay. And you -- do you think the question can be answered?

MR. FRAMPTON: Object to the form. Go ahead.

THE WITNESS: I think that the question can be answered sufficiently that we should not do away with existing policies until further information demonstrating the removal of biological male advantage has been obtained.

BY MR. BLOCK:

Q Okay. Let me ask that again. So the -- the -- the -- because I'm just not sure it came out clearly. **[224]** going to read it again for the record. (As read):

"Whether transgender and cisgender women can engage in meaningful sport, even after gender-affirming hormone therapy, is a highly debated question. However, before this question can be answered with any certainty, the intricacies and complexity of factors that feed into the development of high-performance athletes warrant further investigation of attributes beyond those assessed herein."

Do you agree or disagree with that statement?

MR. FRAMPTON: Object to the form. Go ahead.

THE WITNESS: So what is the question I'm agreeing with or not agreeing with?

BY MR. BLOCK:

Q I -- I believe the question is that until -- until the intricacies and complexity of factors that feed into the development of high-performance athletes -- let me ask the question again in a -- in a clearer way. Do you -- the -- the question is, do you -- is the information presented in this article sufficient **[225]** for a policy maker to answer with any certainty whether transgender and cisgender women can engage in meaningful sport after gender-affirming hormone therapy?

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: What is meant by "meaningful sport"?

BY MR. BLOCK:

Q What -- what do you think is meant by "meaningful sport"?

A I asked first.

Q So you can't answer the question without knowing more what they mean by "meaningful sport"?

A Yes, I would like know what they mean more by "meaningful sport."

Q Okay. Do you think that -- all right. We can come back to this article later too. So a question about the Hamilton article. You have several times, if I'm right, referenced a statement in the Hamilton article about how women have a right to compete in a protected category; is that right?

A Yes, I have stated that.

Q Okay. Is there any other portion of the **[226]** Hamilton article that you remember?

MR. FRAMPTON: Object to the form.

THE WITNESS: I remember there was a lot of statements in the Hamilton article that seemed confusing and contradictory.

BY MR. BLOCK:

Q What do you mean by "confusing and contradictory"?

A Again, if I'm remembering the article correctly, it seemed like they would make a statement in one place about how trans women retain significant advantages and then in another statement state something about how those advantages wouldn't influence sport performance and then come back and state that those are advantages that influence sport performance. I'm -- I'm grossly generalizing here, but that was my impression because I read a lot of the article.

Q Okay. Which portions of the article did you decide to cite in your report?

MR. FRAMPTON: Object to the form.

THE WITNESS: The -- if I'm remembering correctly, that is a direct quote from Hamilton, that cisgender women deserve to compete in a protected category, and I thought that was a very clear statement from that article. **[227]**

BY MR. BLOCK:

Q Okay. But -- but you had said before that several statements in the article are contradictory; right?

A Yes.

Q Okay. And in your report, you quoted the statements that you believe support excluding trans girls and women from female sports; is that right?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, I quoted from Hamilton those parts that -- yeah, as you said.

BY MR. BLOCK:

Q Okay. But you didn't quote any of the portions of the Hamilton article that are contradictory with that; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: I didn't put quotations in there that were confusing and contradictory to other quotations in the article.

BY MR. BLOCK:

Q Well, so if there's two quotations in the article, one of them supports allowing trans women to participate and the other one opposes allowing transgender women to participate, you decided to cite to the quote that opposes allowing trans women to **[228]** participate; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, that is what I quoted.

BY MR. BLOCK:

Q Okay. And why did you choose to cite the portions that you believe support opposing -- I'll ask again. Why did you choose to cite to the portions that would support excluding transgender women instead of the portions of the article that you think support including them?

MR. FRAMPTON: Object to the form.

THE WITNESS: Because as I read the article and evaluated the information, I thought it was a clear statement opposing the inclusion of trans women in women's sports.

(Exhibit 79 was marked for identification by the court reporter and is attached hereto.)

BY MR. BLOCK:

Q Okay. So let's look at the -- let's look at the article. So this will appear on your screen in a second

as Exhibit 79. Let me know when it appears.

A All right. Exhibit 079 - Hamilton.

Q Okay. Is this article that you were **[229]** referencing when you cited to the 2021 Hamilton article?

A Yes. I think I also refer to it in my declaration as the FIMS 2021 statement.

Q Yeah. What -- what is FIMS?

A It's the International Sports Medicine Federation. I think it's French, is why it's like Federation International Medicine Sport. That's why it becomes FIMS.

Q Uh-huh.

A Beyond that, it's just a -- it's a professional organization of people interested in sports medicine.

Q Is -- in your -- your report, you say that the statement is "signed by more than 60 sports medicine experts from prestigious institutions around the world"; is that right?

A What page is that on my declaration so I make sure I'm agreeing to a number that --

Q Sure. It's paragraph 167, which is page 56 of the PDF. And it's page 51 of the bottom pagination.

A All right. Yes, that is what I stated in my declaration.

Q Okay. So the views expressed by this body, you think, are entitled to significant weight; right? **[230]**

MR. FRAMPTON: Object to the form.

THE WITNESS: It is an -- it is a statement from an organization that is, you know, a respected organization.

BY MR. BLOCK:

Q Okay. If you turn to page 2 of this, so page 1402, at the top left, there's a little box that says "Key Points." Do you see that?

A Yes.

Q Okay. Key Points. And the first point there is (as read):

"The use of testosterone concentration limits of 5 nmol/L in transwomen and DSD women athletes is a justifiable threshold based on the best available scientific evidence."

Did I read that right?

A You read that correctly.

Q And so of the points in this article highlighted as the key points, this is the first one; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, that appears to be the first highlighted key point. **[231]**

BY MR. BLOCK:

Q Okay. But you didn't choose to mention this first key point in your report; right?

A That is correct.

Q Okay. Why not?

A I disagree with that key point.

Q Okay. So you only highlighted -- you only cited to the portions of this article that you agreed with; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: I cited the information that I agree with after evaluating the other scientific information.

BY MR. BLOCK:

Q Let's go to 1409. Do you see that?

A Yes.

Q Okay. So the third bullet point here, when we get to -- this is -- I'm sorry, under -- this whole section of bullet points is under the subsection 5.7 "FIMS Consensus Statements for the Integration of DSD Women and Transwomen Athletes into Elite Female Sport"; right?

A That is correct.

Q All right. So based on the foregoing **[232]** information discussed in the article, these are the consensus statements that FIMS agreed upon; right?

A That's a reasonable conclusion, yes.

Q Okay. So the third bullet point on the right-hand column is (as read):

"Transwomen have a (sic) right to compete in sports. However, cisgender women have the right to compete in a protected category."

Is that right?

A That's correct.

Q Okay. And this bullet point is a bullet point that you included in your report; right?

A Correct.

Q Okay. Do you know if you included any of the other bullet points in your report?

A I don't think I included any of the other bullet points.

Q Okay. So let's look at some of those other bullet points. If you go two bullet points down from the -- the one we just looked at, it says (as read):

"As each sport can vary greatly in terms of physiological demands, we support the view held also by others **[233]** stating that individual sport-governing bodies should develop their own individual policies based on broader guidelines developed on the best available scientific evidence, determined experimentally from a variety of sources with a particular preference for studies on transwomen and DSD women athletes."

Did I read that right?

A Yes.

Q Okay. So this bullet point supports having different policies developed by different sport's governing bodies; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: That is a great example of a bullet point that seems contradictory to a previous statement.

BY MR. BLOCK:

Q Okay. But this statement here does not support an across-the-board policy that applies to all differen[t] types of sports; is that right?

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: That is correct. **[234]**

BY MR. BLOCK:

Q And then two more bullet points down, it says (as read):

"The use of serum testosterone concentrations as the primary biomarker to regulate the inclusion of athletes into male and female categories is currently the most justified solution as it is supported by the available scientific literature and should be implemented at the elite level, where there is an emphasis on performance enhancement."

Did I read that right?

A Yes, you read that correctly.

Q Okay. And that's -- that's similar to the key point that we talked about before, on the second page; right?

A That is similar to that previous key point.

Q Okay. And then if you turn the page, the first full -- fir- -- excuse me -- the first full bullet point at the top, you know, again, is -- essentially restates the -- the key point that we discussed before; is that right?

MR. FRAMPTON: Same objection. **[235]** Go ahead.

THE WITNESS: Yes. That reiterates the 5 nmol/L threshold for testosterone.

BY MR. BLOCK:

Q Okay. And then the sentence also says that that threshold may be modified as new evidence arises for an event or sport-specific concentrations; is that right?

A Yes, that is what it says.

Q Okay. And so -- so that -- that bullet point and the other bullet point we looked at about the use of serum testosterone and the other bullet point about having individual policies for individual sports are bullet points that you disagreed with; right?

A That is correct.

Q Okay. And because you disagreed with them, you did not include them in your report?

MR. FRAMPTON: Object to the form. Go ahead.

THE WITNESS: That is correct.

BY MR. BLOCK:

Q Okay. But at least according to this document, the -- all the authors of this statement had agreed on those bullet points as consensus statements; right? **[236]**

MR. FRAMPTON: Object to the form.

THE WITNESS: Assuming that the authors, you know, agreed to it with their signature, that is a reasonable assumption.

BY MR. BLOCK:

Q Okay. Great. And actually -- in fact -- one second. All right. If you look at page 1403, it says -- at the bottom of that first paragraph, do you see where it says "all statements"?

A The bottom of which paragraph?

Q Sorry. On the right-hand column, on page 1403, under the "Methods" section, do you see that? The paragraph begins with -- with "here." "Here, we present."

A Yes.

Q Okay. So the last sentence -- the last two sentences say (as read):

"All statements received unanimous approval by all named authors except for the statement on the testosterone limit of 5 nmol/L, which received majority approval and the voting result is included in this (sic) article." **[237]**

Do you see that?

A Yes, I see that.

Q All right. So let's go down to what the voting results were for that. Okay. It's actually on the bullet points that we looked at before, on 1410.

A On page 1410?

Q Uh-huh.

A All right.

Q Okay. So beginning with -- so the first -- the second full bullet point, it says (as read):

"The statement on the testosterone concentration threshold for transwomen and DSD women athletes was the only point of contention for the FIMS Panel. All 70 authors voted, of whom 87% were in favour of the 5 nmol/L threshold, 2% of the authors were in favour of a threshold of 8 nmol/L, 2% were in favour of a threshold around the upper testosterone concentration of normal healthy females of 0.2-1.7 nmol/L, and 8% of authors were in favour of no change to the limit until further evidence was acquired." **[238]**

Do you see that?

A Yes, I see that.

Q Okay. So -- so based on this paragraph, it appears that none of the 70 authors supported a policy of prohibiting trans women from participating, you know, regardless of how low they suppressed their circulating testosterone levels; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: Can you restate the question?

BY MR. BLOCK:

Q Sure. Did any of the 70 au- -- 70 authors vote in favor of prohibiting trans women completely from prohibiting -- from -- from participating in women's sports regardless of how low they – they lowered their levels of circulating testosterone?

MR. FRAMPTON: Same objection.

THE WITNESS: I would really like to read the article more and not just look at this particular statement on their decision on what they thought were acceptable testosterone levels.

BY MR. BLOCK:

Q Okay. But based on this paragraph, it appears that none of the 70 authors supported a policy analogous to H.B. 3293; right?

MR. FRAMPTON: Same objection.**[239]**

THE WITNESS: And this is another example of something that is confusing and contradictory to me, is when they say that cisgender women deserve a protected category and then have this kind of a statement.

BY MR. BLOCK:

Q Well, isn't one way to reconcile it that it's possible to have a protected category for cisgender women if appropriate conditions are placed on the participation of trans women?

MR. FRAMPTON: Object to the form.

THE WITNESS: My understanding of the

intention of the authors is then it would no longer be a protected category.

BY MR. BLOCK:

Q Well, it would be protected from participation by cisgender men or anyone else with circulating levels of testosterone over the threshold limit; right?

MR. FRAMPTON: Same objection.

THE WITNESS: Within the -- the field, a protected category of women typically means biological women.

BY MR. BLOCK:

Q Okay. Let's look at the next document. All right. And, actually, we already marked this one as an exhibit. This is the women's policy **[240]** briefing book. So this is Exhibit 69, if you could pull it up again.

A All right. Women's Sports Policy Working Group, Briefing Book?

Q Yes. All right. If you look at page 15.

A All right. Page 15.

Q So at the -- the top, you can see this is their Proposed Amendment to the Title IX Regulations. Do you see that?

A Yes.

Q Okay. So if we scroll down to subsection C, Treatment of Transgender Athletes, do you see that?

A Yes.

Q Okay. So -- so subsection (c)(1) says (as read):

[“]Because trans girls/women who have not begun male puberty do not have significant male linked – male sex-linked advantages, they shall be included in girls’ and women’s sports without conditions or limitations.[”]

Do you see that?

A I see that.

Q All right. So to the extent that H.B. 3293 **[241]** prohibits trans girls and women from participating in women’s sports, even if they have not experienced endogenous male puberty, the authors of this briefing book would disagree with H.B. 3293, to that extent?

MR. FRAMPTON: Object to the form.

THE WITNESS: I don’t think that I can speak on behalf of these authors for what they agree or disagree with regarding H.B. 323 (sic) -- whatever it is. Sorry.

BY MR. BLOCK:

Q Okay. So do you think that subsection (c)(1) is consistent with H.B. 3293?

MR. FRAMPTON: Object to the form.

THE WITNESS: Well, (c)(1) says they shall be included in girls and women's sports.

BY MR. BLOCK:

Q So the answer to my question is yes?

MR. FRAMPTON: Object to the form.

BY MR. BLOCK:

Q I mean -- no, I'll just ask that again. Can you just give me a "yes" or "no" answer so I don't have to worry about getting a clean transcript? So just -- my question is, is section (c)(1) consistent with H.B. 3293?

MR. FRAMPTON: Same objection. **[242]** Go ahead.

THE WITNESS: I think there is an inconsistency there.

BY MR. BLOCK:

Q Okay. Thank you. If you look at section (c)(3), it says (as read):

"Trans girls/women who have experienced all or part of male puberty and who have sufficiently mitigated their male sex-linked advantages — through surgery and/or gender affirming hormones consistent with the rules of their international federations — may participate in girls'/women's sport without additional conditions or limitations."

Do you see that?

A I see that.

Q Okay. And so section (c)(3) is also inconsistent with H.B. 3293; correct?

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: I would say that it may or may not, apparently depending on the rules of the **[243]** international federations.

BY MR. BLOCK:

Q Okay. So are there any international federations, aside from rugby, that categorically exclude girls and women who are transgender from participating in the female category?

A There have been a lot of changes in those lately and a lot of organizations debating that, and so I can't say for certain whether there is or is not an organization or no organizations that specifically state that.

Q But you consider yourself an expert on this issue, don't you?

A Yes. And there's a[] lot of organizations that are in process of making decisions, and so I can't say what their decisions are when they have not released their decisions.

Q All right. Well, has any organization released a decision excluding trans girls and women from participating in the female category, even if they have lowered their circulating testosterone, besides rugby?

A I know swimming had a recent change, and I can't remember the exact wording on that, and -- again, that's what I can remember right now at this moment. **[244]**

Q All right. Does -- did the recent change from swimming categorically exclude trans girls and women from participating in women's swimming events?

MR. FRAMPTON: Objection to the form.

THE WITNESS: I would need to look at the document to be sure.

BY MR. BLOCK:

Q Isn't it true that the new swimming policy extended the period of hormone suppression to three years? Does that sound familiar to you?

A As you say it, it sounds familiar, but I can't be sure if I'm remembering it because you told me I should remember it.

Q Okay. Well, we'll -- we'll get you a -- a copy of that. And then subsection (4) says (as read):

"Trans girls/women who have experienced all or part of male puberty and who have not, or only insufficiently, mitigated their male sex-linked advantages according to the international federation standards in their sport may be accommodated within girls'/women's sports but not in head-to-head competition with female **[245]** athletes."

Do you see that?

A I see that.

Q Okay. And so that also is inconsistent with H.B. 3293; correct?

MR. FRAMPTON: Object to the form.

THE WITNESS: This is somewhat of a confusing statement because how is somehow included in women's sports if they're not competing head-to-head with women.

BY MR. BLOCK:

Q Well, there's scrimmages and, you know, team practices and other events that are not for trophies. Those are some examples; right?

A And I would ask, are they really included, then, if they can only participate in limited aspects of the sport.

Q Okay. But my question is whether or not this is consistent with H.B. 3293. And so section (c)(4) is inconsistent with H.B. 3293; correct?

MR. FRAMPTON: Object to the form.

THE WITNESS: I would need to refer back to the bill to be certain, but I think that your statement is, yes, this is an inconsistency. **[246]**

BY MR. BLOCK:

Q Okay. Let's go back to your report. So that's Exhibit -- oh, I'm sorry, I just want to make sure we got through all of the sources cited in that paragraph of your report. So let me -- let's turn to your report and just make sure we've -- we've looked at all of them because I don't want to leave any out. I believe – is this on page 8? Or paragraph 8? It's paragraph 8, I believe. On page 7, paragraph 8. Let me know when you're there.

A I'm there.

Q Okay. So we looked at Coleman 2020; correct?

A Yes.

Q And Hilton and Lundberg 2021; correct?

A Yes.

Q And World Rugby?

A Yes.

Q And Harper 2021?

A Yes.

Q And Hamilton 2021?

A Yes.

Q And a briefing book prepared by the Women's Sports Policy Working Group 2021; right?

A Yes. **[247]**

Q Okay. So now that we've looked at all of those, do any of them advocate in favor of excluding girls and women who are trans from participating in women's sports if they have had puberty blockers and not gone through endogenous puberty?

MR. FRAMPTON: Object to the form. Go ahead.

THE WITNESS: I still think that that statement from Hamilton, where they say women deserve a protected category, with the understanding that protected category, as it is used in the field, means biological women only.

BY MR. BLOCK:

Q Okay. But other portions of the -- the Hamilton statement don't support that; correct?

A Correct.

Q Okay. So after reviewing all these sources, let's see, how -- how many of them do we think support excluding girls and women who are transgender if they've experienced puberty and then suppressed their testosterone?

MR. FRAMPTON: Object to the form.

THE WITNESS: So as we've reviewed these sitting here, I would say Hamilton supports it, with the caveat that it is, at times, contradictory. **[248]**

BY MR. BLOCK:

Q Okay. And did any of these sources support having a single across-the-board rule that applied to all sporting events?

MR. FRAMPTON: Object to the form.

THE WITNESS: Again, the same statement with Hamilton seems to state that, with the caveat that, I guess, you and I can agree there is some contradiction or confusion there.

BY MR. BLOCK:

Q Okay. Let's look at page 4 of your report.

A All right. Page 4, Overview.

Q Yes. If you look at the second bullet point.

A Okay.

Q It says (as read):

"Biological male physiology is the basis for the performance advantage that men, adolescent boys, or male children have over women, adolescent girls, or female children in almost all athletic events."

Did I read that right?

A Yes, you read that correctly.

Q Okay. And so your expert opinions about transgender women are based on the premise that **[249]** transgender women who have not had any gender affirming medical interventions will have the same physiology as cisgender men; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, they are still biological males.

BY MR. BLOCK:

Q And will have the same physiological characteristics that are the basis for the performance advantage; correct?

MR. FRAMPTON: Same objection.

THE WITNESS: That is correct. Male physiology is the basis of the performance advantage.

BY MR. BLOCK:

Q So let's go back to that Hamilton article we were discussing. So that is, I believe, Exhibit 79.

A All right.

Q Okay. Can you go to page 1402, please.

A All right. 1402.

Q Okay. Pull that up. If you look on the right-hand column, on this little table 1 --

A Yes.

Q -- do you see that? And then you go -- one, two, three, four -- **[250]** five items down there, there's a line that begins with "the assumption." Do you see that?

A I do see that.

Q Okay. And that sentence says (as read):

"The assumption that the physiology of elite DSD women and transwomen athletes is the same as elite male athletes is an oversimplified view."

Do you see that?

A I see that statement.

Q Okay. And you didn't cite to that statement in your report; right?

A I disagree with that statement.

Q And, therefore, because you disagreed with it, you chose not to cite it in your report?

MR. FRAMPTON: Object to the form.

THE WITNESS: I don't think it's appropriate to cite a statement that I don't think I can defend.

BY MR. BLOCK:

Q Okay. Do you think it's appropriate to cite an article who -- that contains many statements that -- that you don't think you can defend?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes. Trying to cite that there **[251]** is a lot of information out there.

BY MR. BLOCK:

Q I see. If we go to page 1406 -- well, actually, before going there, were you aware of this statement in the Hamilton article at the time that you wrote your report?

A Yes. I cited the Hamilton article. I had read it.

Q All right. You -- okay. So you read the whole thing, and then you picked out certain statements to cite?

A Correct.

Q Okay. So if you go to page 1406. Do you -- do you see your role in this case as an advocate for one side or the other?

MR. FRAMPTON: Object to the form.

THE WITNESS: I have been retained to give my expert opinion, my expert analysis of the data.

BY MR. BLOCK:

Q All right. And to -- but do -- do you see your role in this case as presenting the portions of the data that support one side?

MR. FRAMPTON: Object to the form.

THE WITNESS: I think my role is to present **[252]** the data and the information with which I agree with as an expert.

BY MR. BLOCK:

Q Okay. So you -- you don't see your role in this case as prevent- -- presenting an overview of the data for and against H.B. 3293; right?

MR. TRYON: Objection.

MR. FRAMPTON: Object to form.

THE WITNESS: I think I'm suppo- -- my role is presenting the information from the best of my expertise and analysis of it, which -- what I think is the correct information.

BY MR. BLOCK:

Q Okay. Not -- so -- so you don't think -- if

the Court wanted just an overview of the information out there for and against H.B. 3293, your expert report wouldn't be the source of getting that; right?

MR. FRAMPTON: Object to the form.

MR. TRYON: Objection.

THE WITNESS: I would think that would be a specific request made by the Court to get information.

BY MR. BLOCK:

Q So -- but you saw -- but you said, when you wrote your blog post, that, you know, the purpose of that blog post was to provide information for educators **[253]** to use on their own, to teach the subject; right?

A That is correct.

Q Okay. And so you wrote that blog post with a different purpose in mind than you wrote this document; right?

A Yes. The blog post was intended for educators.

Q And do you think that it's important for educators to have accurate information?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, educators need accurate information.

BY MR. BLOCK:

Q Okay. So do -- do you think educators need information different from what the court needs?

MR. FRAMPTON: Object to the form.

THE WITNESS: Truthful information is truthful information, and I've done my best to present truthful information.

BY MR. BLOCK:

Q Okay. So let's go to 1406 of -- of Hamilton.

MR. TRYON: Before you go on. Mr. Frampton, I can't hear you when you're objecting. If you could speak a little louder, please.

MR. FRAMPTON: Sure. **[254]**

BY MR. BLOCK:

Q So in -- in 1406, in the paragraph beginning with the words "despite the lack," do you see that?

A Page 1406?

Q Left -- left-hand column --

A Okay. Yeah. That's three down?

Q Yes.

A Okay.

Q Okay. If you look at, I think, the third sentence, says (as after it says "Table 1," in parentheses, read):

"Data showing lower baseline isometric torque and muscle volume in transwomen compared to cisgender males highlight the problematic nature of inferring that transwomen and cisgender males are the same, as this ignores the impact of gender-affirming treatments such as HRT and GAS and the psychological effects of gender dysphoria such as low self-esteem, anxiety and/or depression, and becoming socially isolated."

Do you see that?

A I see that. **[255]**

Q Okay. Do you disagree that there is data showing lower baseline isometric torque and muscle volume for trans women compared to cisgender women?

A So if I'm remembering correctly, reference here is probably to the -- the article by Wiik and Lundberg and others. That is the only paper I'm aware of that evaluated isometric torque and muscle volume in transgender individuals. Can I refer to that paper to verify?

Q Yeah. If you look at 51, it -- it does go back to the -- the Wiik article. You're saying you want to look directly at the Wiik article?

A I would like to.

Q All right. Well, we can try to make time for that later. So -- but sitting here, you're saying you're not sure that that sentence accurately reports the -- the findings of the Wiik article?

A Yeah, I can't remember for -- right now what the baseline data were in the Wiik article, whether they were statistically significant or just numerically different or what.

Q Okay.

A I can see the graph in my mind, but not in **[256]** enough detail to completely answer that.

Q Okay. Hold on one second. All right. Let's go to the Harper article again. So that is Exhibit 78.

A All right.

Q So if you go to page 7 of the Harper.

A All right.

Q All right. There's a paragraph that begins with "of interest." Do you see that?

A Right-hand side, first full paragraph, under the table?

Q Yes.

A Okay.

Q All right. Where it says (as read):

"Of interest, compared with cisgender men, hormone-naive transwomen demonstrate 6.4%-8.0% lower lean body mass, 6.0%-11.4% lower muscle CSA and approximately 10%-14% lower handgrip strength."

Do you see that?

A Yes.

Q And then it says (as read):

"This disparity is noteworthy given **[257]** that hormone-naive transwomen and cisgender men have similar testosterone levels."

Do you see that?

A Yes.

Q Okay. So do you have any reason to disagree with those reported findings?

A I would like to include the next sentence, where it says "explanations for this strength difference are unclear," and continuing on with that, indicating that the trans women may actively refrain from building muscle and/or engaging in disordered eating. So there's a whole statement of speculative explanations for that.

Q So do you -- do you have any explanations for those differences?

A Well, we have no known biological markers in which we can draw blood or a sample of something to say that a person is transgender. And so it would apparently be a social explanation for why the transgender individuals have lower handgrip strength and smaller muscles.

Q Okay. And so does that -- does that affect whether or not having lower handgrip strength and **[258]** stronger (sic) muscles gives an advantage in athletic performance?

MR. FRAMPTON: Object to the form. Go ahead.

THE WITNESS: In those cited studies, the handgrip strength of the trans women was in the 90 to 95th percentile for cisgender women. So while they may be slightly less strong than a typical male, they are considerably stronger than the typical female.

Q Okay. Right. But my -- but my question is, in terms of comparing the strength of trans women to the strength of cis men, don't those studies show that, with respect to those indicators of athletic performance, the trans women are not the same as the cis men?

MR. FRAMPTON: Object to the form.

THE WITNESS: So, Mr. Block, are you trying to say that smaller, weaker men are trans women?

BY MR. BLOCK:

Q I'm -- I'm asking my question. Can you answer my question, please?

A Could you please clarify the question?

Q Yes. Don't those -- doesn't that data show that -- **[259]** to use the words of Harper -- hormone-naïve trans women may not, on average, have the same athletic attributes as cisgender men?

MR. FRAMPTON: Object to the form. Go ahead.

THE WITNESS: I think there are a whole lot of qualifying statements that need to be included in that.

BY MR. BLOCK:

Q Okay. And so putting aside the cause of these differences, putting aside whether those causes are, you know, physiological or as a result of social factors, all right, at the end of the day, regardless of the cause, doesn't this data reflect that on a population level, hormone-naive trans women may not, on average, have the same athletic attributes as cisgender men?

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: Those studies were not attempting to evaluate baseline population-wide strength for trans women, and so I don't think that we can accurately extrapolate them to the population of trans women.

BY MR. BLOCK:

Q Okay. If the participa- -- in the **[260]** participants on -- in those studies had performed physical fitness tests alongside cisgender men, would it be reasonable to assume that the participants in these studies would not have performed as well on those physical fitness tests?

MR. FRAMPTON: Object to form.

THE WITNESS: So if we are stating these participants, yes, these participants were not as strong as their comparison group. But I do again want to caveat that neither of these groups really were designed to represent population-wide strength or body mass distributions.

BY MR. BLOCK:

Q Now, you've discussed in your article -- or your article -- you've discussed in your report, you know, your view that once you have acquired muscle mass, that lowering your circulating testosterone does not sufficiently reduce that muscle mass to eliminate a performance advantage; is that right?

A I think you've appropriately characterized what I've stated.

Q Thank you. And so in your article, do -- or in your report, do you discuss at all whether if someone lowers their circulating testosterone before acquiring a lot **[261]** of muscle mass or doing exercises or training, whether having a lower level of testosterone would restrict their ability to add new muscle mass?

MR. FRAMPTON: Object to the form.

THE WITNESS: I don't think I addressed that topic specifically, as far as how much reducing testosterone and then engaging in training can compensate for reduced testosterone.

BY MR. BLOCK:

Q Okay. So let's say the -- the trans women in this study and the cis men in the study both engage in the same types of exercise regimens, but the trans women, given their lower baselines and -- have these lower baselines and have lowered their testosterone before engaging in these exercise regimens, is it – do you have an expert opinion on whether you would expect that these trans women, having lowered their testosterone levels, would be able to acquire new muscle mass at the same degree as the cis men who had not lowered their testosterone levels?

MR. FRAMPTON: Object to the form.

THE WITNESS: Based on research not cited in my article, because I didn't think it was worth going into in that particular publication -- or that expert declaration, there is information that in middle-aged **[262]** men who suppress their testosterone and such as a treatment for prostate health problems, they're able to engage in strength training to overcome the lost testosterone. And so that is the closest to a speculative statement we can make regarding of how transgender women, or trans women, would respond to training.

BY MR. BLOCK:

Q Okay. If we go back to the Hamilton article for a second. I apologize. If you go to 1407 of the Hamilton article. Let me know when you're there, okay?

A All right. 1407. I'm there.

Q Uh-huh. It says -- halfway through the -- the first paragraph there, there's a sentence that begins "in contrast." Do you see that?

A Page 1407. Are we on the left-hand side?

Q I'm sorry, on the right-hand side.

A Ah, okay. I wondered. There we go. Right-hand side, just after citation to 61, it says, "In contrast."

Q Right. It says (as read):

"In contrast, when bioavailable testosterone was reduced to castrate **[263]** levels in young men, isometric strength did not increase after resistance exercise training."

Are you familiar with that study that -- that's being referred to?

A I am not familiar with that study.

Q Okay. If you look at footnote 62 of the article, it says it's a study by Kvorning, K-V-O-R-N-I-N-G, from 2006. Just sitting here today, does -- are you familiar with the Kvorning study from 2006?

A That -- that study is not ringing a bell.

Q Okay. Okay. The -- the name of the study is "Suppression of endogenous testosterone production attenuates the response to strength training: a randomized, placebo-controlled, and blinded intervention study." Still doesn't ring a bell?

A Still not ringing a bell.

Q Okay. So if -- if -- from the title of that study, does the study seem to be in tension with the study you just cited to me about how people, the cisgender men, who are on therapies that lower their tosterone -- testosterone being able to have strength **[264]** training to overcome the deficit?

MR. FRAMPTON: Object to the form.

THE WITNESS: Looking at that study and the study I was referring to, it appears that the two are somewhat contradictory, but it's also hard to say with this saying young men and the older -- the other one was dealing with older men. Without looking at both studies side by side, it's really hard to make a comparison.

BY MR. BLOCK:

Q Okay. So in the -- in the Hamilton article, after the sentence I read, it says (as read):

"Assuming these findings are replicated and if extrapolated to elite DSD women athletes and transwomen athletes, they would imply that decreasing bioavailable testosterone concentrations would mitigate to some extent any previous sporting advantage due to the previously high testosterone concentrations."

Do you agree with that sentence?

MR. FRAMPTON: Object to the form.

THE WITNESS: Would mitigate to some extent, **[265]** yes.

BY MR. BLOCK:

Q Okay.

MR. BLOCK: Can we take a break and go off the record?

THE VIDEOGRAPHER: We are off -- off the record at 3:33 p.m.

(Recess.)

THE VIDEOGRAPHER: We are on the record at 3:43 p.m.

BY MR. BLOCK:

Q Hi, Dr. Brown. I -- I won't keep you too much longer, but -- but I do have some -- I'm going to keep you a little bit longer, though. If --

A No worries.

Q If we could go to the Hilton article again, which is marked as Exhibit -- I can't see it on my computer. One sec. The Hilton article is Exhibit 76.

A All right.

Q All right. Thanks. If you look at page 208, under 4.3.

A Yes.

Q All right. Just the second sentence there, it says (as read): **[266]**

"Sex differences in endurance performance are generally smaller than for events relying more on muscle mass and explosive strength."

Do you see that?

A Yes, I see that.

Q Okay. Do you -- do you agree with that statement?

A Typically, the differences between males and females for endurance running events or swimming events are somewhere in the range of 10 to 13 percent compared to the 25 percent or more in strength sports.

Q So -- so that means you agree with that statement?

A Yes.

Q Okay. Thanks. All right. If you look at, again, 208, it says -- the paragraph before 4.3.

A That big long one?

Q Yep. And near -- like two-thirds down, there's a sentence that begins with "furthermore." Do you see that?

A Okay. Furthermore, given the (sic) cohorts?

Q Yeah. So I -- I just want to direct your **[267]** attention to the first half of the sentence. This is the Hilton article. And it says (as read):

"Furthermore, given that cohorts of transgender women often have slightly lower baseline measurements of muscle and strength than control males."

Do you see that?

A Yes.

Q Okay. And then if you follow that footnote, it goes to footnote 53, and there's an article by someone whose name I can't pronounce. It's Van C-A-E-N-E-G-E-M. Are you able to click through to footnote 53?

A Can we agree to call that Van C?

Q Oh, good -- good call. Yes.

A Yeah, I don't know how to say the last name either.

Q Okay. All right. And so could you -- you see the footnote?

A Yes.

Q Okay. And the footnote is to an article that says, "Preservation of volumetric bone density and geometry in trans women during cross-sex hormonal therapy: a prospective observational study"; right?

A Yes. **[268]**

Q Okay. And so Hilton cites this article for the proposition that -- I have to get -- I don't want to misquote her. Hold on -- it says -- cites for the proposition that cohorts of transgender women often have slightly lower baseline measurements of muscle and strength than control males; right?

A Yes, that is what it says.

Q Okay. And so that's a sim- -- that's similar to the statement in the Hamilton article; right?

MR. FRAMPTON: Object to the form.

THE WITNESS: I'm sorry, can we go back to what the Hamilton article says, or could you --

BY MR. BLOCK:

Q Sorry, I'm -- I just want to -- you know, we looked at two sources that talk about how the baseline measurements of trans women are not always the same as the baseline measurements of control cis men. And we looked at two studies saying that, one was the Hamilton study and one was the Harper study. And all I want to do is add this study as -- this article as a third article making that observation. Would you agree that this article is another article that at least makes the observation that the baseline measurements for trans women appear to often be lower than the baseline measurements for cisgender **[269]** men who are used as controls?

MR. FRAMPTON: Object to the form.

THE WITNESS: I -- I think in this article by Hilton, a couple of key points here is where it says "cohorts of transgender women," not saying population representative sampling or anything like that. And then there's a lot of further qualifications that you go on in that sentence emphasizing caution with interpreting these data.

BY MR. BLOCK:

Q Yeah. Well, so, actually, I have a question for you. So you talk about how these are just cohorts of trans women, not population samples, but you cite to these same articles in support of your argument that --about the effects of gender-affirming hormones, don't you?

A Yes, I cite these articles.

Q Okay. So how come -- can't the same caveat be made that whatever conclusions you're drawing about trans women from these articles don't necessarily apply to trans women at a population level?

MR. FRAMPTON: Object to the form.

THE WITNESS: These are the best sources of information that we have, and the studies looking at **[270]** changes over time or changes in strength, muscle mass and such that I've cited, that was the purpose of the study, was to evaluate those changes and then statistically apply it to a population whereas those studies were not designed to get a population baseline sampling for normative data.

BY MR. BLOCK:

Q Okay. Well, that -- I'm glad you made that point because -- let's go to -- to your expert report where -- on page -- on page -- let me make sure I have the right page. So page 2 -- actually, go to page 1, so I'm not missing anything. Let me know when you're at page 1.

A So is page 1 Personal Qualifications and Disclosure?

Q It is.

A Okay.

Q So right before the bullet points, you say (as read):

"Articles that I have published that are closely related to topics that I discuss in this white paper include..."

And then there's a list. Right? **[271]**

A Yes.

Q And -- and then if you go to the -- the second to last bullet point.

A Yes.

Q Do you see that? That says (as read):

"A study finding (among other things) that height, body mass, and maximal oxygen consumption were higher in a group of male NCAA Division 2 distance runners, while women NCAA Division 2 distance runners had higher percent body fat."

Do you see that?

A Yes.

Q Okay. And we discussed this study during our previous deposition. Do you remember that?

A Yeah. It's a fun paper.

Q Yeah. But we discussed how this data about height, body mass and oxygen consumption was base- - was data -- baseline data that you took of -- of these athletes, but the purpose of the study was not to do a population-wide, you know, sampling of -- of height, body mass and oxygen consumption; right?

A Yes, that is correct. **[272]**

Q Okay. So -- so what you just said before, when we were talking about the -- the cohorts of trans women, you had said, well, the purpose of those studies was not to provide population sampling on, you know, the physiological characteristics of -- of the trans women in the study; therefore, you couldn't extrapolate that as a general matter, all trans women were likely to have similar characteristics. Is that – is that a fair summary of what you had just said?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, that is a fair summary.

BY MR. BLOCK:

Q But in your description of your study here, do you think a reader, reading that sentence, would think that you are making the statement that as a general matter, on a population-wide basis, you found in your study that height, body mass and mox – maximal oxygen consumption were higher for the male NCAA competitors compared to female NCAA competitors?

MR. FRAMPTON: Object to the form.

THE WITNESS: I'm kind of unclear with what you're trying to ask.

BY MR. BLOCK:

Q Yeah, so I'm saying that this happened to be **[273]** the data for a particular cohort that you're doing a different study on; correct?

MR. FRAMPTON: Object to the form.

THE WITNESS: So, yes, as I've stated, this is a group of male and female Division II distance runners.

BY MR. BLOCK:

Q Okay. And so that study wouldn't allow you to draw any conclusions generalizable to other males and females about, you know, what their comparative height, body mass and oxygen consumption would be; right?

MR. FRAMPTON: Same objection.

THE WITNESS: I don't think I've ever purported that that was the purpose of this study.

BY MR. BLOCK:

Q You don't think that someone reading that sentence, where it says the study -- a study finding these things, you don't think someone reading that sentence would have the impression that that was the purpose of the study?

MR. FRAMPTON: Object to the form.

THE WITNESS: Those were findings of the study. That's what I have states, is those are findings of the study. **[274]**

BY MR. BLOCK:

Q Was the rest of the -- is the rest of the study relevant to the topic of this case?

A You mean is that the male athletes were faster than the female athletes?

Q I mean -- what -- what I mean is you -- you --you select this finding from the study, but were any other findings from that study relevant to this case?

A Yes, we could say that. For the same heart rate, the men were faster than the women.

Q Okay. Okay. Let's go to -- to page 4.

A On my declaration?

Q Yeah. Or your report.

A Yeah, just make sure we're on the same -- so this is the overview?

Q Yes. And I just want to direct your attention to the three bullet points that you've listed there. Do you see them?

A Yes, I do.

Q Okay. Are you offering any expert opinions in this case other than the opinions contained in those three bullet points?

MR. FRAMPTON: Object to the form.

THE WITNESS: Well, I -- I mean, those are the basis for everything else, those three bullet points, **[275]** and most of the other information is trying to support and substantiate why I drew those conclusions.

BY MR. BLOCK:

Q Okay. So -- but there are no -- I appreciate that. There's -- you're not offering an opinions on any other issue, are you?

MR. FRAMPTON: Object to the form.

THE WITNESS: Kind of unclear what you're asking. I think it states there fairly clearly what I'm -- the -- the statements I'm trying to make.

BY MR. BLOCK:

Q Yeah, I'm just trying to nail down the full scope of the expert opinions you're offering here. And so you're not offering any expert opinions on the appropriateness of particular modes of healthcare for trans people; is that right?

A That is correct, I'm not offering an opinion on healthcare for transgender individuals.

Q Okay. And you are not -- you discuss these bullet points, what you say are advantages, but you are not offering an opinions on whether particular policies are fair or unfair in light of the data that you present here, are you? **[276]**

MR. FRAMPTON: Object to the form and scope. Go ahead.

THE WITNESS: So I think this comes back to our previous discussion where we discuss the irreconcilable differences between inclusion and fairness.

BY MR. BLOCK:

Q Yes, it does, which is why I'm coming back to it. So I -- I -- you know, I understand that, you know, you have laid out your criteria, your – excuse me -- your credentials for proving -- for providing an expert opinion on whether an advantage exists, and so I -- I -- I just want to find out whether or not, you know, the -- in light of that information you present regarding the existence or nonexistence of an advantage, whether a particular policy maker will then decide that something is fair or unfair, is not -- is not something that you are providing an expert opinion on; right?

MR. FRAMPTON: Same objection. Go ahead.

THE WITNESS: So I'm trying to detail the advantages, the differences between males and females biologically, documenting the advantages in athletic **[277]** performance the males have over female, documenting what we know regarding transgender individuals and their -- the treatments that they might receive and how that would affect athletic advantages, and then bringing up the point that there is, apparently, some irreconcilable differences -- I'm not sure if that's the best way to state it, but I state it in the document -- between goals of inclusion and fairness.

BY MR. BLOCK:

Q Yeah, I guess -- someone reading your report -- you know, let's say someone reads all the information in the report, absorbs all the facts, you know, and then, you know, is asked, based on all the facts presented in your report, is it fair to include trans girls and women or not to include them, would you have any greater expertise in answering that ultimate question than anyone else who has absorbed the facts you presented in your report?

MR. FRAMPTON: Object to the form.

THE WITNESS: Are you saying does every piece of knowledge I've ever written put on -- on this document and someone would know everything that I know?

BY MR. BLOCK:

Q No. I'm saying that based on these facts, you know, someone needs to draw a conclusion about what's **[278]** fair, okay? And so my question is – you know, I understand that you're providing an expert --you know, opinions on the -- the -- the -- the facts you say in your report. All my question is that, you know, the second step of drawing a conclusion about what's fair or unfair is not something that you are an expert on; right?

MR. FRAMPTON: Object to the form. Go ahead.

THE WITNESS: I would hope that someone would read my document, and they're also going to read the document from the other experts, weigh the evidence and make a decision on what is -- what is fair.

BY MR. BLOCK:

Q And -- and you are not offering, you know, that decision, that ultimate decision, as part of your expert report; right? That's for someone else to decide?

MR. FRAMPTON: Object to the form.

THE WITNESS: Yes, that is my intention, is that someone else will weigh the information, weigh the data and make their decision.

MR. BLOCK: All right. Thank you, Dr. Brown. I have no further questions.

MR. FRAMPTON: Anyone else? **[279]**

MS. GREEN: This is Roberta Green on behalf of WVSSAC. No questions.

THE VIDEOGRAPHER: Can we go off the record, Attorney Block?

MR. BLOCK: Sure. Unless anyone else wants to say on the record that they don't have any other questions.

MR. CROPP: This is Jeffrey Cropp with Harrison County Board of Education and Dora Stutler. I have no question[s].

MR TAYLOR: Michael Taylor on behalf of the State BOE and Superintendent Burch. No questions.

MR. TRYON: Dave Tryon. No questions.

MR. FRAMPTON: Hal Frampton for the intervenor. No questions. It sounds like we're done.

MR. BLOCK: See you in another two years, Dr. Brown.

(Simultaneous speaking.)

MS. DUPHILY: Hold on. Let's take this off the record. One second.

VIDEOGRAPHER: We are off the record at 4:03 p.m., and this concludes today's testimony given by Gregory Brown.

I, GREGORY BROWN, Ph.D., do hereby declare under penalty of perjury that I have read the foregoing transcript; that I have made any corrections as appear noted, in ink, initialed by me, or attached hereto; that my testimony as contained herein, as corrected, is true and correct.

Executed this 9 day of May, 2022, at Kearney, Nebraska.

/s/ Gregory A. Brown
Gregory Brown, Ph.D.

Volume I

B.P.J v. WEST VIRGINIA STATE BOARD OF EDUCATION

GREGORY BROWN, Ph.D. (#5122856)

ERRATA SHEET

Page: 29 Line: 23 Change: The word “interest” should be “interested”

Reason: This more accurately reflects what was said

Page: 85 Line: 13 & 16 Change: McManis should be spelled McManus

Reason: Correct Spelling

Page: 151 Line: 10 Change: Change “a third” to “two thirds”

Reason: This more accurately reflects what was said

Page: 157 Line: 7 Change: change to “… yes, as to the first part of the question. And as to the second part I would say it’s fair to say that I don’t cite Klaver in percent body fat

Reason: Clarifying my answers to a two part questions

Page: 163 Line: 19 Change: Change text to “… group. And I recent published in Advances in …”

Reason: This more accurately reflects what was said

Page: 163 Line: 8 Change: The word “peacock” should be “PECOP”

Reason: PECOP is the correct title

/s/ Gregg a. Brown	May 9, 2022
WITNESS	Date

B.P.J v. WEST VIRGINIA STATE BOARD OF EDUCATION

GREGORY BROWN, Ph.D. (#5122856)

ERRATA SHEET

Page: 191 Line: 13 Change: change “Higgard” to Higerd”

Reason: Correct Spelling

Page: 245 Line: 8 Change: change “somehow” to “someone”

Reason: this more accurately reflects what was said

Page: 273 Line: 23 Change: change “states” to “stated”

Reason: this more accurately reflects what was said

/s/ Gregg a. Brown	May 9, 2022
WITNESS	Date

IN THE UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA

CHARLESTON DIVISION

B. P. J., et al.,

Plaintiffs,

v. CIVIL ACTION NO. 2:21-cv-00316

WEST VIRGINIA STATE BOARD OF EDUCATION, et al.,

Defendants,

and

LAINEY ARMISTEAD,

Defendant-Intervenor.

DECLARATION OF DR. CHAD T. CARLSON, M.D., FACSM

I, Dr. Chad T. Carlson, pursuant to 28 U.S. Code § 1746, declare under penalty of perjury under the laws of the United States of America that the facts contained in my Expert Report of Dr. Chad T. Carlson, M.D., FACM prepared for *B.P.J. v. West Virginia,* attached hereto, are true and correct to the best of my knowledge and belief, and that the opinions expressed therein represent my own expert opinions.

Executed on February 23, 2022.

/s/ Chad T. Carlson MD
Chad T. Carlson MD

Expert Report of Dr. Chad Thomas Carlson, M.D., FACM prepared for *B.P.J. v. West Virginia* February 23, 2022

INTRODUCTION

Up to the present, the great majority of news, debate, and even scholarship about transgender participation in female athletics has focused on track and field events and athletes, and the debate has largely concerned questions of fairness and inclusion. However, the transgender eligibility policies of many high school athletic associations in the United States apply with equal force to all sports, including sports in which players frequently collide with each other, or can be forcefully struck by balls or equipment such as hockey or lacrosse sticks. And in fact, biologically male transgender athletes have competed in a wide range of high school, collegiate, and professional girls' or women's sports, including, at least, basketball,[1] soccer,[2] volleyball,[3] softbal,[4] lacrosse,[5] and even women's tackle football.[6]

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[1]https://www.espn.com/espnw/athletes-life/story/Jid/10170842/espnw-gabrielle-ludwig-52-year-old-transgender-women-college-basketball-player-enjoying-best-year-life (accessed 2/17/22)

[2] https://www.unionleader.com/news/education/nh-bill-limits-women-s-sports-to-girls-bornfemale/articled1998eal-a1b9-5ba4-a48d-51a2aa01b910.html; https://www.outsports.com/2020/1/17/21069390/womens-soccer-mara-gomez-transgenderplayer-argentina-primera-division-villa-san-marcos (accessed 6/20/21)

[3]https://news.ucsc.edu/2016/09/challenging-assumptions.html (accessed 6/20/21); https://www.outsports.com/2017/3/20/14987924/trans-athlete-volleyball-tia-thompson (accessed 6/20/21)

[4]https://www.foxnews.com/us/californias-transgender-law-allows-male-high-schooler-to-makegirls-softball-team (accessed 6/20/21)

[5]https://savewomenssports.com/f/emilysstory?blogcategory=Our+Stories (accessed 6/20/21)

[6]https://www.outsports.com/2017/12/13/16748322/britney-stinson-trans-football-baseb all (accessed 6/20/21); https://www.mprnews.org/story/2018/12/22/transgender-football-playerprevails-in-lawsuit (accessed 6/20/21)

The science of sex-specific differences in physiology, intersecting with the physics of sports injury, leaves little doubt that participation by biological males in these types of girls' or women's sports, based on gender identity, creates significant additional risk of injury for the biologically female participants competing alongside these transgender athletes.

In 2020, after an extensive review of the scientific literature, consultation with experts, and modeling of expected injuries, World Rugby published revised rules governing transgender participation, along with a detailed explanation of how the new policy was supported by current evidence. World Rugby concluded that "there is currently no basis with which safety and fairness can be assured to biologically female rugby players should they encounter contact situations with players whose biological male advantages persist to a large degree," and that after puberty, "the lowering of testosterone removes only a small proportion of the documented biological differences." Hence, World Rugby concluded that biological men should not compete in women's rugby. (World Rugby Transgender Women Guidelines 2020.) World Rugby has been criticized by some for its new guidelines, but those criticisms have often avoided discussions of medical science entirely, or have asserted that modeling scenarios can overstate true risk. What cannot be denied, however, is that World Rugby's approach is evidence-based, and rooted in concern for athlete safety. As a medical doctor who has spent my career in sports medicine, it is my opinion that World Rugby's assessment of the evidence is scientifically sound, and that injury modeling meaningfully predicts that biologically male transgender athletes do constitute a safety risk for the biologically female athlete in women's sports.

In a similar vein, in 2021, the UK Sports Councils' Equality Group released new guidance for transgender inclusion in organized sports. This guidance was formulated after extensive conversations with stakeholders, a review of scientific findings related to transgender athletes in sport through early 2021, and an assessment of the use by some sport national governing bodies of case-by-case assessment to determine eligibility. Noteworthy within these stakeholder consultations was a lack of consensus on any workable solution, as well as concerns related to athlete safety and "adherence to rules which give sport validity." The Literature Review accompanying the guidance document further noted that "[t]here are significant differences between the sexes which render direct competition between males and females . . . unsafe in sports which allow physical contact and collisions." (UK Sports Councils' Equality Group Literature Review 2021 at 1.) Their review of the science "made clear that there are retained differences in strength, stamina and physique between the average woman compared with the average transgender woman....with or without testosterone suppression." (UK Sports Councils' Equality Group Guidance at 3.) This was also reflected in their ten guiding principles, stating that physical differences between the sexes will "impact safety parameters in sports which are combat, collision or contact in nature." (UK Sports Councils' Equality Group Guidance 2021 at 7.) Ultimately, UK Sport concluded that the full inclusion of transgender athletes in women's sports "cannot be reconciled within the current structure of sport," stating that "the inclusion of transgender people into female sport cannot be balanced regarding transgender inclusion, fairness and safety in gender-affected sport where there is meaningful competition . . . . due to retained differences in strength, stamina and physique between the average woman compared with the average transgender woman..., with or without testosterone suppression." (UK Sports Councils' Equality Group Guidance 2021 at 6.) Finally, UK Sport affirmed the use of sex categorization in sport, along with age and disability, as important for the maintenance of safety and fairness. (UK Sports Councils' Equality Group Guidance 2021 at 7-8.)

Unfortunately, apart from World Rugby's careful review and the recent release of UK Sports Councils' guidance, the public discourse is lacking any careful consideration of the question of safety. As a physician who has spent my career caring for athletes, I find this silence about safety both surprising and concerning. It is my hope through this white paper to equip and motivate sports leagues and policy makers to give adequate attention to the issue of safety for female athletes when transgender policies are being considered. I first explain the nature and causes of common sports injuries. I then review physiological differences between male and female bodies that affect the risk and severity of injuries to females when biological males compete in the female category, and explain why testosterone suppression does not eliminate these heightened risks to females. Finally, I explain certain conclusions about those risks.

CREDENTIALS

1. I am a medical doctor practicing Sports Medicine, maintaining an active clinical practice at Stadia Sports Medicine in West Des Moines, Iowa. I received my M.D. from the University of Nebraska College of Medicine in 1994 and completed a residency in family medicine at the University of Michigan in 1997.

2. Following my time in Ann Arbor, I matched to a fellowship in Sports Medicine at Ball Memorial Hospital in Muncie, Indiana, training from 1997 to 1999, with clinical time split between Central Indiana Orthopedics, the Ball State Human Performance Laboratory, and the Ball State University training room. I received my board certification in Sports Medicine in 1999, which I continue to hold. Since residency training, my practice has focused on Sports Medicine—the treatment and prevention of injuries related to sport and physical activity.

3. Since 1997, I have served in several clinical practices and settings as a treating physician, including time as team physician for both the University of Illinois and Ball State University, where I provided care to athletes in several sports, including football, ice hockey, basketball, field hockey, softball, gymnastics, soccer, and volleyball. In the course of my career, I have provided coverage for NCAA Power Five Conference championships and NCAA National Championship events in basketball, field hockey and gymnastics, among other sports, as well as provided coverage for national championship events for U.S.A. gymnastics, and U.S. Swimming and Diving. I have also covered professional soccer in Des Moines.

4. Since 2006, I have been the physician owner of Stadia Sports Medicine in West Des Moines, Iowa. My practice focuses on treatment of sports and activity-related injury, including concussive injury, as well as problems related to the physiology of sport.

5. I have served in and provided leadership for several professional organizations over the course of my career. In 2004, I was designated a Fellow of the American College of Sports Medicine (ACSM). I have served on ACSM's Health and Science Policy Committee since 2010,

and for a time chaired their Clinical Medicine Subcommittee. From 2009 to 2013, I served two elected terms on the Board of Directors of the American Medical Society for Sports Medicine (AMSSM), and during that time served as Chair of that body's Practice and Policy Committee. I was subsequently elected to a four-year term on AMSSM's executive committee in 2017, and from 2019-20, I served as AMSSM's President. AMSSM is the largest organization of sports medicine physicians in the world. I gained fellowship status through AMSSM in 2020—my first year of eligibility. My work for ACSM and AMSSM has brought with it extensive experience in public policy as relates to Sports Medicine.

6. In 2020, I was named as AMSSM's first board delegate to the newly-constituted Physical Activity Alliance. I am a named member of an NCAA advisory group on COVID-19, through which I provided input regarding the cancellation of the basketball tournament in 2020. I also serve as a member of the Iowa Medical Society's Sports Medicine Subcommittee and have been asked to serve on the Iowa High School Athletic Association's newly-forming Sports Medicine Advisory Committee.

7. I have served as a manuscript reviewer for organizational policy pronouncements, and for several professional publications, most recently a sports medicine board review book just published in 2021. I have published several articles on topics related to musculoskeletal injuries in sports and rehabilitation, which have been published in peer-reviewed journals such as Clinical Journal of Sports Medicine, British Journal of Sports Medicine, Current Reviews in Musculoskeletal Medicine, Athletic Therapy Today, and the Journal of Athletic Training. In conjunction with my work in policy advocacy,

I have helped write several pieces of legislation, including the initial draft of what became the Sports Medicine Licensure Clarity Act, signed into law by President Trump in 2018, which eases the restrictions on certain practitioners to provide health services to athletes and athletic teams outside of the practitioner's home state. A list of my publications over the past ten (10) years is included as an appendix to this report.

8. In the past four years, I have not testified as an expert witness in a deposition or at trial.

9. I am being compensated for my services as an expert witness in this case at the rates of $650 per hour for consultation, $800 per hour for deposition testimony, and $3,500 per half-day of trial testimony.

I. OVERVIEW

10. In this statement, I offer information and my own professional opinion on the potential for increased injury risk to females in sports when they compete against biologically male transgender athletes.[7] At many points in this statement, I provide citations to published, peer-reviewed articles that provide relevant and supporting information to the points I make.

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[7] In the body of this paper, I use the terms "male" and "female" according to their ordinary medical meaning—that is to say, to refer to the two biological sexes. I also use the word "man" to refer to a biologically male human, and "woman" to refer to a biologically female human. In the context of this opinion, I include in these categories non-syndromic, biologically-normal males and females who identify as a member of the opposite sex, including those who use endogenous hormone suppression to alter their body habitus. In contexts that are not focused on questions of biology and physiology, terms of gender are sometimes used to refer to subjective identities rather than to biological categories — something I avoid for purposes of a paper focused on sports science.

11. The principal conclusions that I set out in this white paper are as follows:

a. Government and sporting organizations have historically considered the preservation of athlete safety as one component of competitive equity.

b. Injury in sport is somewhat predictable based on modeling assumptions that take into account relevant internal and external risk factors.

c. Males exhibit large average advantages in size, weight, and physical capacity over females—often falling far outside female ranges. Even before puberty, males have a performance advantage over females in most athletic events. Failure to preserve protected female-only categories in contact sports (broadly defined) will ultimately increase both the frequency and severity of injury suffered by female athletes who share playing space with these males.

d. Current research supports the conclusion that suppression of testosterone levels by males who have already begun puberty will not fully reverse the effects of testosterone on skeletal size, strength, or muscle hypertrophy, leading to persistence of sex-based differences in power, speed, and force-generating capacity.

12. In this white paper, I use the term "contact sports" to refer broadly to all sports in which collisions between players, or collisions between equipment such as a stick or ball and the body of a player, occur with some frequency (whether or not permitted by the rules of the game), and are well recognized in the field of sports medicine as

causes of sport-related injuries.[8] The 1975 Title IX implementing regulations (34 CFR § 106.41) say that "for purposes of this [regulation] contact sports include boxing, wrestling, rugby, ice hockey, football, basketball, *and other sports* the purpose or major activity of which involves bodily contact." Certainly, all of the sports specifically named in the regulation fall within my definition of "contact sport." Mixed martial arts, field hockey (Barboza 2018), soccer (Kuczinski 2018), rugby (Viviers 2018), lacrosse (Pierpoint 2019), volleyball,[9] baseball, and softball also involve collisions that can and do result in injuries, and so also fall within my definition.

II. A BRIEF HISTORY OF THE RATIONALE FOR SEPARATION OF SPORT BY SEX

13. World Rugby is correct when it notes that "the women's category exists to ensure protection, safety, and equality" for women. (World Rugby Transgender Women Guidelines 2020.) To some extent, those in charge of sport governing bodies in the modern era have always recognized the importance of grouping athletes together based on physical attributes, in order to ensure both safety and competitive balance. Weight classifications have existed in wrestling since it reappeared as an Olympic event in 1904. Women and men have participated in separate categories since the advent of intercollegiate sporting clubs early in the 20th century. When Title IX went into effect in 1975, there were just under 300,000

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[8] It is common to see, within the medical literature, reference to distinctions between "contact" and "collision" sports. For purposes of clarity, I have combined these terms, since in the context of injury risk modeling, there is no practical distinction between them.

[9] See https://www.latimes.com/sports/story/2020-12-08/stanford-volleyball-hayley-hodsonconcussions-cte-lawsuit, and https://volleyballmag.com/corinneatchison/ (both accessed 6/20/21).

female high school athletes, and fewer than 10,000 female collegiate athletes. With the changes that resulted from Title IX, it was assumed that newly-available funds for women in sport would ensure the maintenance of existing, or creation of new, sex-segregated athletic teams that would foster greater participation by women. This has been borne out subsequently; by the first half of the 1980's these numbers had risen to 1.9 million and nearly 100,000 respectively. (Hult 1989.)

14. The rationale for ongoing "separate but equal" status when it came to sex-segregated sports was made clear within the language of the original implementing regulations of Title IX , which, acknowledging real, biologically-driven differences between the sexes, created carve-out exceptions authorizing sex-separation of sport for reasons rooted in the maintenance of competitive equity. Importantly, the effect of these innate sex-based differences on the health and safety of the athlete were acknowledged by the express authorization of sex-separated teams for sports with higher perceived injury risk—i.e., "contact sports." (Coleman 2020.)

15. In the almost half century since those regulations were adopted, the persistent reality of sex-determined differences in athletic performance and safety has been recognized by the ongoing and nearly universal segregation of men's and women's teams—even those that are not classically defined as being part of a contact or collision sport.

16. Now, however, many schools and sports leagues in this country are permitting males to compete in female athletics—including in contact sports—based on gender identity. In my view, these policies have been adopted without careful analysis of safety implications. Other researchers and clinicians have addressed questions of the

negative impact of such policies on fairness, or equality of athletic experiences for girls and women, in published articles, and in court submissions. One recent review of track and field performances, including sprints, distance races and field events, noted that men surpass the top female performance in each category between 1000 and 10,000 times *each year,* with hundreds or thousands of men beating the top women in each event. (Coleman & Shreve.) Although this was not their primary focus, World Rugby well-summarized the point when it observed that in a ranking list of the top thousand performances in most sports, every year, *every one* will have been achieved by a biological male. (World Rugby Transgender Women Guidelines 2020.) Although most easily documented in athletes who have gone through puberty, these differences are not exclusively limited to post-pubescent athletes either.

17. I have reviewed the expert declaration of Gregory A. Brown, Ph.D., FACM of February 23, 2022, provided in this case, which includes evidence from a wide variety of sources, including population-based mass testing data, as well as age-stratified competition results, all of which support the idea that prepubertal males run faster, jump higher and farther, exhibit higher aerobic power output, and have greater upper body strength (evidenced by stronger hand grip and better performance with chin-ups or bent arm hang) than comparably aged females. This performance gap is well-documented in population-based physiologic testing data that exists in databases such as the Presidential Fitness Test, the Eurofit Fitness test, and additional mass testing data from the UK and Australia. Collectively, this data reveals that pre-pubertal males outperform comparably aged females in a wide array of athletic tests including but not limited to the countermovement jump test, drop jump test, change of

direction test, long jump, timed sit-up test, the 10 X 5 meter shuttle run test, the 20 meter shuttle run test, curl-ups, pull-ups, push-ups, one mile run, standing broad jump, and bent arm hang test. Dr. Brown further references studies showing a significant difference in the body composition of males and females before puberty. In sum, a large and unbridgeable performance gap between the sexes is well-studied and equally well-documented, beginning in many cases before puberty. In this white paper, I focus on some of these differences as they touch on the question of athlete safety.

III. UNDERSTANDING THE CAUSES OF SPORTS INJURIES

18. The causes for injury in sport are multifactorial. In recent decades, medical researchers have provided us an evolving understanding of how sports injuries occur, as well as the factors that make them more or less probable, and more or less severe. Broadly speaking, there are two ways of modeling injury: the epidemiological model, and the biomechanical model. These models are not mutually exclusive, but provide complementary conceptual frameworks to help us stratify risk in sport.

A. The epidemiological model of injury

19. From a practical standpoint, sports medicine researchers and clinicians often use the "epidemiological model" to explain, prevent and manage sports injuries. Broadly speaking, this model views an injury in sport as the product of internal and external risk factors, triggered by an inciting event. In other words, a given injury is "caused" by a number of different factors that are unique to a given situation. (Meeuwise 1994.) When the interplay of these factors exceeds the injury threshold, injury

occurs. One example of how this interplay might work would be a female distance runner in track who develops a tibial stress fracture, with identified risks of low estrogen state from amenorrhea (suppression of menses), an aggressive winter training program on an indoor tile surface, and shoes that have been used for too many miles, and are no longer providing proper shock absorption. Most risk factors ebb and flow, with the overall injury risk at any given time fluctuating as well. Proper attention to risk factor reduction *before* the start of the sports season (including appropriate rule-making) is the best way to reduce actual injury rates *during* the season.

20. As alluded to, the risk factors associated with injury can be broadly categorized as internal or external. Internal risk factors are internal to the athlete. These include relatively fixed variables, such as the athlete's age, biological sex, bone mineral density (which affects bone strength) and joint laxity, as well as more mutable variables such as body weight, fitness level, hydration state, current illness, prior injury, or psychosocial factors such as aggression.

21. External risk factors are, as the name suggests, external to the athlete. These include non-human risks such as the condition of the playing surface or equipment, athletic shoe wear, or environmental conditions. Other external risk factors come from opposing competitors, and include such variables as player size, speed, aggressiveness, and overall adherence to the rules of the game. As already mentioned, these risks can be minimized through the proper creation and enforcement of rules, as well as the appropriate grouping of athletes together for purposes of competition. To the latter point, children don't play contact sports with adults and, in the great majority of cases, men and women compete in categories specific to

their own biological sex. Certainly these categorical separations are motivated in part by average performance differences and considerations of fairness and opportunity. But they are also motivated by safety concerns. When properly applied, these divisions enhance safety because, when it comes to physical traits such as body size, weight, speed, muscle girth, and bone strength, although a certain amount of variability exists within each group, the averages and medians differ widely *between* the separated groups.[10]

22. Thus, each of these commonly utilized groupings of athletes represents a pool of individuals with predictable commonalities. Epidemiological risk assessment is somewhat predictable and translatable as long as these pools remain intact. But the introduction of outside individuals into a given pool (e.g. an adult onto a youth football team, or males into most women's sports) would change the balance of risk inside that pool. Simply put, when you introduce larger, faster, and stronger athletes from one pool into a second pool of athletes who are *categorically* smaller (whether as a result of age or sex), you have altered the characteristics of the second pool, and, based on known injury modeling, have statistically increased the injury risk for the original athletes in that

[10] In some cases, safety requires even further division or exclusion. A welterweight boxer would not compete against a heavyweight, nor a heavyweight wrestle against a smaller athlete. In the case of youth sports, when children are at an age where growth rates can vary widely, leagues will accommodate for naturally-occurring large discrepancies in body size by limiting larger athletes from playing positions where their size and strength is likely to result in injury to smaller players. Thus, in youth football, players exceeding a certain weight threshold may be temporarily restricted to playing on the line and disallowed from carrying the ball, or playing in the defensive secondary, where they could impose high-velocity hits on smaller players.

pool. This, in a nutshell, is the basis for World Rugby's recommendations.

23. Most clinical studies of the epidemiology of sports injuries use a multivariate approach, identifying multiple independent risk factors and examining how these factors might interact, in order to determine their relative contribution to injury risk, and make educated inferences about causation. (Meeuwise 1994.)

24. In applying the multivariate approach, the goal is to keep as many variables as possible the same so as to isolate the potential effect of a single variable (such as age or biological sex) on injury risk, as well as to determine how the isolated variable interacts with the other analyzed variables to affect injury risk. Failure to consider relevant independent variables can lead to error. Researchers focusing on differences between male and female athletes, for example, would not compare concussion rates of a high school girls' soccer team to concussion rates of a professional men's soccer team, because differences in the concussion rate might be due to a number of factors besides sex, such as age, body mass, relative differences in skill, speed, or power, as well as differences in training volume and intensity.

25. As indicated earlier, an injury event is usually the end product of a number of different risk factors coming together. (Bahr 2005.) A collision between two soccer players who both attempt to head the ball, for example, might be the inciting event that causes a concussion. Although the linear and angular forces that occur through sudden deceleration would be the proximate cause of this injury, the epidemiological model of injury would also factor in "upstream" risks, predicting the possibility of an injury outcome for each athlete differently depending on the sum of these risks. If the collision injury described

above occurs between two disparately-sized players, the smaller athlete will tend to decelerate more abruptly than the larger athlete, increasing the smaller athlete's risk for injury. Additional discrepancies in factors such as neck strength, running speeds, and muscle force generation capacity all result in differing risks and thus, the potential for differing injury outcomes from the same collision. As I discuss later in this white paper, there are significant statistical differences between the sexes when it comes to each of these variables, meaning that in a collision sport where skeletally mature males and females are playing against one another, there is a higher statistical likelihood that injury will result when collisions occur, and in particular there is a higher likelihood that a female will suffer injury. This again is the basis for the recent decision by World Rugby to disallow the crossover of men into women's rugby, regardless of gender identity. (World Rugby Transgender Women Guidelines 2020.) The decision-making represented by this policy change is rational and rooted in objective facts and objective risks of harm, because it takes real, acknowledged, and documented physical differences between the sexes (in many cases before adolescence), and models expected injury risk on the basis of the known differences that persist even after hormone manipulation.

B. The biomechanical model of injury

26. Sports medicine researchers and clinicians also consider a biomechanical approach when it comes to understanding sports injuries. In the biomechanical model of injury, injury is considered to be analogous to the failure of a machine or other structure. Every bone, muscle, or connective tissue structure in an athlete's body has a certain load tolerance. Conceptually, when an external "load" exceeds the load tolerance of a given

structure in the human body, an injury occurs. (Fung 1993 at 1.) Thus, researchers focus on the mechanical load—the force exerted on a bone, ligament, joint or other body part—and the load tolerance of that impacted or stressed body part, to understand what the typical threshold for injury is, and how predictable this might be. (McIntosh 2005 at 2-3.) Biomechanical models of injury usually consider forces in isolation. The more consistent the movement pattern of an individual, and the fewer the contributions of unexpected outside forces to the athlete, the more accurate biomechanical predictions of injury will be.

27. Biomechanical modeling can be highly predictive in relatively simple settings. For example, in blunt trauma injury from falls, mortality predictably rises the greater the fall. About 50% of people who fall four stories will survive, while only 10% will survive a fall of seven stories. (Buckman 1991.) As complexity increases, predictability in turn decreases. In sport, the pitching motion is highly reproducible, and strain injury to the ulnar collateral ligament (UCL) of the elbow can be modeled. The load tolerance of the UCL of a pitcher's elbow is about 32 Newton-meters, but the failure threshold of a ligament like this in isolation is not the only determinant of whether injury will occur. During the pitching motion, the valgus force imparted to the elbow (gapping stress across the inner elbow that stretches the UCL) routinely reaches 64 Newtons, which is obviously greater than the failure threshold of the ligament. Since not all pitchers tear their UCLs, other variables innate to an athlete must mitigate force transmission to the ligament and reduce risk. The load tolerance of any particular part of an athlete's body is thus determined by other internal factors such as joint stiffness, total ligament support, muscle strength across the joint, or bone mineral density. Injury load can be self-

generated, as in the case of a pitcher's elbow, or externally-generated, as in the case of a linebacker hitting a wide receiver. While load tolerance will vary by individual, as described above, and is often reliant on characteristics innate to a given athlete, external load is determined by outside factors such as the nature of the playing surface or equipment used, in combination with the weight and speed of other players or objects (such as a batted ball) with which the player collides. (Bahr 2005.)

28. As this suggests, the two "models" of sports injuries described above are not in any sense inconsistent or in tension with each other. Instead, they are complementary ways of thinking about injuries that can provide different insights. But the important point to make regarding these models is that in either model, injury risk (or the threshold for injury) rises and falls depending on the size of an externally-applied force, and the ability of a given athlete to absorb or mitigate that force.

IV. THE PHYSICS OF SPORTS INJURY

29. Sports injuries often result from collisions between players, or between a player and a rapidly moving object (e.g. a ball or hockey puck, a lacrosse or hockey stick). In soccer, for example, most head injuries result from collisions with another player's head or body, collision with the goal or ground, or from an unanticipated blow from a kicked ball. (Boden 1998; Mooney 2020.) In basketball, players often collide with each other during screens, while diving for a loose ball, or while driving to the basket. In lacrosse or field hockey, player-to-player, or player-to-stick contact is common.

30. But what are the results of those collisions on the human body? Basic principles of physics can cast light on this question from more than one angle. A general understanding of these principles can help us identify factors that will predictably increase the relative risk, frequency, and severity of sports injuries, given certain assumptions.

31. First, we can consider **energy.** Every collision involves an object or objects that possess energy. The energy embodied in a moving object (whether a human body, a ball, or anything else) is called kinetic energy.

32. Importantly, the kinetic energy of a moving object is expressed as: $\boldsymbol{Ek = 1\, MV^2}$ **.** That is, kinetic energy is a function of the mass of the object multiplied by the *square* of its velocity. (Dashnaw 2012.) To illustrate with a simple but extreme example: if athletes A and B are moving at the same speed, but athlete A is twice as heavy, athlete A carries twice as much kinetic energy as athlete B. If the two athletes weigh the same amount, but athlete A is going twice as fast, athlete A carries four times as much kinetic energy as athlete B. But as I have noted, the kinetic energy of a moving object is a function of the mass of the object multiplied by the square of its velocity. Thus, if athlete A is twice as heavy, and moving twice as fast, athlete A will carry eight times the kinetic energy of athlete B into a collision.[11]

33. The implication of this equation means that what appear to be relatively minor discrepancies in size and speed can result in major differences in energy imparted in a collision, to the point that more frequent and more severe injuries can occur. To use figures that correspond more closely to average differences between men and

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[11] $2 \text{ X } 2^2 = 8$

women, if Player M weighs only 20% more than Player F, and runs only 15% faster, Player M will bring *58% more kinetic energy* into a collision than Player F.[12]

34. The law of conservation of energy tells us that energy is never destroyed or "used up." If kinetic energy is "lost" by one body in a collision, it is inevitably transferred to another body, or into a different form. In the case of collision between players, or between (e.g.) a ball and a player's head, some of the energy "lost" by one player, or by the ball, may be transformed into (harmless) sound; some may result in an increase in the kinetic energy of the player who is struck (through acceleration, which I discuss below); but some of it may result in *deformation* of the player's body—which, depending on its severity, may result in injury. Thus, the greater the kinetic energy brought into a collision, the greater the potential for injury, all other things being equal.

35. Alternately, we can consider force and *acceleration,* which is particularly relevant to concussion injuries.

36. Newton's third law of motion tells us that when two players collide, their bodies experience equal and opposite forces at the point of impact.

37. Acceleration refers to the rate of change in speed (or velocity). When two athletes collide, their bodies necessarily accelerate (or decelerate) rapidly: stopping abruptly, bouncing back, or being deflected in a different direction. Newton's second law of motion tells us that: $\boldsymbol{F = ma}$ (that is, force equals mass multiplied by acceleration). From this equation we see that when a larger and a smaller body collide, and (necessarily) experience equal and opposite forces, the smaller body (or

[12] $1.2 \times (1.15)^2 = 1.587$

smaller player, in sport) will experience more rapid acceleration. We observe this physical principle in action when we watch a bowling ball strike bowling pins: the heavy bowling ball only slightly changes its course and speed; the lighter pins go flying.

38. This same equation also tells us that if a given player's body or head is hit with a *larger* force (e.g., from a ball that has been thrown or hit faster), it will experience *greater* acceleration, everything else being equal.

39. Of course, sport is by definition somewhat chaotic, and forces are often not purely linear. Many collisions also involve angular velocities, with the production of rotational force, or torque. Torque can be thought of as force that causes rotation around a central point. A different but similar equation of Newtonian physics governs the principles involved.[13] Torque is relevant to injury in several ways. When torque is applied through joints in directions those joints are not able to accommodate, injury can occur. In addition, rotational force can cause different parts of the body to accelerate at different rates—in some cases, very rapid rates, also leading to injury. For example, a collision where the body is impacted at the waist can result in high torque and acceleration on the neck and head.

40. Sport-related concussion—a common sports injury and one with potentially significant effects—is attributable to linear, angular, or rotational acceleration and deceleration forces that result from impact to the head, or from an impact to the body that results in a

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[13] In this equation, $\boldsymbol{r = la}$**,** torque equals moment of inertia multiplied by angular acceleration, where "moment of inertia" is defined as $\boldsymbol{I = mr^2}$**,** that is, mass multiplied by the square of the distance to the rotational axis.

whiplash "snap" of the head. (Rowson 2016.) In the case of a concussive head injury, it is the brain that accelerates or decelerates on impact, colliding with the inner surface of the skull. (Barth 2001 at 255.)

41. None of this is mysterious: each of us, if we had to choose between being hit either by a large, heavy athlete running at full speed, or by a small, lighter athlete, would intuitively choose collision with the small, light athlete as the lesser of the two evils. And we would be right. One author referred to the "increase in kinetic energy, and therefore imparted forces" resulting from collision with larger, faster players as "profound." (Dashnaw 2012.)

V. GENDER DIFFERENCES RELEVANT TO INJURY

42. It is important to state up front that it is self-evident to most people familiar with sport and sport injuries that if men and women were to consistently participate together in competitive contact sports, there would be higher rates of injury in women. This is one reason that rule modifications often exist in leagues where co-ed participation occurs.[14] Understanding the physics of sports injuries helps provide a theoretical framework for why this is true, but so does common sense and experience. All of us are familiar with basic objective physiological differences between the sexes, some of which exist in childhood, and some of which become apparent after the onset of puberty, and persist throughout adulthood. And as a result of personal

[14] For example, see https://www.athleticbusiness.com/college/intramural-coed-basketball-playing-rules-vary-greatly.html (detailing variety of rule modifications applied in co-ed basketball). Similarly, coed soccer leagues often prohibit so-called "slide tackles," which are not prohibited in either men's or women's soccer. See, e.g., http://www.premiercoedsports.com/pages/rulesandpolicies/soccer.

experience, all of us also have some intuitive sense of what types of collisions are likely to cause pain or injury. Not surprisingly, our "common sense" on these basic facts about the human condition is also consistent with the observations of medical science. Below, I provide quantifications of some of these well-known differences between the sexes that are relevant to injury risk, as well as some categorical differences that may be less well known.

A. Height and weight

43. It is an inescapable fact of the human species that males as a group are statistically larger and heavier than females. On average, men are 7% to 8% taller than women. (Handelsman 2018 at 818.) According to the most recently available Centers for Disease Control and Prevention (CDC) statistics, the weight of the average U.S. adult male is 16% greater than that of the average U.S. adult female. (CDC 2018.) This disparity persists into the athletic cohort. Researchers find that while athletes tend on average to be lighter than non-athletes, the weight difference between the average adult male and female athlete remains within the same range—between 14% and 23%, depending on the sport analyzed. (Santos 2014; Fields 2018.) Indeed, World Rugby estimates that the typical male rugby player weighs 20% to 40% more than the typical female rugby player. (World Rugby Transgender Women Guidelines 2020.) This size advantage by itself allows men to bring more force to bear in a collision.

B. Bone and connective tissue strength

44. Men have bones in their arms, legs, feet, and hands that are both larger and stronger per unit volume than those of women, due to greater cross-sectional area,

greater bone mineral content, and greater bone density. The advantage in bone size (cross-sectional area) holds true in both upper and lower extremities, even when adjusted for lean body mass. (Handelsman 2018 at 818; Nieves 2005 at 530.) Greater bone size in men is also correlated with stronger tendons that are more adaptable to training (Magnusson 2007), and an increased ability to withstand the forces produced by larger muscles (Morris 2020 at 5). Male bones are not merely larger, they are stronger per unit of volume. Studies of differences in arm and leg bone mineral density — one component of bone strength — find that male bones are denser, with measured advantages of between 5% and 14%. (Gilsanz 2011; Nieves 2005.)

45. Men also have larger ligaments than women (Lin 2019 at 5), and stiffer connective tissue (Hilton 2021 at Table 1), providing greater protection against joint injury.

C. Speed

46. When it comes to acceleration from a static position to a sprint, men are consistently faster than women. World record sprint performance gaps between the sexes remain significant at between 7% and 10.5%, with world record times in women now exhibiting a plateau (no longer rapidly improving with time) similar to the historical trends seen in men. (Cheuvront 2005.) This performance gap has to do with, among other factors, increased skeletal stiffness, greater cross-sectional muscle area, denser muscle fiber composition and greater limb length. (Handelsman 2018.) Collectively, males, on average, run about 10% faster than females. (Lombardo 2018 at 93.) This becomes important as it pertains to injury risk, because males involved in sport will often be travelling at faster speeds than their female counterparts in

comparable settings, with resultant faster speed at impact, and thus greater impact force, in a given collision.

D. Strength/Power

47. In 2014, a male mixed-martial art fighter identifying as female and fighting under the name Fallon Fox fought a woman named Tamikka Brents, and caused significant facial injuries in the course of their bout. Speaking about their fight later, Brents said:

> "I've fought a lot of women and have never felt the strength that I felt in a fight as I did that night. I can't answer whether it's because she was born a man or not because I'm not a doctor. I can only say, I've never felt so overpowered ever in my life, and I am an abnormally strong female in my own right."[15]

48. So far as I am aware, mixed martial arts is not a collegiate or high school interscholastic sport. Nevertheless, what Brent experienced in an extreme setting is true and relevant to safety in all sports that involve contact. In absolute terms, males as a group are substantially stronger than women.

49. Compared to women, men have "larger and denser muscle mass, and stiffer connective tissue, with associated capacity to exert greater muscular force more rapidly and efficiently." (Hilton 2021 at 201.) Research shows that on average, during the prime athletic years (ages 18-29) men have, on average, 54% greater total muscle mass than women (33.7 kg vs. 21.8 kg) including 64% greater muscle mass in the upper body, and 47% greater in the lower body. (Janssen 2000 at Table 1.) The cross-sectional area of muscle in women is only 50% to 60% that of men in the upper arm, and 65% to 70% of that of men in the thigh.

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[15] https://bjj-world.com/transgender-mma-fighter-fallon-fox-breaks-skull-of-her-female-opponent/

This translates to women having only 50% to 60% of men's upper limb strength and 60% to 80% of men's lower limb strength. (Handelsman 2018 at 812.) Male weightlifters have been shown to be approximately 30% stronger than female weightlifters of equivalent stature and mass. (Hilton 2021 at 203.) But in competitive athletics, since the stature and mass of the average male exceeds that of the average female, actual differences in strength between average body types will, on average, exceed this. The longer limb lengths of males augment strength as well. Statistically, in comparison with women, men also have lower total body fat, differently distributed, and greater lean muscle mass, which increases their power-to-weight ratios and upper-to-lower limb strength ratios as a group. Looking at another common metric of strength, males average 57% greater grip strength (Bohannon 2019) and 54% greater knee extension torque (Neder 1999). Research shows that sex-based discrepancies in lean muscle mass begin to be established from infancy, and persist through childhood to adolescence. (Davis 2019; Kirchengast 2001; Taylor 1997; Taylor 2010; McManus 2011.)

50. Using their legs and torso for power generation, men can apply substantially larger forces with their arms and upper body, enabling them to generate more ball velocity through overhead motions, as well as to generate more pushing or punching power. In other words, isolated sex-specific differences in muscle strength in one region (even differences that in isolation seem small) can, and do combine to generate even greater sex-specific differences in more complex sport-specific functions. One study looking at moderately-trained individuals found that males can generate 162% more punching power than females. (Morris 2020.) Thus, multiple small advantages aggregate into larger ones.

E. Throwing and kicking speed

51. One result of the combined effects of these sex-determined differences in skeletal structure is that men are, on average, able to throw objects faster than women. (Lombardo 2018; Chu 2009; Thomas 1985.) By age seventeen, the *average* male can throw a ball farther than 99% of seventeen-year-old females—which necessarily means at a faster initial speed assuming a similar angle of release— despite the fact that factors such as arm length, muscle mass, and joint stiffness individually don't come close to exhibiting this degree of sex-defined advantage. One study of elite male and female baseball pitchers showed that men throw baseballs 35% faster than women-81 miles/hour for men vs. 60 miles/hour for women. The authors of this study attribute this to a sex-specific difference in the ability to generate muscle torque and power. (Chu 2009.) A study showing greater throwing velocity in male versus female handball players attributed it to differences in body size, including height, muscle mass, and arm length. (Van Den Tillaar 2012.) Interestingly, significant sex-related difference in throwing ability has been shown to manifest even before puberty, but the difference increases rapidly during and after puberty. (Thomas 1985 at 266.) These sex-determined differences in throwing speed are not limited to sports where a ball is thrown. Males have repeatedly been shown to throw a javelin more than 30% farther than females. (Lombardo 2018 Table 2; Hilton 2021 at 203.) Even in preadolescent children, differences exist. International youth records for 5- to 12-year-olds in the javelin show 34-55% greater distance in males vs. females using a 400g javelin.[16]

[16] http://age-records.125mb.com/.

52. Men also serve and spike volleyballs with higher velocity than women, with a performance advantage in the range of 29-34%. (Hilton 2021.) Analysis of first and second tier Belgian national elite male volleyball players shows ball spike speeds of 63 mph and 56 mph respectively. (Forthomme 2005.) NCAA Division I female volleyball players—roughly comparable to the second-tier male elite group referenced above—average a ball spike velocity of approximately 40 mph (18.1 m/s). (Ferris 1995 at Table 2.) Notably, based on the measurements of these studies, male spiking speed in *lower* elite divisions is almost 40% greater than that of NCAA Division I female collegiate players. Separate analyses of serving speed between elite men and women Spanish volleyball players showed that the average power serving speed in men was 54.6 mph (range 45.3-64.6 mph), with maximal speed of 76.4 mph. In women, average power serving speed was 49 mph (range 41-55.3 mph) with maximal speed of 59 mph. This translates to an almost 30% advantage in maximal serve velocity in men. (Palao 2014.)

53. Recall that kinetic energy is dependent on mass and the square of velocity. A volleyball (with fixed mass) struck by a male, and traveling an average 35% faster than one struck by a female, will deliver 82% more energy to a head upon impact.

54. The greater leg strength and jumping ability of men confer a further large advantage in volleyball that is relevant to injury risk. In volleyball, an "attack jump" is a jump to position a player to spike the ball downward over the net against the opposing team. Research on elite national volleyball players found that on average, males exhibited a 50% greater vertical jump height during an "attack" than did females. (Sattler 2015.) Similar data looking at countermovement jumps (to block a shot) in

national basketball players reveals a 35% male advantage in jump height. (Kellis 1999.) In volleyball, this dramatic difference in jump height means that male players who are competing in female divisions will more often be able to successfully perform a spike, and this will be all the more true considering that the women's net height is seven inches lower than that used in men's volleyball. Confirming this inference, research also shows that the successful attack percentage (that is, the frequency with which the ball is successfully hit over the net into the opponent's court in an attempt to score) is so much higher with men than women that someone analyzing game statistics can consistently identify games played by men as opposed to women on the basis of this statistic alone. These enhanced and more consistently successful attacks by men directly correlate to their greater jumping ability and attack velocity at the net. (Kountouris 2015.)

55. The combination of the innate male-female differences cited above, along with the lower net height in women's volleyball, means that if a reasonably athletic male is permitted to compete against women, the participating female players will likely be exposed to higher ball velocities that are outside the range of what is typically seen in women's volleyball. When we recall that ball-to-head impact is a common cause of concussion among women volleyball players, this fact makes it clear that participation in girls' or women's volleyball by biologically male individuals will increase concussion injury risk for participating girls or women.

56. Male sex-based advantages in leg strength also lead to greater kick velocity. In comparison with women, men kick balls harder and faster. A study comparing kicking velocity between university-level male and female soccer players found that males kick the ball with an average 20%

greater velocity than females. (Sakamoto 2014.) Applying the same principles of physics we have just used above, we see that a soccer ball kicked by a male, travelling an average 20% faster than a ball kicked by a female, will deliver 44% more energy on head impact. Greater force-generating capacity will thus increase the risk of an impact injury such as concussion.

VI. ENHANCED FEMALE VULNERABILITY TO CERTAIN INJURIES

57. Above, I have reviewed physiological differences that result in the male body bringing greater weight, speed, and force to the athletic field or court, and how these differences can result in a greater risk of injury to females when males compete against them. It is also true that the female body is more vulnerable than the male body to certain types of injury even when subject to comparable forces. This risk appears to extend to the younger age cohorts as well. An analysis of Finnish student athletes from 1987-1991, analyzing over 600,000 person-years of activity exposures, found, in students under fifteen years of age, higher rates of injury in girls than boys in soccer, volleyball, judo and karate. (Kujala 1995.) Another epidemiological study looking specifically at injury rates in over 14,000 middle schoolers over a 20 year period showed that "in sex-matched sports, middle school girls were more likely to sustain any injury (RR = 1.15, 95% CI = 1.1, 1.2) or a time-loss injury (RR = 1.09, 95% CI = 1.0, 1.2) than middle school boys." In analyzed both-sex sports (i.e., sex-separated sports that both girls and boys play, like soccer), girls sustained higher injury rates, and greater rates of time-loss injury. (Beachy 2014.) Another study of over 2000 middle school students at nine schools showed that the injury rate was higher for girls'

basketball than for football (39.4 v 30.7/1000 AEs), and injury rates for girls' soccer were nearly double that of boys' soccer (26.3 v. 14.7/1000 AEs). (Caswell 2017.) In this regard, I will focus on two areas of heightened female vulnerability to collision-related injury which have been extensively studied: concussions, and anterior cruciate ligament injuries.

A. Concussions

58. Females are more likely than males to suffer concussions in comparable sports, and on average suffer more severe and longer lasting disability once a concussion does occur. (Harmon 2013 at 4; Berz 2015; Blumenfeld 2016; Covassin 2003; Rowson 2016.) Females also seem to be at higher risk for post-concussion syndrome than males. (Berz 2015; Blumenfeld 2016; Broshek 2005; Colvin 2009; Covassin 2012; Dick 2009; Marar 2012; Preiss-Farzanegan 2009.)

59. The most widely-accepted definition of sport-related concussion comes from the Consensus Statement on Concussion in Sport (see below).[17] (McCrory 2018.) To

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[17] "Sport related concussion is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilised in clinically defining the nature of a concussive head injury include:
SRC may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head.

SRC typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours.

SRC may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.

summarize, concussion is "a traumatically induced transient disturbance of brain function and involves a complex pathophysiological process" that can manifest in a variety of ways. (Harmon 2013 at 1.)

60. Sport-related concussions have undergone a significant increase in societal awareness and concurrent injury reporting since the initial passage of the Zachery Lystedt Concussion Law in Washington State in 2009 (Bompadre 2014), and the subsequent passage of similar legislation governing return-to-play criteria for concussed athletes in most other states in the United States. (Nat'l Cnf. of State Leg's 2018). Concussion is now widely recognized as a common sport-related injury, occurring in both male and female athletes. (CDC 2007.) Sport-related concussions can result from player-surface contact or player-equipment contact in virtually any sport. However, sudden impact via a player-to-player collision, with rapid deceleration and the transmission of linear or rotational forces through the brain, is also a common cause of concussion injury. (Covassin 2012; Marar 2012; Barth 2001; Blumenfeld 2016; Boden 1998; Harmon 2013 at 4.)

61. A large retrospective study of U.S. high school athletes showed a higher rate of female concussions in soccer (79% higher), volleyball (0.6 concussions/10,000 exposures, with 485,000 reported exposures, vs. no

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SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.

The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc) or other comorbidities (e.g., psychological factors or coexisting medical conditions)."

concussions in the male cohort), basketball (31% higher), and softball/baseball (320% higher). (Marar 2012.) A similarly-sized, similarly-designed study comparing concussion rates between NCAA male and female collegiate athletes showed, overall, a concussion rate among females 40% higher than that of males. Higher rates of injury were seen across individual sports as well, including ice hockey (10% higher); soccer (54% higher); basketball (40% higher); and softball/baseball (95% higher). (Covassin 2016.) The observations of these authors, my own observations from clinical practice, and the acknowledgment of our own Society's Position Statement (Harmon 2013), all validate the higher frequency and severity of sport-related concussions in women and girls.

62. Most epidemiological studies to date looking at sport-related concussion in middle schoolers show that more boys than girls are concussed. There are fewer studies estimating concussion *rate.* This is, in part, because measuring injury rate is more time and labor-intensive. Researchers at a childrens' hospital, for example, could analyze the number of children presenting to the emergency department with sport-related concussion and publish findings of absolute number. However, to study concussion incidence, athlete exposures also have to be recorded. Generally speaking, an athlete exposure is a single practice or game where an athlete is exposed to playing conditions that could reasonably supply the necessary conditions for an injury to occur. Rates of athletic injury, concussion among them, are then, by convention, expressed in terms of injury rate per 1000 athletic exposures. More recently, some studies have been published that analyze the rates of concussion in the middle school population. Looking at the evidence, the conclusion can be made that females experience

increased susceptibility to concussive injuries before puberty. For example, Ewing-Cobbs, et al. (2018) found elevated post-concussion symptoms in girls across all age ranges studied, including children between the ages of 4 and 8. Kerr's 2017 study of middle school students showed over three times the rate of female vs male concussion in students participating in sex-comparable sports [0.18 v. 0.66/1000 A.E.'s]. (Kerr 2017.) This is the first study I am aware of that mimics the trends seen in adolescent injury epidemiology showing a higher rate of concussion in girls than boys in comparable sports.

63. More recent research looking at the incidence of sport-related concussions in U.S. middle schoolers between 2015 and 2020, found that the rate of concussion was higher in middle school athletes than those in high school. In this study, girls had more than twice the rate of concussion injury (0.49/1000 athletic exposures vs 0.23/1000 AE) in analyzed sports (baseball/softball, basketball, soccer and track), as well as statistically greater time loss. (Hacherl 2021 (Journal of Athletic Training); Hacherl 2021 (Archives of Clinical Neuropsychology).) The authors hypothesized that the increasing incidence of concussion in middle school may relate to "other distinct differences associated with the middle school sport setting itself, such as, the large variations in player size and skill."[18]

64. In addition, females on average suffer materially greater cognitive impairment than males when they do suffer a concussion. Group differences in cognitive impairment between females and males who have suffered concussion have been extensively studied. A study of 2340 high school and collegiate athletes who suffered

[18] https://www.nata.org/press-release/062421/middle-school-sports-have-overall-higher-rate-concussion-reported-high-school.

concussions determined that females had a 170% higher frequency of cognitive impairment following concussions, and that in comparison with males, female athletes had significantly greater declines in simple and complex reaction times relative to their preseason baseline levels. Moreover, the females experienced greater objective and subjective adverse effects from concussion even after adjusting for potentially protective effect of helmets used by some groups of male athletes. (Broshek 2005 at 856, 861; Colvin 2009; Covassin 2012.)

65. This large discrepancy in frequency and severity of concussion injury is consistent with my own observations across many years of clinical practice. The large majority of student athletes who have presented at my practice with severe and long-lasting cognitive disturbance have been adolescent girls. I have seen girls remain symptomatic for over a year, and lose ground academically and become isolated from their peer groups due to these ongoing symptoms. For patients who experience these severe effects, post-concussion syndrome can be life-altering.

66. Some of the anatomical and physiological differences that we have considered between males and females help to explain the documented differences in concussion rates and in symptoms between males and females. (Covassin 2016; La Fountaine 2019; Lin 2019; Tierney 2005; Wunderle 2014.) Anatomically, there are significant sex-based differences in head and neck anatomy, with females exhibiting in the range of 30% to 40% less head-neck segment mass and neck girth, and 49% lower neck isometric strength. This means that when a female athlete's head is subjected to the same load as an analogous male, there will be a greater tendency for head

acceleration, and resultant injury. (Tierney 2005 at 276-277.)

67. When modeling the effect of the introduction of male mass, speed, and strength into women's rugby, World Rugby gave particular attention to the resulting increases in forces and acceleration (and injury risk) experienced in the head and neck of female players. Their analysis found that "the magnitude of the known risk factors for head injury are . . . predicted by the size of the disparity in mass between players. The addition of [male] speed as a biomechanical variable further increases these disparities," and their model showed an increase of up to 50% in neck and head acceleration that would be experienced in a typical tackle scenario in women's rugby. As a result, "a number of tackles that currently lie beneath the threshold for injury would now exceed it, causing head injury." (World Rugby Transgender Women Guidelines 2020.) While rugby is notoriously contact-intensive, similar increases to risk of head and neck injury to women are predictable in any sport context in which males and females collide at significant speed, as happens from time to time in sports including soccer, softball, and basketball.

68. In addition, even when the heads of female and male athletes are subjected to identical accelerative forces, there are sex-based differences in neural anatomy and physiology, cerebrovascular organization, and cellular response to concussive stimuli that make the female more likely to suffer concussive injury, or more severe concussive injury. For instance, hypothalamic-pituitary disruption is thought to play a role in post-concussion symptomatology that differentially impacts women. (McGroarty 2020; Broshek 2005 at 861.) Another study found that elevated progesterone levels during one portion of the menstrual cycle were associated with more

severe post-concussion symptomatology that differentially impacted women. (Wunderle 2014.)

69. As it stands, when females compete against each other, they already have higher rates of concussive injury than males, across most sports. The addition of biologically male athletes into women's contact sports will inevitably increase the risk of concussive injury to girls and women, for the multiple reasons I have explained above, including, but not limited to, the innate male advantage in speed and lean muscle mass. Because the effects of concussion can be severe and long-lasting, particularly for biological females, we can predict with some confidence that if participation by biological males in women's contact sports based on gender identity becomes more common, more biological females will suffer substantial concussive injury and the potential for long-term harm as a result.

B. Anterior Cruciate Ligament injuries

70. The Anterior Cruciate Ligament ("ACL") is a key knee stabilizer that prevents anterior translation of the tibia relative to the femur and also provides rotatory and valgus knee stability.[19] (Lin 2019 at 4.) Girls and women are far more vulnerable to ACL injuries than are boys and men. The physics of injury that we have reviewed above makes it inevitable that the introduction of biologically male athletes into the female category will increase still further the occurrence of ACL injuries among girls or women who encounter these players on the field.

71. Sports-related injury to the ACL is so common that it is easy to overlook the significance of it. But it is by no means a trivial injury, as it can end sports careers, require

[19] Valgus force at the knee is a side-applied force that gaps the medial knee open.

surgery, and usually results in early-onset, post-traumatic osteoarthritis, triggering long-term pain and mobility problems later in life. (Wang 2020.)

72. Even in the historic context in which girls and women limit competition to (and so only collide with) other girls and women, the rate of ACL injury is substantially higher among female than male athletes. (Flaxman 2014; Lin 2019; Agel 2005.) One meta-analysis of 58 studies reports that female athletes have a 150% relative risk for ACL injury compared with male athletes, with other estimates suggesting as much as a 300% increased risk. (Montalvo 2019; Sutton 2013.) Particularly in those sports designated as contact sports, or sports with frequent cutting and sharp directional changes (basketball, field hockey, lacrosse, soccer), females are at greater risk of ACL injury. In basketball and soccer, this risk extends across all skill levels, with female athletes between two and eight times more likely to sustain an ACL injury than their male counterparts. (Lin 2019 at 5.) These observations are widely validated, and consistent with the relative frequencies of ACL injuries that I see in my own practice.

73. When the reasons underlying the difference in the incidence of ACL injury between males and females were first studied in the early 1990s, researchers speculated that the difference might be attributable to females' relative inexperience in contact sports, or to their lack of appropriate training. However, a follow-up 2005 study looking at ACL tear disparities reported that, "Despite vast attention to the discrepancy between anterior cruciate ligament injury rates between men and women, these differences continue to exist." (Agel 2005 at 524.) Inexperience and lack of training do not explain the

differences. Sex seems to be an independent predictor of ACL tear risk.

74. In fact, as researchers have continued to study this discrepancy, they have determined that multiple identifiable anatomical and physiological differences between males and females play significant roles in making females more vulnerable to ACL injuries than males. (Flaxman 2014; Lin 2019; Wolf 2015.) Summarizing the findings of a number of separate studies, one researcher recently cited as anatomical risk factors for ACL injury smaller ligament size, decreased femoral notch width, increased posterior-inferior slope of the lateral tibia plateau, increased knee and generalized laxity, and increased body mass index (BMI). With the exception of increased BMI, each of these factors is more likely to occur in female than male athletes. (Lin 2019 at 5.) In addition, female athletes often stand in more knee valgus (that is, in a "knock-kneed" posture) due to wider hips and a medially-oriented femur. Often, this is also associated with a worsening of knee valgus during jump landings. The body types and movement patterns associated with these valgus knee postures are more common in females and increase the risk for ACL tear. (Hewett 2005.)

75. As with concussion, the cyclic fluctuation of sex-specific hormones in women is also thought to be a possible risk factor for ACL injury. Estrogen acts on ligaments to make them more lax, and it is thought that during the ovulatory phase of menses (when estrogen levels peak), the risk of ACL tear is higher. (Chidi-Ogbolu 2019 at 1; Herzberg 2017.)

76. Whatever the factors that increase the injury risk for ACL tears in women, the fact that a sex-specific

difference in the rate of ACL injury exists is well established and widely accepted.

77. Although non-contact mechanisms are the most common reason for ACL tears in females, tears related to contact are also common, with ranges reported across multiple studies of from 20%-36% of all ACL injuries in women. (Kobayashi 2010 at 672.) For example, when a soccer player who is kicking a ball is struck by another player in the lateral knee of the stance leg, medial and rotational forces can tear the medial collateral ligament (MCL), the ACL, and the meniscus. Thus, as participation in the female category based on identity rather than biology becomes more common (entailing the introduction of athletes with characteristics such as greater speed and lean muscle mass), and as collision forces suffered by girls and women across the knee increase accordingly, the risk for orthopedic injury and in particular ACL tears among impacted girls and women will inevitably rise.

78. Of course there exists variation in all these factors within a given group of males or females. However, it is also true that within sex-specific pools, size differential is somewhat predictable and bounded, even considering outliers. When males are permitted to enter into the pool of female athletes based on gender identity rather than biological sex, there is an increased possibility that a statistical outlier in terms of size, weight, speed, and strength—and potentially an extreme outlier—is now entering the female pool. Although injury is not guaranteed, risks to female participants will increase. And as I discuss later, the available evidence together suggests that this will be true even with respect to males who have been on testosterone suppression for a year or more. World Rugby relied heavily upon this when they were determining their own policy, and I think it is important

to reiterate that this policy, rooted in concern for athlete safety, is justifiable based upon current evidence from medical research and what we know about biology.

VII. TESTOSTERONE SUPPRESSION WILL NOT PREVENT THE HARM TO FEMALE SAFETY IN ATHLETICS

79. A recent editorial in the New England Journal of Medicine opined that policies governing transgender participation in female athletics "must safeguard the rights of all women—whether cisgender or transgender." (Dolgin 2020.) Unfortunately, the physics and medical science reviewed above tell us that this is not practically possible. If biological males are given a "right" to participate in the female category based on gender identity, then biological women will be denied the right to reasonable expectations of safety and injury risk that have historically been guaranteed by ensuring that females compete (and collide) only with other females.

80. Advocates of unquestioning inclusion based on gender identity often contend that hormonal manipulation of a male athlete can feminize the athlete enough that he is comparable with females for purposes of competition. The NCAA's Office of Inclusion asserts (still accessible on the NCAA website as of this writing) that "It is also important to know that any strength and endurance advantages a transgender woman arguably may have as a result of her prior testosterone levels dissipate after about one year of estrogen or testosterone suppression therapy."[20] (NCAA 2011 at 8.) Whether or not this is true is a critically important question.

[20] https://www.ncaa.org/sports/2016/3/2/lesbian-gay-bisexual-transgender-and-questioning-lgbtq.aspx

81. At the outset, we should note that while advocates sometimes claim that testosterone suppression *can* eliminate physiological advantages in a biological male, none of the relevant transgender eligibility policies that I am aware of prior to 2021 requires any demonstration that it has *actually* achieved that effect in a particular male who seeks admission into the female category. The Connecticut policy that is currently at issue in ongoing litigation permits admission to the female category at the high school level without requiring any testosterone suppression at all. Prior to their new policy, just announced in January 2022, the NCAA's policy required no demonstration of any reduction of performance capability, change in weight, or regression of any other physical attribute of the biological male toward female levels. It did not require achievement of any particular testosterone level, and did not provide for any monitoring of athletes for compliance. Moving forward, through a phasing process, the NCAA will ultimately require athletes in each sport to meet requirements of their sport's national governing body (NGB). If no policy exists, the policy of that sport's international governing body applies, or, finally, if no policy exists there, the 2015 policy of the International Olympic Committee (IOC) will apply. The 2015 IOC policy requires no showing of any diminution of any performance capability or physical attribute of the biological male, and requires achievement and compliance monitoring only of a testosterone level below 10nmol/liter—a level far above levels occurring in normal biological females (0.06 to 1.68 nmol/L).[21] Indeed, female athletes with polycystic ovarian disorder—a condition that results in elevated testosterone levels—

[21] Normal testosterone range in a healthy male averages between 7.7 and 29.4 nmol/L.

rarely exceed 4.8 nmol/L, which is the basis for setting the testing threshold to detect testosterone *doping* in females at 5.0 nmol/L. Thus, males who qualify under the 2015 IOC policy to compete as transgender women may have testosterone levels—even after hormone suppression—double the level that would disqualify a biological female for doping with testosterone.[22]

82. As Dr. Emma Hilton has observed, the fact that there are over 3000 sex-specific differences in skeletal muscle alone makes the hypothesis that sex-linked performance advantages are attributable solely to current circulating testosterone levels improbable at best. (Hilton 2021 at 200-01.)

83. In fact, the available evidence strongly indicates that no amount of testosterone suppression can eliminate male physiological advantages relevant to performance and safety. Several authors have recently reviewed the science and statistics from numerous studies that demonstrate that one year (or more) of testosterone suppression does not substantially eliminate male performance advantages. (Hilton 2021; De Varona 2021; Harper 2021.) As a medical doctor, I will focus on those specific sex-based characteristics of males who have undergone normal sex-determined pubertal skeletal growth and maturation that are relevant to the *safety* of female athletes. Here, too, the available science tells us

[22] In November 2021, the IOC released new guidelines, deferring decision-making about a given sport's gender-affectedness to its governing body. The current NCAA policy, however, still utilizes the 2015 IOC policy to determine an athlete's eligibility in event that the sport's national and international governing bodies lack policies to determine eligibility.

that testosterone suppression does not eliminate the increased risk to females or solve the safety problem.

84. The World Rugby organization reached this same determination based on the currently available science, concluding that male physiological advantages that "create risks [to female players] appear to be only minimally affected" by testosterone suppression. (World Rugby Transgender Women Guidelines 2020.)

85. Surprisingly, so far as public information reveals, the NCAA's Committee on Competitive Safeguards is not monitoring and documenting instances of transgender participation on women's teams for purposes of injury reporting. In practice, the NCAA is conducting an experiment which in theory predicts an increased frequency and severity of injuries to women in contact sports, while at the same time failing to collect the relevant data from its experiment.

86. In their recent guidelines, UK Sport determined that, "based upon current evidence, testosterone suppression is unlikely to guarantee fairness between transgender women and natal females in gender-affected sports." (UK Sports Councils' Equality Group Guidance 2021 at 7.) They also warned that migration to a scenario by NGBs where eligibility is determined through case-by-case assessment "is unlikely to be practical nor verifiable for entry into gender-affected sports," in part because "many tests related to sports performance are volitional," and incentives on the part of those tested would align with intentional poor performance. (UK Sports Councils' Equality Group Guidance 2021 at 8.)

87. Despite these concerns, this appears to be exactly the route that the IOC is taking, as reflected in their Framework on Fairness, Inclusion and Non-

Discrimination on the Basis of Gender Identity, released in November of 2021.[23] In it, the IOC lists two disparate goals. First, that "where sports organizations elect to issue eligibility criteria for men's and women's categories for a given competition, they should do so with a view to … [p]roviding confidence that no athlete within a category has an unfair and disproportionate competitive advantage … [and] preventing a risk to the physical safety of other athletes." (IOC Framework 2021 § 4.1.) At the same time, governing bodies are not to preclude any athlete from competing until evidence exists based upon "robust and peer-reviewed research that . . . demonstrates a consistent, unfair, disproportionate competitive advantage in performance and/or an unpreventable risk to the physical safety of other athletes" — research moreover that "is largely based on data collected *from a demographic group that is consistent in gender and athletic engagement with the group that the eligibility criteria aim to regulate.*" (IOC Framework 2021 § 6.1) Finally, affected athletes may appeal any evidence-based decision-making process through a further "appropriate internal mediation mechanism, such as a Court of Arbitration for Sport." (IOC Framework 2021 § 6.1.) Rather than cite any of the growing evidence that testosterone suppression cannot mitigate sex-based performance differences, the IOC's new policy remains aspirational and opaque. And yet the research relating to hormonal suppression in transgender athletes, as confirmed by World Rugby and UK Sport, already speaks

[23] The IOC Framework on Fairness, Inclusion and Non-Discrimination on the Basis of Gender Identity and Sex Variations is available at https://stillmed.olympics.com/media/Documents/News/2021/11/I0C-Framework-Fairness-Inclusion-Non-discrimination-2021.0f?_ga=2.72651665.34591192.1645554375-759350959.1644946978

very clearly to the fact that males retain a competitive advantage over women that cannot be eliminated through testosterone suppression alone. What follows is a brief summary of some of these retained differences as they relate to sport safety.

A. Size and weight

88. Males are, on average, larger and heavier. As we have seen, these facts alone mean that males bring more kinetic energy into collisions, and that lighter females will suffer more abrupt deceleration in collisions with larger bodies, creating heightened injury risk for impacted females.

89. I start with what is obvious and so far as I am aware undisputed—that after the male pubertal growth spurt, suppression of testosterone does not materially *shrink* bones so as to eliminate height, leverage, performance, and weight differences that follow from simply having longer, larger bones, and being subsequently taller.

90. In addition, multiple studies have found that testosterone suppression may modestly reduce, but does not come close to eliminating the male advantage in muscle mass and lean body mass, which together contribute to the greater average male weight. Researchers looking at transitioning adolescents found that the weight of biological male subjects *increased* rather than decreased after treatment with an antiandrogen testosterone suppressor. (Tack 2018.) In one recent meta-analysis, researchers looking at the musculoskeletal effects of hormonal transition found that even after males had undergone 36 months of therapy, their lean body mass and muscle area remained above those of females. (Harper 2021.) Another group in 2004 studied the effects of testosterone suppression to less than

1 nmol/L in men after one or more years, but still found only a 12% total loss of muscle area by the end of thirty-six months. (Gooren 2004.)

B. Bone density

91. Bone mass (which includes both size and density) is maintained over *at least* two years of testosterone suppression (Singh-Ospina 2017; Fighera 2019), and one study found it to be preserved even over a median of 12.5 years of suppression (Hilton 2021; Ruetsche 2005).

C. Strength

92. A large number of studies have now observed minimal or no reduction in strength in male subjects following testosterone suppression. In one recent meta-analysis, strength loss after twelve months of hormone therapy ranged from negligible to 7%. (Harper 2021.) Given the baseline male strength advantage in various muscle groups of from approximately 25% to 100% above female levels that I have noted in Section V.D above, even a 7% reduction leaves a large retained advantage in strength. Another study looking at handgrip strength—which is a proxy for general strength—showed a 9% loss of strength after two years of hormonal treatment in males who were transitioning, leaving a 23% retained advantage over the female baseline. (Hilton 2021.) Yet another study which found a 17% retained grip strength advantage noted that this placed the median of the group treated with hormone therapy in the 95th percentile for grip strength among age-matched females. (Scharff 2019.) Researchers looking at transitioning adolescents showed no loss of grip strength after hormone treatment. (Tack 2018.)

93. One recent study on male Air Force service members undergoing transition showed that they

retained more than two thirds of pretreatment performance advantage over females in sit-ups and push-ups after between one and two years of testosterone-reducing hormonal treatment. (Roberts 2020.) Another recently-published observational cohort study looked at thigh strength and thigh muscle cross-sectional area in men undergoing hormonal transition to transgender females. After one year of hormonal suppression, this group saw only a 4% decrease in thigh muscle cross-sectional area, and a negligible decrease in thigh muscle strength. (Wiik 2020.) Wiik and colleagues looked at isokinetic strength measurements in individuals who had undergone at least 12 months of hormonal transition and found that muscle strength was comparable to baseline, leaving transitioned males with a 50% strength advantage over reference females. (Wiik 2020.) Finally, one cross-sectional study that compared men who had undergone transition at least three years prior to analysis, to age-matched, healthy males found that the transgender individuals had retained enough strength that they were still outside normative values for women. This imbalance continued to hold even after *eight* years of hormone suppression. The authors also noted that since males who identify as women often have lower baseline (i.e., before hormone treatment) muscle mass than the general population of males, and since baseline measures for this study were unavailable, the post-transition comparison may actually represent an overestimate of muscle mass regression in transgender females. (Lapauw 2008; Hilton 2021.)

94. World Rugby came to the same conclusion based on its own review of the literature, reporting that testosterone suppression "does not reverse muscle size to female levels," and in fact that "studies assessing [reductions in] mass, muscle mass, and/or strength

suggest that reduction in these variables range between 5% and 10%. Given that the typical male vs female advantages range from 30% to 100%, these reductions are small." (World Rugby Transgender Women Guidelines 2020.)

95. It is true that most studies of change in physical characteristics or capabilities over time after testosterone suppression involve untrained subjects rather than athletes, or subjects with low to moderate training. It may be assumed that all of the Air Force members who were subjects in the study **I** mention above were physically fit and engaged in regular physical training. But neither that study nor those studies looking at athletes quantify the volume or type of strength training athletes are undergoing. The important point to make is that the only effect strength training could have on these athletes is to *counteract* and reduce the limited loss of muscle mass and strength that does otherwise occur to some extent over time with testosterone blockade. There has been at least one study that illustrates this, although only over a short period, measuring strength during a twelve-week period where testosterone was suppressed to levels of 2 nmol/L. During that time, subjects actually increased leg lean mass by 4%, and total lean mass by 2%, and subject performance on the 10 rep-max leg press improved by 32%, while their bench press performance improved by 17%. (Kvorning 2006.)

96. The point for safety is that superior strength enables a biological male to apply greater force against an opponent's body during body contact, or to throw, hit, or kick a ball at speeds outside the ranges normally encountered in female-only play, with the attendant increased risks of injury that I have already explained.

D. Speed

97. As to speed, the study of transitioning Air Force members found that these males retained a 9% running speed advantage over the female control group after one year of testosterone suppression, and their average speed had not declined significantly farther by the end of the 2.5 year study period. (Roberts 2020.) Again, I have already explained the implications of greater male speed on safety for females on the field and court, particularly in combination with the greater male body weight.

CONCLUSION

Since the average male athlete is larger and exerts greater power than the average female athlete in similar sports, male—female collisions will produce greater energy at impact, and impart greater risk of injury to a female, than would occur in most female-female collisions. Because of the well-documented physiological testing and elite performance differences in speed and strength, as well as differences in lean muscle mass that exist across all age ranges, the conclusions of this paper can apply to a certain extent before, as well as during, and after puberty. We have seen that males who have undergone hormone therapy in transition toward a female body type nevertheless retain musculoskeletal "legacy" advantages in muscle girth, strength, and size. We have also seen that the additive effects of these individual advantages create multiplied advantages in terms of power, force generation and momentum on the field of play. In contact or collision sports, sports involving projectiles, or sports where a stick is used to strike something, the physics and physiology reviewed above tell us that permitting male-bodied athletes to compete against, or on the same team as females—even when undergoing testosterone suppression—must be expected to create predictable, identifiable, substantially increased, and unequal risks of injuries to the participating women.

Based on its independent and extensive analysis of the literature coupled with injury modeling, World Rugby recognized the inadequacy of the International Olympic Committee's policy to preserve safety for female athletes in their contact sport (the NCAA policy is even more lax in its admission of biological males into the female category). Among the explicit findings of the World Rugby working group were the following:

- Forces and inertia faced by a smaller and slower player during collisions are significantly greater when in contact with a larger, faster player.
- Discrepancies in mass and speed (such as between two opponents in a tackle) are significant determinants of various head and other musculoskeletal injury risks.
- The risk of injury to females is increased by biological males' greater ability to exert force (strength and power), and also by females' reduced ability to receive or tolerate that force.
- Testosterone suppression results in only "small" reductions in the male physiological advantages. As a result, heightened injury risks remain for females who share the same field or court with biological males.
- These findings together predict a significant increase in injury rates for females in rugby if males are permitted to participate based on gender identity, *with or without testosterone suppression,* since the magnitude of forces and energy transfer during collisions will increase substantially, directly correlated to the differences in physical attributes that exist between the biological sexes.

Summarizing their work, the authors of the World Rugby Guidelines said that, "World Rugby's number one stated priority is to make the game as safe as possible, and so World Rugby cannot allow the risk to players to be increased to such an extent by allowing people who have the force and power advantages conferred by testosterone to play with and against those who do not." (World Rugby Transgender Guidelines 2020.) As my own analysis above makes clear, I agree with the concerns of UK Sport and the conclusions of World Rugby regarding risk to female athletes. Importantly, I also agree that it must be a high priority for sports governing bodies (and other regulatory or governmental bodies governing sports) to make each sport as safe as reasonably possible. And in my view, medical practitioners with expertise in this area have an obligation to advocate for science-based policies that promote safety.

The *performance* advantages retained by males who participate in women's sports based on gender identity are readily recognized by the public. When an NCAA hurdler who ranked 200th while running in the collegiate male division transitions and immediately leaps to a number one ranking in the women's division;[24] when a high school male sprinter who ranked 181st in the state running in the boys' division transitions and likewise takes first place in the girls' division (De Varona 2021), the problem of fairness and equal opportunities for girls and women is immediately apparent, and indeed this problem is being widely discussed today in the media.

The causes of sports injuries, however, are multivariate and not always as immediately apparent. While, as I have noted, some biological males have indeed

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[24] https://en.wikipedia.org/wiki/Cece_Telfer (accessed 6/20/21)

competed in a variety of girls' and women's contact sports, the numbers up till now have been small. But recent studies have reported very large increases in the number of children and young people identifying as transgender compared to historical experience. For example, an extensive survey of 9th and 11th graders in Minnesota found that 2.7% identified as transgender or gender-nonconforming— well over 100 times historical rates (Rider 2018), and many other sources likewise report this trend.[25]

Faced with this rapid social change, it is my view as a medical doctor that policymakers have an important and pressing duty not to wait while avoidable injuries are inflicted on girls and women, but instead to proactively establish policies governing participation of biological males in female athletics that give proper and scientifically-based priority to safety in sport for these girls and women. Separating participants in contact sports based on biological sex preserves competitive equity, but also promotes the safety of female athletes by protecting them from predictable and preventable injury. Otherwise, the hard science that I have reviewed in this white paper leaves little doubt that eligibility policies based on ideology or gender identity rather than science, will, over time, result in increased, and more serious, injuries to girls and women who are forced to compete against biologically male transgender athletes. When basic science and physiology both predict increased injury, then leagues, policy-makers, and legislators have a

[25]https://www.nytimes.com/2016/07/01/health/transgender-population .html?.?mc=aud_dev&ad-keywords=auddevgate&gclid= CjOKCQjwkZiFBhD9ARIsAGxFX8BV5pozB9LI5Ut570QzuMhu rWThvBMisV9NyN9YTXIzW170AnGT6VkaAuOjEALw_wcB&gclsrc=aw.ds (accessed 6/20/21)

responsibility to act to protect girls and women before they get hurt.

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APPENDIX - LIST OF PUBLICATIONS

Publications of Dr. Chad Thomas Carlson, M.D., FACSM

Sports Medicine CAQ Study Guide, Healthy Learning, 2021 [editor].

SEXUAL VIOLENCE IN SPORT: AMERICAN MEDICAL SOCIETY FOR SPORTS MEDICINE POSITION STATEMENT. Published in Curr Sports Med Reports June 2020;19(6):232-4; Clin J Sports Med June 8 2020; Br J Sports Med 2020;0:1-3.

Traveling with Medication. NCAA Sports Science Institute Bulletin, 2015 http://www.ncaa.org/sport-science-institute/traveling-medication.

A SURVEY OF STATE MEDICAL LICENSING BOARDS: CAN THE

TRAVELING TEAM PHYSICIAN PRACTICE IN YOUR STATE? 2013. Jan (47)1:60-62.

AXIAL BACK PAIN IN THE ATHLETE: PATHOPHYSIOLOGY AND

APPROACH TO REHABILITATION. Curr Rev Musculoskel Med. 2009 (2):88-93.

THE NATURAL HISTORY AND MANAGEMENT OF HAMSTRING INJURIES. Curr Rev Musculoskel Med 2008 (1):120-128.

SPONDYLOLYSIS AND THE ATHLETE. Athletic Ther Today. 2007 (12)4:3739.

“ACUTE SUBDURAL HEMATOMA IN A HIGH SCHOOL FOOTBALL PLAYER,” J Athl Training, 38;2(63), 2003.

THE RELATIONSHIP OF EXCESSIVE WEIGHT LOSS TO PERFORMANCE IN HIGH SCHOOL WRESTLERS - A PILOT STUDY; presented at the AMSSM national meeting, San Diego, CA, 2000; Clinical Journal of Sport Medicine 10(4):310, October, 2000.

CURRICULUM VITAE (ABBREVIATED)

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6000 University Ave.
Suite 250
West Des Moines, IA, 50266
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Active professional licenses: IA, NE, CA, TX, TN, NC, AZ, FL (telemed)

Board certified family medicine, ABMS 1998; recertified 2005, 2012

Board certified sports medicine, ABMS 1999; recertified 2009, 2019

<u>EDUCATION:</u>

- Fellowship: Sports Medicine -- Ball Memorial Hospital/Central Indiana Orthopedics, 1997-1999; Completed 4/99
- Residency: University of Michigan Department of Family Medicine,1994-97
- University of Nebraska College of Medicine M.D. obtained May 1994
- University of Nebraska at Lincoln

- B.S. with majors in history (emphasis American) and biology obtained May 1990

EMPLOYMENT HISTORY:

- Physician Owner, Stadia Sports Medicine, West Des Moines, IA, 2006 - present
- Staff Physician, University of Illinois, 9/04-6/06
- Director, Carle Sports Medicine, Carle Foundation Hospital, Urbana, IL, 2001-2004; Team physician, University of Illinois.
- Private practice, Ionia County Hospital, Ionia, MI, 1999-2001.

HOSPITAL AFFILIATIONS:

- Iowa Methodist Hospital, Des Moines
- Mercy Medical Center, Des Moines

PROFESSIONAL HONORS/AWARDS:

- Appointed to Board of Directors, Physical Activity Alliance, 2020
- Appointed to joint AMSSM/NCAA COVID-19 Working Group, March 2020-present
    - Medical advisory panel, 2021 Women's Division I NCAA Basketball Tournament
- AMSSM Founders Award 2019, awarded once annually for the Sports Medicine Physician nationally who best exemplifies the practice of Sports Medicine
- Fellow designation, American Medical Society for Sports Medicine, 2019
- Elected to Executive Committee, American Medical Society for Sports Medicine, 2017-21
    - **President of AMSSM, 2019-2020**

- Practice/Policy Committee, AMSSM, 2007-2016 (Former Chair)
    - Author of US HR 921, the Sports Medicine Licensure Clarity Act, which passed the US House of Representatives and Senate in January 2017, and was signed into law by President Trump, 2017
- Appointed member of physician liaison group to the NCAA to discuss return to sport strategies in the COVID-19 pandemic, 2020
- Appointed to Board of Directors, Running the Race, 2018-present
- Sports Ultrasound Committee, Policy Co-Chair, AMSSM, 2015-2017
- Elected to Board of Directors, American Medical Society for Sports Medicine, 2009-2013.
- Member, Health and Science Policy Committee, ACSM, 2010-present
    - Chair, Clinical Medicine Subcommittee, HSPC, ACSM, 2012-2015
- Iowa Medical Society Leadership Development Committee, 2022
- Member of Sports Medicine Subcommittee for the Iowa State Medical Society, 2007-present
    - Iowa designate to National Youth Sports Safety Summit
        - New York City — 2015
        - Indianapolis — 2016

    - Kansas City — 2017

- AMSSM designate for the American Academy of Orthopaedic Surgeons' Knee Osteoarthritis Quality Measure review committee, 2014-2016
- Associate Editor, Current Reviews in Musculoskeletal Medicine, 2006-2010.
- Fellow, American College of Sports Medicine: Designated in 2004

SPECIAL QUALIFICATIONS:

- Prior legal consulting work in cases with both local and national reach
- Extensive training in office musculoskeletal injury
- Oversight of treadmill stress testing/metabolic stress testing
- Independent consultation regarding establishment of individual exercise programs consistent with revised ACSM guidelines
- Proficient at evaluation/management of bone mineral density problems at all ages
- Qualified procedurally for:

  Ultrasound diagnostic testing and guided injections

  Joint injection/aspiration

  Percutaneous tenotomy (TENEX) Rotator cuff barbotage

  Lactate/Anaerobic threshold, VO2mAx/ exercise testing

  Laryngoscopy for vocal cord assessment

  Compartment pressure assessment

Ultrasound-guided nerve blocks

- Extensive experience speaking to large national groups on issues pertaining to sports medicine, including, but not limited to:
    - Overuse Injury
    - Head and Neck Injuries on the Field
    - Exercise-Induced Asthma
    - The Shoulder Exam
    - Principles of Exercise Prescription
    - Traumatic Brain Injury in Sport
    - The Knee Exam
    - The Ankle Exam
    - The Hip Exam
    - The Pre-Participation Exam
    - Cardiopulmonary Exercise Testing for Determination of Training Zone Estimates and to Identify Causes of Exercise-Related Dyspnea
    - Athletic Amenorrhea
    - Advocacy in Sports Medicine
    - Medical Practice Economics

PUBLICATIONS/RESEARCH:

- Sports Medicine CAQ Study Guide, Healthy Learning, Monterey, CA. 2021.[editor].
- AXIAL BACK PAIN IN THE ATHLETE: PATHOPHYSIOLOGY AND APPROACH TO

REHABILITATION. Curr Rev Musculoskel Med. 2009 (2):88-93

- SPONDYLOLYSIS AND THE ATHLETE. Athletic Ther Today. 2007 (12)4:37-39.
- THE NATURAL HISTORY AND MANAGEMENT OF HAMSTRING INJURIES. Curr Rev Musculoskel Med 2008 (1):120-128.
- A SURVEY OF STATE MEDICAL LICENSING BOARDS: CAN THE TRAVELING TEAM PHYSICIAN PRACTICE IN YOUR STATE? BJSM. 2013. Jan (47)1:60-62.
- SEXUAL VIOLENCE IN SPORT: AMERICAN MEDICAL SOCIETY FOR SPORTS MEDICINE POSITION STATEMENT
    - Curr Sports Med Reports June 2020;19(6):232-4.
    - Clin J Sports Med June 8 2020;
    - Br J Sports Med 2020;0:1-3
- "ACUTE SUBDURAL HEMATOMA IN A HIGH SCHOOL FOOTBALL PLAYER," J Athl Training, 38;2(63), 2003
- Traveling with Medication. NCAA Sports Science Institute Bulletin, 2015 http://www.ncaa.org/sport-science-institute/traveling-medication
- THE RELATIONSHIP OF EXCESSIVE WEIGHT LOSS TO PERFORMANCE IN HIGH SCHOOL WRESTLERS — A PILOT STUDY; presented at the AMSSM national meeting, San Diego, CA, 2000 Clinical Journal of Sport Medicine 10(4):310, October, 2000