

Sex Determination in Humans

Background, National Curriculum links and suggested aims

This lesson is intended for use when teaching about sex determination to Years 10-11. It has been written for use in a Biology lesson.

Teacher background knowledge

No special background knowledge required for a Biology teacher and virtually none for any teacher, whatever their specialism (see 'Student background knowledge' below). What is more important is a realisation that the standard story of sex determination is a simplification. It is a simplification that holds pretty well for the large majority of humans but not for all. Given how important issues of our sex are for just about all of us in terms of our identity, it is important that teachers are sensitive and keep in mind that in a class there may be students for whom these issues are of more than academic interest.

Cross-curricular links

There are links to Philosophy (ethics).

Student background knowledge

All students need to know is the standard story that humans have two sex chromosomes in each diploid cell, with females having two X chromosomes and males one X and one Y chromosome. Gametes (eggs and sperm) are haploid (only one set of chromosomes) and therefore either carry an X chromosome or a Y.

Resources and timing

Two lessons of 50 minutes with time in between for students to research issues to do with Caster Semenya.

Activities

1. Students need to realise that the standard story for sex determination (two X chromosomes = females; one X chromosome and one Y chromosome = males), while true for the large majority of people, is an oversimplification. One useful way of looking at the issue is for students to consider, separately, issues to do with (a) chromosomes, (b) physical appearance and (c) how people feel about themselves. *The central point is that sometimes these three do not match up.* There is a certain amount of teaching to do and then students need to talk about such issues, both to get on top of the biology and to clarify and develop their views.

- a. Although the XX/XY sex chromosome story looks clear-cut, there are a number of ways in which things can work out rather differently. For a start, there are occasional situations when someone ends up with just one or more than two sex chromosomes. Women with Turner's syndrome lack part or all of one of their X chromosomes. Women who are XXX have an additional X chromosome. Men who are XXY, XXXY or even XXXXY have Klinefelter syndrome. All such individuals suffer from various medical conditions. Men who are XYY have few or no medical conditions. Then there are various mosaics where some cells in a person have one set of sex chromosomes (e.g. a single X – as in Turner's syndrome) and others have another (e.g. XY, as in a normal male).
- b. Intersex people are individuals who are born with physical characteristics (e.g. their genitalia) that do not fit the normal definition of male and female. They are sometimes said to have 'disorders of sexual development' – though not everyone likes this phrase. You could try asking students how they would feel if they were thus described. Some societies have been tolerant of individuals who cannot straightforwardly be classified as male or female, but in many societies it was thought shameful for parents to have such children. In the case of unusual genitalia – e.g. unusually short penises or unusually large clitorises – it was (indeed, often still is) not uncommon for surgical intervention to take place soon after birth. Quite aside from the issue of some children being brought up as boys when they felt they were girls (or vice versa), there were cases where individuals identified as boys at birth developed breasts and started to menstruate at puberty or, correspondingly, individuals identified as girls at birth started at puberty to develop male characteristics. Students could come up with proposals as to what (if anything) should be done for intersex children and adults.
- c. It is likely that many students will already know something about transgender issues – from the media and, in some cases, from personal experience. The key point is that transgender people have a gender identity that is different from the sex they were assigned at or soon after birth. Unlike intersex people, transgender people typically have conventional sex-specific physical characteristics at birth and only subsequently feel uncomfortable with their assigned sex. Students should think about how old individuals should be before being allowed to be treated medically (hormones, surgery) to help them develop the characteristics of the gender with which they identify. Students can also think about whether it is a good idea or not to classify toilets at school as male and female and whether transwomen (i.e. identified as male at birth) should be allowed to participate in competitive female sports.

2. Caster Semenya is an elite middle-distance runner who has won gold medals at the Olympics and the World Championships. In 2009, she was asked by the IAAF (International Association of Athletics Federations) to take a sex verification test after making the sort of dramatic improvements that usually arouse suspicion of illicit drug use. The results were not made public but it subsequently became widely known that she had unusually high levels of blood testosterone for a woman. These levels were natural in the sense that Caster Semenya took no substances that would lead to such levels. In 2018, the IAAF introduced new regulations for female athletes with such unusually high levels of testosterone; in future, such athletes would have to take medication to reduce their blood testosterone levels. Get students to think about whether this is right or not. They could also think about whether, for example, swimmers with large hands or large feet should be banned from competition. One aim is to help students to develop the quality of their reasoning and argumentation.

Resource links

- Sex chromosome variation in humans:
https://www.who.int/health-topics/gender#tab=tab_1,
https://en.wikipedia.org/wiki/Sex_chromosome_anomalies.
- Intersex issues:
<https://en.wikipedia.org/wiki/Intersex>,
http://www.isna.org/faq/what_is_intersex,
https://www.huffpost.com/entry/intersex-hanne-odiele_n_58875dabe4b096b4a2347790?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAANN-y7fXQrU-AbXMNZvBhl_okUEhZzBWpHtZE6yjLLy58ziEuBOrHz6MEqjchVsPkmI3-gAIMN1L45XBCEI6i8vmmnvn1A0IH0tNxuzWj1l_wFbekY4-d50CVcMyl2UnxpB04EUYCMIYmFCRQ49546Gwo4VAgQcwQv8hlj510pe.
- Transgender issues:
<https://www.stonewall.org.uk/truth-about-trans>,
<https://transequality.org/issues>, https://www.researchgate.net/publication/333404593_Can_evolutionary_thinking_shed_light_on_gender_diversity.
- Caster Semenya:
https://geneticliteracyproject.org/2019/05/15/what-defines-a-female-athlete-law-professor-and-former-runners-case-for-why-caster-semenyas-testosterone-levels-are-critical-in-determining-if-she-should-compete-with-other-women/?mc_cid=b20ad7d5a0&mc_eid=66dc5064c0,

https://theconversation.com/caster-semenya-how-much-testosterone-is-too-much-for-a-female-athlete-116391?utm_medium=email&utm_campaign=Latest%20from%20The%20Conversation%20for%20May%202%202019%20-%201298412108&utm_content=Latest%20from%20The%20Conversation%20for%20May%202%202019%20-%201298412108+CID_3687a1807414dd7b14fbbbb49ff02387&utm_source=campaign_monitor_uk&utm_term=Caster%20Semenya%20how%20much%20testosterone%20is%20too%20much%20for%20a%20female%20athlete,
https://theconversation.com/ten-ethical-flaws-in-the-caster-semenya-decision-on-intersex-in-sport-116448?fbclid=IwAR04Jii2_uLAP0V6fBmjHpi46fqZ8XyBT-MyPhOF5B8m6LOvkJmXxJLMkAc,
https://geneticliteracyproject.org/2019/06/06/exploring-the-solid-rationale-for-separating-elite-male-and-female-athletes-in-competition/?mc_cid=5a77a89dfc&mc_eid=66dc5064c0,
https://en.wikipedia.org/wiki/Caster_Semenya,
<https://www.theguardian.com/sport/caster-semenya>.



Caster Semenya and Alice Schmidt during the 2011 World Athletics championships in Daegu. (Erik van Leeuwen;

https://commons.wikimedia.org/wiki/File:Caster_Semenya_Daegu_2011.jpg)