Transgender Perspectives in the Biology Classroom
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When my spouse told me that they identified as female (they had been assigned male at birth), I did not consider how it would change my practice as a high school biology teacher. However, my spouse’s entrance into the Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, and Asexual (LGBTQIA+) community has significantly changed my teaching approach. This article tells my story as a relatable experience and provides classroom practices to help teachers interact with trans students in a socially just way. I am asking teachers to step away from a pragmatic orientation to a more philosophical one. Teachers care about the best way to teach; this can mean reflecting on our attitudes and the hidden curriculum in our classroom, then changing them for the better. (Hidden curriculum refers to the unwritten, unofficial, and often unintended lessons, values, and perspectives that students learn in school.)

Biology teachers will have more questions about trans people because their content usually includes chromosomal inheritance and sex-linked traits (HS LS3.B, HS LS3.A) (NGSS Lead States 2013). Trans people, and specifically trans students, are the most vulnerable population in the United States. Seventy-five percent of transgender youth feel unsafe at school, have significantly lower GPAs, are more likely to skip school because of safety concerns, and are less likely to plan on continuing their education (Kosciw et al. 2015).

Additionally, Lesbian, Gay, Bisexual, Transgender, Questioning, or Queer (LGBTQ) people are less likely to choose STEM careers. A study by the Institution of Engineering and Technology found that 29% of LGBTQIA+ young people avoided careers in STEM because of fears that they would be discriminated against (McDonald 2018).

Teachers may have diverse feelings about gender identity and gender-complex students (those who are stepping away from societal definitions of gender). Some educators do not believe in the broader definitions of gender for religious reasons. Public school educators may not agree on the choices students make, but we will have transgender students in our classrooms, as well as gender-complex parents and colleagues. People who know my background have asked me to provide guidance in a science teacher-specific context. Before we can make changes in our classroom, we need to listen in an unprejudiced way so that there is heart behind our actions.

Introduction to gender complexities
The long-held notion that students identify as transgender so that they can look at the opposite sex in a locker room is unfounded. To address this idea, we need to introduce some background on gender identity. First, there is “sex assigned at birth,” which is the decision doctors make based on external genitals when a child is born. Since genitalia are private, we do not realize that they can be quite diverse in appearance. Sometimes doctors make difficult decisions, and a child can be assigned something different than their gender identity—this is often labeled “intersex.”

Students may also choose the intersex label based on hormonal differences or internal anatomy. A few medical examples of people having both undescended testes and ovaries are documented, but there is no modern medical documentation of “hermaphrodites” (Schoenhau et al. 2008).

The spectrum of gender identity includes people identifying as male, female, or nonbinary. People can also identify as “agender,” which means they are not on the spectrum and do not identify with any gender. Gender expression involves how individuals communicate their gender to others. Gender expression can be communicated through clothing, makeup, hairstyles, facial hair, and mannerisms; this can also fluctuate and change depending on how the individual feels when figuring out their authentic gender expression. For example, there was a significant discussion in the teachers’ lounge at my school: the perceived threat of a “man with a beard” wearing a dress trying to use the women’s restroom at a sporting event. This person may have been figuring out if they felt comfortable wearing dresses or felt that the beard helped express the masculine part, while the dress helped express the feminine part. When students or colleagues mention or act on harmful stereotypes, it is important to specifically address and counter them. (See Online Resources: Human Rights Commission: Debunking the Myths Transgender Health and Well-Being).

My story
I have always talked with my students about how it is never okay to make fun of someone for what they wear, whether it is a religious symbol, communicates poverty, or represents a different sense of fashion. Similar to national dialogs of cultural and religious wear, clothing that sends different signals about gender should not indicate a threat.

When my now ex-spouse transitioned, it was a difficult experience physically, socially, emotionally, and financially for both of us. In the Mid-
west, therapy sessions cost about $150, and are needed at least twice a month. Electrolysis sessions for facial hair removal were $65 dollars a session and were needed weekly. There was also a complete wardrobe shift. As a middle-class teacher and a secretary who was also responsible for paying for day care, it was difficult to meet these costs.

Students are constrained by similar expenses, although sex hormone blockers can help stop the secondary sex characteristics that adults may want to address. This can include “top” and “bottom” surgery, as well as breast implants, laryngeal shaving, etc. My ex-spouse chose to pursue mastectomy inserts (originally created for women who had a breast removed because of cancer) to create a bust profile. Eventually her hormone regime of estrogen and spironolactone made the inserts unnecessary for her (spironolactone blocks male sex hormone (androgen) receptors and can suppress testosterone production).

During my ex-spouse’s transition, they (the preferred pronoun) attempted suicide. If an older, privileged white person with a master’s degree not only ideates but attempts suicide, it is remarkable that trans teenagers can survive similar societal pressures. I remember many microaggressions during that time. As we shopped for groceries, double takes and stares were common. Cashiers always seemed to make errors at the register—they were distracted and trying to figure out my ex-spouse’s gender and our relationship, while simultaneously taking care of the bill. I remember sudden hushed conversations as we passed by and incredibly difficult conversations with family and coworkers. The stories are endless and shape how I now teach. Please be aware that I am not telling these stories to create the idea that trans people and/or students are victims, or to encourage a deficit mindset in teachers. I am telling these stories to create empathy and reliability so that teachers are moved to action.

What I do now in my classroom

Students
My syllabus offers a statement of support. For example, “I identify as an ally to the lesbian, gay, bisexual, transgender, queer, intersex, and asexual (LGBTQIA) community, and I am available to listen and support you in an affirming manner. Please communicate with me regarding how I can meet and support your needs. Know that your counselors and principals are committed to supporting you.”

I verbally follow up with, “Everybody is different, everyone is unique, and everyone is struggling in their own way. It is important, no matter whatever else, that if a person looks or speaks differently, to always be kind. Always be kind. Treat them how you would want to be treated.” If you do not say it, students will not assume it.

I make a seating chart that has student names from the roster, and then I say, “If your written name is not the one you want me and your classmates to use, please let me know before tomorrow, either after class or through email.” Usually this means changing “Elizabeth” to “Beth,” but this approach gives me a way to correct the list without calling out names and forcing an impromptu correction.

I point out gender assumptions during direct instruction. For example, most students have the misconception that larger mammals are male, and smaller ones are female. For many organisms, it is the opposite—females are larger than males—and we talk about reasons why during the ecology unit. At some point our cultural definitions of gender break down in the biological world.

Some students simply want to “pass” (their gender identity and physical appearance match), as opposed to being “clocked” (physical appearance and gender expression are different to the observer). I never talk about a person’s gender identity or gender expression in class, and I police group interactions so that gender-complex students know they are safe.

If I am unsure about a student’s gender, I ask, “What is your preferred/affirmed pronoun?” Some preferred pronouns may be plural like “They/Theirs” and “Ze/Zirs” (Pan 2018). I make sure to use their preferred pronoun and ensure that other students in the classroom use it. Using the wrong pronoun is a microaggression—a comment or action that subtly and often unconsciously expresses a prejudiced attitude toward a member of a marginalized group. If you do misgender someone and they correct you, simply say “thank you for the correction, I will do better next time,” instead of apologizing. When someone hears constant apologies, they can infer that their gender identity is a weight or a burden.

Parents
Students may or may not be changing clothes when they get to school or before they return home. Parents may be completely unaware of their child’s gender identity and expression, or they can be very supportive and well-informed. It is important to note that parents have gone, or are going through, a grief process of losing the ideas they had for their child related to the sex that was assigned at birth.

At some point parents can begin to see the new possibilities and the exciting reality of their child becoming their more-authentic self. I do make sure to keep parents up-to-date on any symptoms that are indicative of a change in mental health. Once I make contact, a parent will usually reveal what they know.

Colleagues
One of the best questions I have been asked is: “What do you say to a colleague who refuses to use the right pronouns or name for a student?” My
response is: “We teach all kinds of students we fundamentally disagree with, even bullies and bigots. As teachers in public school, we are required to meet students’ needs, not teachers’ pedagogical ideology. This student has made some specific requests and is asking nicely to be treated kindly by meeting those requests.”

The genetics unit
At the beginning of my genetics unit, I specifically talk about the difference between chromosomal identity, and gender identity and expression. This is probably the most significant practice; if gender identity and expression is not discussed, it does not exist to students and that means a student’s identity can be erased, left out, or ignored. This can unintentionally do much damage to students (Miller 2019). Below is how I approach the discussion in my own classroom.

Punnett squares
When I start my lesson on sex-linked traits, I make a point to validate all family structures, including gay and lesbian couples, and reinforce the idea that sex assigned at birth / chromosomal identity may not align to gender identity. Additionally, research shows that gametes can be manipulated, so there are three “parents” of one organism. This is currently used for mitochondrial DNA transfer. (See Online Resources.)

Role of hormones and other factors
Causes of differences of gender identity are multiple and complex; however, a common hypothesis is that during utero development the gene that triggers testosterone (SRY) fails or signals incompletely. The World Health Organization’s Genomic Resource Centre offers a more complete discussion (see Online Resources.)

“Guevedoces” is a term in Spanish that means “penis at 12” and is common in a Dominican Republic community where it is common for “girls” to have a sex assigned at birth as females, but at puberty enough testosterone floods the system for them to grow external male genitalia. There are several videos about the phenomenon that help create empathy, perhaps moving students’ perceptions away from a “choice” narrative (see Online Resources).

Don’t pathologize
Most teachers teach a genetic disorder unit and may discuss trans identity within the context of aneuploidy (Turner’s Syndrome, Klinefelter’s syndrome).

Online Resources

WEBSITES THAT SUPPORT SCIENCE EDUCATORS FOR SOCIAL JUSTICE IN GENDER EXPRESSION:
SEEDS Science Educators for Equity Diversity and Social Justice: http://seedsweb.org/
Gender Inclusive Biology: https://www.genderinclusivebiology.com/

WEBSITES THAT SUPPORT MULTIPLE/DIFFERENT/SPECTRUM GENDERS FOR STUDENT RESEARCH:
Intergender: https://scopeblog.stanford.edu/2015/02/24/sex-biology-redefined-genes-dont-indicate-binary-sexes/
Spectrum: www.nature.com/news/sex-redefined-1.16943#spectrum
Three-Parent Children: www.npr.org/sections/health-shots/2018/06/06/616334508/her-son-is-one-of-the-few-children-to-have-3-parents

WEBSITES AND RESEARCH THAT SPECIFICALLY SUPPORT TRANSGENDER IDENTITY FROM A SCIENTIFIC PERSPECTIVE
Twins example: www.independent.co.uk/life-style/transgender-twins-girl-boy-transition-jack-jace-grafe-monroe-georgia-a8597621.html?fbclid=iwAR22Pog107kMyYhwcWU2a2LH7tJcSj0p0FW8Offhba1dnhWgCfxbV1

GENERAL RESOURCES FOR UNDERSTANDING GENDER COMPLEXITY
The Genderbook (Appropriate for 6th grade and up): www.thegenderbook.com/
Genderbread website (Appropriate for all ages, with student and teacher resources) www.genderbread.org/
Trans Student Educational Resources: www.transstudent.org/
The Gay Lesbian and Straight Education Network: www.glsen.org/
Sex verification testing of athletes: www.hhmi.org/biointeractive/testing-athletes

RESOURCES FOR FUTURE SCIENTISTS
American Society for Engineering Education, promoting LGBTQ equality in STEM education: https://lgbtq.asee.org/
National Organization of Gay and Lesbian Scientists and Technical Professionals: www.noglstp.org/
500 Queer Scientists: www.500queerscientists.com/
Scientists estimate that as many as 1 in 100 people may have a difference/disorder of sex development or DSD (Ainsworth 2015). Examples of this would be a mother who has a majority of XY cells or a grandfather who had abdominal surgery, only for doctors to find a uterus. Other people may be born intersex— their sexual organs are undefined at birth, so surgeons assign a sex. All these conditions are interesting and appropriate to talk about in a biology classroom, but they do not explain the trans experience. The biological and social events that cause a person to identify as trans are undefined and multiple, and continue to be researched.

Previous to my experience, I would present genetic disorders as weird, cool, or macabre (think the Elephant Man, or wolf-boy/Ambras syndrome). It was well-intentioned to show the power of genetics and DNA; however, that kind of language “otherizes” and dehumanizes people who are struggling. A more socially constructive response is to have students imagine the adaptations an individual would have to make to complete daily tasks. Additionally, it may be appropriate to talk about what “typicality” means, in a relationship to statistical bell curves. Just because something isn’t typical does not mean it is aberrant.

**Sex testing in sports**

There are HHMI resources that support a classroom discussion of sex and gender in the sports world (see Online Resources). It is important to point out to students that the sports world assumes that there are just two genders, and makes rules and assumptions as such. As teachers, we must point out that the world is broader than a two-gender system and that sports is a separate world of culture and category. What is fair and what is equitable can be two different things. Figuring out the definitions of male and female in a sport forum does not mean that those definitions carry to the whole of society.

**Gender in other cultures**

Other cultures besides the dominant American culture have different definitions of gender. Some First Nation peoples (Native American cultures) recognize a spectrum of genders. Nepal added a third gender to their census questions in 2011 (Hill and Mays 2013). Research and discussion of these cultures can help students see multiple perspectives and help instill a global mindset.

**Modeling for all students**

Many teachers might assume they only need to recognize that gender is a spectrum in the genetics unit, and only when there is a trans or gender-complex student in the class. Making trans and gender-complex students feel recognized and safe to be their authentic self is the main goal, but it is not the only goal. I feel that every cis-gender (gender identity and gender expression culturally match sex assigned at birth) student also needs to hear and have adults model this recognition. In the future, whether it’s during the next class period, in the next year, at college, or in the workforce, students need a baseline of understanding. Then, they can correct others when misgendering occurs and help create a culture where violence and discrimination against trans people is simply past history.

**A final call for kindness**

This article is not meant as the final word in a teacher’s research on equity and inclusion of trans students; it is meant as a starting point. Many teachers may be hesitant to explain these issues, answer questions, or incorporate these practices. However, people are dying because of trans discrimination. Twenty-eight people died in the United States in 2017 from violent assaults due to their gender identity (Human Rights Campaign Staff 2018). We cannot continue to teach while ignoring the damage our hidden curriculum does to the outside world. As biology teachers, the vast majority of us are advocates for environmental justice. It is an easy value and stance to advocate. But I am calling for social justice—the kind that recognizes and respects all students in the classroom.

**REFERENCES**


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