# 4 - Gender Identity vs Biological Sex

Most of this reading assignment will be completed online. You may click the link below, access this online assignment in the Part 4 module in Canvas, or do a Google search using the keyword "HHMI Sex Verification Testing".

https://www.hhmi.org/biointeractive/testing-athletes?utm_source=BioInteractive+News&utm_campaign=63b97368c4-BioInteractive_News_Vol_109_2018_1_10_COPY_01&utm_medium=email&utm_term=0_98b2f5c6ba-63b97368c4-69814393

Please complete the four parts of the Click and Learn Assignment: Introduction, Human Development, Case Studies (Swimmer and Sprinter), Conclusion.

## Sex Development in Mammals

### Overview

In mammals, an individual's biological sex is partly determined by the sex chromosomes; females have two X chromosomes, while males have an X and a Y chromosome. Genes on these chromosomes are responsible for sex determination during embryonic development. Most noteworthy is the ***SRY*** gene, located on the *p* arm of the Y chromosome. In the early human embryo, the precursors of the sex organs are the same in both males and females. At approximately week six of embryonic development, the events that set-in motion male-specific gonad formation are initiated by the *SRY* gene. The protein product produced by the *SRY* gene is an activator for other male-specific genes, while acting as a repressor for female-specific genes. About two weeks later, embryos begin to take on either male or female specific phenotypes.

Because the X and Y chromosome form a homologous pair during meiosis I, synapsis and crossing over can move the *SRY* gene from the Y chromosome to the X chromosome. If the *SRY* gene moves to the X chromosome as the male parent produces gametes, upon fertilization an XX embryo can develop some male-specific traits. The same can also happen if there is a mutation in the *SRY* gene so that it no longer produces a functional protein. As a result, an XY embryo is unable to begin the key steps necessary for male sex differentiation. In both cases, the embryos grow without fully developing a male or female phenotype. The resulting condition is called a **disorder of sexual development (DSD)**. The overall occurrence of these DSDs is rare; about 1 in 5,500 children is born with ambiguous genitalia at birth. Imaging tests, such as an ultrasound, will usually show immature internal reproductive organs that are nonfunctional; therefore, leading to infertility.

### Biological Sex Assignment

Despite a diagnosis of ambiguous genitalia, a **biological sex** (male or female) is assigned to the newborn infant, and the child is raised according to the determined biological sex. Diagnostic tests are performed to provide the physicians and the parents with as much information as possible to make a choice about the biological sex of the infant. Karyotype analysis can show which sex chromosomes are present, followed by physical examination of the external genitalia. Imaging tests show the internal structures of reproductive organs and tissues. Hormone tests are performed to examine sex hormone levels and DNA tests are done to identify sex-specific gene mutations. Once the physicians and the family make a choice as to the biological sex of the child, psychological support is offered to allow the child to grow

up as normal as possible. In some cases, reconstruction surgery can be performed to provide the child with external genitalia that fit the assigned sex.  With support from family and friends, and the medical community, a child born with ambiguous genitalia can lead a happy life. However, there may arise new issues once the child reaches puberty. Secondary sex characteristics can fail to develop, or a child assigned to one sex at birth feels that they are the opposite sex.

## Case Study in Sex Determination

E. Weil, "What If It's (Sort of) a Boy and (Sort of) a Girl?" The New York Times Magazine, September 24, 2006, pages 48-53.

Excerpts have been reprinted from this story.

When Brian Sullivan was born in New Jersey on August 14, 1956, doctors kept his mother, a Catholic housewife, sedated for three days until they could decide what to tell her. Brian was born with ambiguous genitalia. He spent the first 18 months of his life as a boy, until doctors performed exploratory surgery, found a uterus, and ovotestes (gonads containing both ovarian and testicular tissue) and told the parents that they'd made a mistake: Brian was actually a girl. Brian was renamed Bonnie, reconstructive surgery was performed to make her look more like a female on the outside and doctors counseled the family to throw away all pictures of Brian as a baby, move to a new town, and get on with their lives. The Sullivans did the best they could; they relocated, had three more children and did not speak of the circumstances around their oldest child's birth for many years. The doctors promised the parents that if they shielded Bonnie from her medical history, she would grow up normal, happy, heterosexual, and give them grandchildren.

Bonnie Sullivan spent most of her childhood and young-adult life extremely unhappy, feeling different from her peers, but unsure why. Around age 10, her parents told her that she had had an operation to remove her very large clitoris, but that everything turned out fine. At age 19, Bonnie started trying to access her medical records and succeeded when she was 22. She finally learned what happened to her as a baby.  As a means of recovery from this startling news, Bonnie changed her name to Cheryl Chase, graduated from M.I.T. with a degree in math and then went on to study Japanese at Harvard. She threw herself into her work thinking that if she worked really hard, she would overcome her identity problems and finally be happy. After helping found a successful technology company in Japan, she realized that being happy was not going to happen until she found out the truth about who she was. She learned about the doctors' decision to give her reconstructive surgery to make her look more female, and why the medical community believes that surgery be done as early as possible based on their decision as to the sex of the child born with ambiguous genitalia.

Chase is now a leading activist about who has the right to decide what should be done with other people’s bodies. Is it the doctor, the parents, or the child who should decide biological sex? In 2004, she addressed the Human Rights Commission concerning the question of medical procedures of children born with ambiguous genitals. After the report was ratified, Chase commented, "What the Human Rights Commission has done is to recognize me as a human being. You've stated that just because I was born looking in a way that bothered other people doesn't mean that I should be excluded from human rights protections that are afforded to other people."

Disorders of sexual development are not the same as, say, a heart condition. Parents may feel entitled to make decisions based on the sense that they know what is right for their family members, and the reality is that in the case of these children, the right treatment for one child may not be the right treatment for all. These are not happy people, either. Some of them have isolated, difficult lives.