

Why Sex Is Not Binary

The complexity is more than cultural. It's biological, too.

By Anne Fausto-Sterling

Dr. Fausto-Sterling is a professor of biology and gender studies.

Oct. 25, 2018

Two sexes have never been enough to describe human variety. Not in biblical times and not now. Before we knew much about biology, we made social rules to administer sexual diversity. The ancient Jewish rabbinical code known as the Tosefta, for example, sometimes treated people who had male and female parts (such as testes and a vagina) as women — they could not inherit property or serve as priests; at other times, as men — forbidding them to shave or be secluded with women. More brutally, the Romans, seeing people of mixed sex as a bad omen, might kill a person whose body and mind did not conform to a binary sexual classification.

Today, some governments seem to be following the Roman model, if not killing people who do not fit into one of two sex-labeled bins, then at least trying to deny their existence. This month, Prime Minister Viktor Orbán of Hungary banned university-level gender studies programs, declaring that “people are born either male or female” and that it is unacceptable “to talk about socially constructed genders, rather than biological sexes.” Now the Trump administration’s Department of Health and Human Services wants to follow suit by legally defining sex as “a person’s status as male or female based on immutable biological traits identifiable by or before birth.”

This is wrong in so many ways, morally as well as scientifically. Others will explain the human damage wrought by such a ruling. I will stick to the biological error.

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It has long been known that there is no single biological measure that unassailably places each and every human into one of two categories — male or female. In the 1950s the psychologist John Money and his colleagues studied people born with unusual combinations of sex markers

(ovaries and a penis, testes and a vagina, two X chromosomes and a scrotum, and more). Thinking about these people, whom today we would call intersex, Dr. Money developed a multilayered model of sexual development.

He started with chromosomal sex, determined at fertilization when an X- or Y-bearing sperm fuses with an X-bearing egg. At least that's what usually happens. Less commonly, an egg or sperm may lack a sex chromosome or have an extra one. The resultant embryo has an uncommon chromosomal sex — say, XXY, XYY or XO. So even considering only the first layer of sex, there are more than two categories.

And that's just the first layer. Eight to 12 weeks after conception, an embryo acquires fetal gonadal sex: Embryos with a Y chromosome develop embryonic testes; those with two X's form embryonic ovaries. This sets the stage for fetal hormonal sex, when the fetal embryonic testes or ovaries make hormones that further push the embryo's development in either a male or a female direction (depending on which hormones appear). Fetal hormonal sex orchestrates internal reproductive sex (formation of the uterus, cervix and fallopian tubes in females or the vas deferens, prostate and epididymis in males). During the fourth month, fetal hormones complete their job by shaping external genital sex — penis and scrotum in males, vagina and clitoris in females.

By birth, then, a baby has five layers of sex. But as with chromosomal sex, each subsequent layer does not always become strictly binary. Furthermore, the layers can conflict with one another, with one being binary and another not: An XX baby can be born with a penis, an XY person may have a vagina, and so on. These kinds of inconsistencies throw a monkey wrench into any plan to assign sex as male or female, categorically and in perpetuity, just by looking at a newborn's private parts.

Adding to the complexity, the layering does not stop at birth. The adults surrounding the newborn identify sex based on how they perceive genital sex (at birth or from an ultrasound image) and this begins the process of gender socialization. Fetal hormones also affect brain development, producing yet another layer called brain sex. One aspect of brain sex becomes evident at puberty when, usually, certain brain cells stimulate adult male or adult female levels and patterns of hormones that cause adult sexual maturation.

Dr. Money called these layers pubertal hormonal sex and pubertal morphological sex. But these, too, may vary widely beyond a two-category classification. This fact is the source of continuing disputes about how to decide who can legitimately compete in all-female international sports events.

There has been a lot of new scientific research on this topic since the 1950s. But those looking to biology for an easy-to-administer definition of sex and gender can derive little comfort from the most important of these findings. For example, we now know that rather than developing under the direction of a single gene, the fetal embryonic testes or ovaries develop under the direction of opposing gene networks, one of which represses male development while stimulating female differentiation and the other of which does the opposite. What matters, then, is not the presence or absence of a particular gene but the balance of power among gene networks acting together or in a particular sequence. This undermines the possibility of using a simple genetic test to determine “true” sex.

The policy change proposed by the Department of Health and Human Services marches backward in time. It flies in the face of scientific consensus about sex and gender, and it imperils the freedom of people to live their lives in a way that fits their sex and gender as these develop throughout each individual life cycle.

Anne Fausto-Sterling is an emeritus professor of biology and gender studies at Brown University.

A version of this article appears in print on Oct. 29, 2018, Section A, Page 19 of the New York edition with the headline: Why Sex Is Not Binary