

## 16. Gender

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Evolution of Sex  
Pascal Gagneux

March 3, 2020

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### Your comments on Sex vs Gender

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**Sex:** biological, genetic, more binary, but not totally

**Gender:** social, psychological, more fluid, ranges/gradients

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### Your comments on Sex vs Gender

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**Sex:** "what you are stuck with", mostly binary, can be non-binary, sexually ambiguous, intersex

**Gender:** "what you feel", self perception, as perceived by others

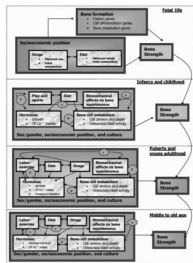
Very different experiences of sex and gender by different students, from families that hardly or never stress the importance of gender, to families that define most aspects of life into male or female. some of you were gender-shocked, others were sexism-shocked.

Strong impact of geography, where you grew up, and media exposure, often exposure to topics only after starting college.

**On best ways to engage people in discussions of the need to tolerate differences:**

Need for personal connections, seeing others as humans and being perceived as a human is key.  
Requires huge effort to see the humanity in people who might not grant you much humanity of your own!

## Bare Bones of Sex



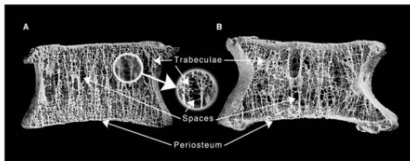
Natural & Cultural variation in place and time:  
 socio-economics  
 infancy and childhood (nutrition)  
 puberty and young adulthood  
 Middle to old age  
 Disease  
 Physical activity  
 Religion  
 Time...  
 all associated with measurable changes in bones

Culture as partner in the production  
 of body systems, commonly  
 referred to as biology!

Fausto-Sterling, A. The Bare Bones of Sex, Part 1: Sex and Gender *J. of Women in Culture and Society* (2005)

A life history–systems overview of bone development. (1) Physical activity has direct effects on bone cell receptors and indirect effects by building stronger muscles, which exert physical strain on bones, thus stimulating bone synthesis. (2) Physical activity that takes place outdoors involves exposure to sunlight, thus stimulating vitamin D synthesis, part of the hormonal system regulating calcium metabolism. (3) Biomechanical strain affects bone cell metabolism by activating genes concerned with bone cell division and bone (re)modeling. (4) Hormones affect bone cell metabolism by activating genes concerned with bone cell division, cell death, bone (re)modeling, and new hormone synthesis.

## Bare Bones of Sex



A. Healthy vertebra with dense trabecular structures.  
 B. Osteoporosis, more common in women, but hugely affected by life and culture.

Fausto-Sterling, A. The Bare Bones of Sex, Part 1: Sex and Gender *J. of Women in Culture and Society* (2005)

Vertebral structure. Scanning electron micrographs of longitudinal sections of human vertebrae. This image is a modification of one published in Mosekilde 2000. (A) Healthy vertebra showing the trabecular structure of the cancellous bone (inset) and the surrounding periosteum. Note the regular vertical arrangement and density of the trabeculae. (B) A vertebra exhibiting osteoporosis. Note the increased number and size of spaces where cross struts have broken, as well as the less organized and less dense trabecular structure.

## Bare Bones of Sex



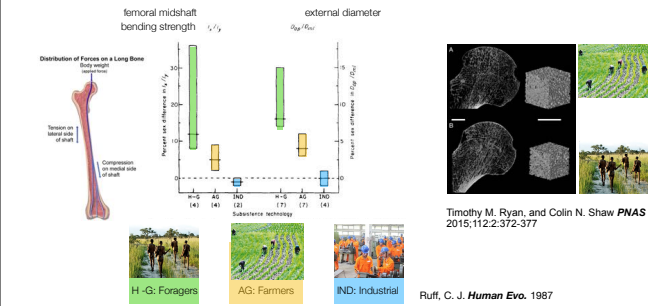
Bones completely  
 renew themselves over  
 ~ ten year period!

“πάντα ῥεῖ”  
 Heraclitus of Ephesus,  
 6th Century BC

Fausto-Sterling, A. The Bare Bones of Sex, Part 1: Sex and Gender *J. of Women in Culture and Society* (2005)

Body parts as tangible as bones are affected by countless dynamic processes. Many of these influences have cultural roots, such as levels of physical activity, nutrition, psycho-social stress, even amount of time spent outdoors (vitamin D made by exposure to sunlight affects bone density).

## Subsistence strategy and skeletal dimorphism



Sexual dimorphism in two measures of relative bending strength of the femoral midshaft in three broad subsistence categories.

Mode of subsistence can rapidly change sexual dimorphism as shown for North American Inuits, farmers and city dwellers!

Practice question: What is the difference in sexual skeletal dimorphism (bone bending strength) between hunter gatherers and industrial societies?

Sexual dimorphism is much diminished in industrial societies.

## Why osteoporosis?

**Antagonistic Pleiotropy:** genes that afford fitness benefits early in life but have harmful effects later in life.

**Disposable Soma:** trade-off in energy investments allocated for reproduction at the body's expense; the body ages because of investment in reproduction.

**Mismatch:** environments in the evolutionary past are aberrant from current environments so traits that were once adaptive are now mismatched.

An Evolutionary and Life-History Perspective on Osteoporosis  
Felicia C. Madimenos. *Annu. Rev. Anthropol.* 2015. 44:189-206

Three evolutionary theories for why osteoporosis exist:

Practice question: What is Antagonistic pleiotropy?

A situation where the same gene has positive effects early but negative effects late in life.

One of the most important causes of aging!

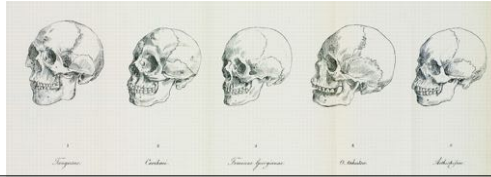
## Race and gender

both important social notions with complex connections to biology

**Race:**

## Caucasian? WTF!

Johann Friedrich Blumenbach 1752-1840



There is no scientific validity to the term “caucasian”, “pink” would be at least twice as scientifically accurate.....

Practice question: What are the scientific roots of the term Caucasian?

No scientific roots, based on esthetic preferences of an 18th century anatomist. (who was surprisingly non-racist....)

## Caucasian? WTF!

Johann Friedrich Blumenbach 1752-1840



Caucasus is a region, NOT a “race”

## Eurocentrism including among intellectual giants



David Hume 1711-1776

"I am apt to suspect the Negroes, and in general all other species of men to be naturally inferior to the whites. There never was any civilized nation of any other complexion than white, nor even any individual eminent in action or speculation."



Immanuel Kant 1724-1804

Die Menschheit ist in ihrer größten Vollkommenheit in der Rasse der Weißen. Die gelben Indianer haben schon ein geringeres Talent. Die Neger sind weit tiefer, und am tiefsten steht ein Teil der amerikanischen Völkerschaften. [...] Die Neger von Afrika haben von der Natur kein Gefühl, welches über das Lappische steigt.

Humanity exists in its highest perfection in the White Race. The yellow Indians already have a lower talent. Negroes are far lower, and lowest are the peoples of America. [...] The Negroes of Africa have by nature no feeling that rises above the trifling.

Two giants of western thought, the philosophers Hume and Kant were profoundly prejudiced towards people that looked different from what they were accustomed to. Kant has been said by Anthropologist Nina Jablonski to have founded scientific racism. Practice question: What is a profound irony about the beliefs of Immanuel Kant, one great western philosopher of ethics? He was profoundly racist.

## Timbuktu to Tokyo



Where do black people stop, and white and yellow people start??

Biological differences between people are real. Most differences (85% of the biological variation, as measured by differences in DNA and proteins) exists within any population. The notion that there are a small number of races is scientifically incorrect. There are thousands of populations that mostly show gradual differences. walking from Timbuktu to Tokyo, there is no single moment where black people stop, pink people start and “yellow” people begin.....but if you are airdropped in Timbuktu, you would immediately know that you are neither in Toulouse nor in Tokyo.

Practice question: Biological differences between people are real, but the notion of a small number of distinct races is scientifically flawed, why?

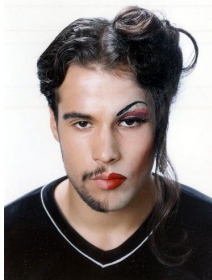
Most biological diversity are present within populations and differences between populations are gradual rather than discrete.

## Tous parents, tous différents



images from an exhibit at the Musée de l'homme in Paris. dated, as it mentions 6 billion humans, when we are now well over 7 billion.....but great images nonetheless.

## Gender



How many classifications? Cultural construct of bins for much more fluid realities?

## Gender



MARTIN, KATHRIN, MARTIN FOEHSE



Man until his 30s, woman for 10 years, and man again, Martin to Kathrin Foehse and back to Martin.

## Non-binary males as females

**Chuckchi** (Siberia)-Group of Shamanic people that identify a 3rd gender-3rd gender people are typically born as males but take on female roles  
**Mahu** (Hawaii)-Can be biologically male or female-Gender role is either somewhere between male and female or both male and female  
**Faafafine** (Samoa)-Biologically male but take on female gender roles and appearance  
**Fakaleiti** (Tonga)- Very similar to Fa'afafine- Born biologically male but dress like females and take on female gender roles and mannerisms.  
**Whakawhane** (Maori, New Zealand)- Whakawhane are biological males who prefer the company of females  
**Winkte** (Lakota)- Winkte means "two-spirited." Born as males but take on traditional female gender roles.  
**Nadleehi** (Navajo)- Are born biologically male but possess both male and female spirits.  
**Alpha** (Mohave)- The Mohave Indians identify four genders: male, female, alpha, and heema- Alpha are males that live as females.  
**Muxe** (Zapotec of Oaxaca)- Muxe are males who dress as females or dress in male clothing but wear makeup.  
**Travesti** (South America)- Person who is born male but identifies as a female gendered person- Usually dress and act typically female  
**Skeeterj** (Russian)-religious practice to cut off testicles and become t  
**Femminiello** (Italy)- Biological males who take on female gender roles and dress as females.  
**kogek** (Ottoman Empire)- Men who dressed and acted like females  
**Bangala** (DRC Congo)- Shamans who dressed in women's clothing.  
**Ashtime** (Maale, Ethiopia)- Ashtime were eunuchs who lived in the homes of political and spiritual leaders of the community.  
**Mashoga** (Kenya, Tanzania)- Biological males who take on a female gender identity.  
**Sekrete** (Madagascar)- Boys who were thought to have feminine characteristics were raised as girls- Were taught to dress, act, and talk as women.  
**Xanith** (Oman)-Biological males who adopt traditional female roles, mannerisms, and dress  
**Metis** (Nepal)-Biological males who dress and live as females, assuming typical female roles  
**Hijra** (South Asia)- Hijra are biological males who identify themselves with the female gender by dressing as females and taking on female roles  
**Aravani** (Tamil Nadu)- A subset of Hijra named after the mythical deity Aravan- Biological males who adopt female gender identities and roles.  
**Acault** (Germany)- Biological males who take on the roles and characteristics of females- Some identify themselves as gay, but many do not  
**Kathoey** (Thailand)- Kathoey means "ladyboy" in English- Biological males who identify themselves as neither male nor female, but a 3rd gender  
**Waria** (Indonesia)- Born as males but typically identify as female.  
**Bakla** (Philippines)- Biological males who assume the role of females.  
**Calabai** (Indonesia)- Calabai are biological males who identify and live as females, but do not desire to become females.

Fewer societies seem to have concepts for women with strong masculine characteristics compared to the larger number of societies that have notions of men living more feminine lives.

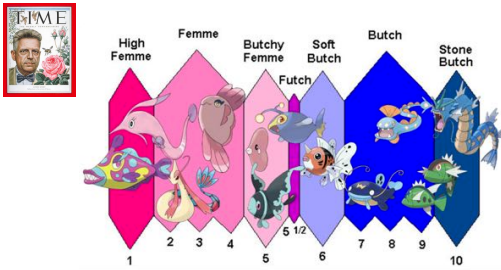
Does sexism cause a bias for third or forth gender?

## Non-binary females as males

**Wakatanee** (Maori, New Zealand)-Wakatanee are biological females who take on jobs that are typically male such as manual labor or warriors.  
**Ninagouk**(Zigpape (Blackfoot)-Ninagouk(Zigpape means "manly hearted woman."- Biological females who did not have to follow the social constraints of other females.  
**Lhamana** (Zuni)- Another Native American "two-spirit" gender- Person takes on both male and female roles at the same time- Perform both traditionally male and female work-  
Also take on the role of priests, mediators, and artists.  
**Huame** (Mohave)-The Mohave Indians identify four genders: male, female, alpha, and huame. Huame are females that live as males.  
**Burmesha** (Albania)- Also known as "sworn virgins."- Biological females who dress as males and take a vow of chastity- Albanian society places high value in males; Burmesha become sworn virgins to become highly respected members of society.  
**Mamluk** (Egypt)- Young girls with masculine traits who were raised as boys- Were awarded all of the legal and social advantages that girls were not allowed, but boys were- This practice died out in the 1700s.  
**Mino** (Bleni)- Women with masculine traits or who were thought to be aggressive- Formed an all female regiment of warriors- Mino were never married and never had children.  
**Ankole** (Uganda)- Women who were elected by the people to dress and act as men- Doing this allowed them to be an oracle to their god, Mukasa.  
**Calalai** and **Bissu** (Indonesia)- **Calalai** are biological females who identify and live as males- **Bissu** are both male and female but at the same time neither male nor female. They may be born as hermaphrodites. They dress in attire that only Bissu are allowed to wear.  
**Quariwarmi** (Inca, Peru)- The Quariwarmi were 3rd gender people who were ritual attendants or shamans- Wore androgynous clothing- Worshiped a two-gendered god, "chuqul chinchay."  
**Guinevoodoo** (Dominican Republic)- One of the only cases where a recognized 3rd gender is because of pseudo-hermaphroditic trait.

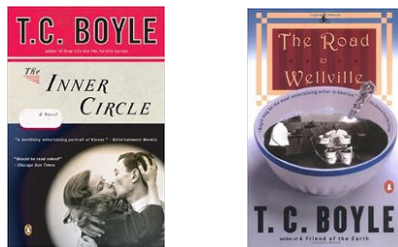


## Gradients rather than Platonic categories



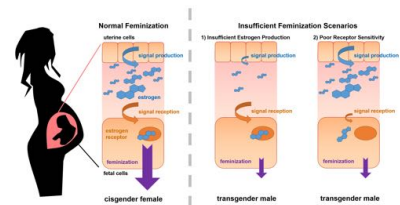
Kinsey scale for sexual orientation in women FUTCH Femme vs BUTCH scale (pokemon version)

## Alfred Kinsey



Two great books by Tom Corraghessan Boyle: one on Kinsey and the other on Kellogg (obsessed with preventing masturbation...)

## Factors that could influence gender identity



<http://a1n.hms.harvard.edu/flash/2016/gender-lines-science-transgender-identity/>  
Katherine J. Wu  
figures by Brad Wierowski

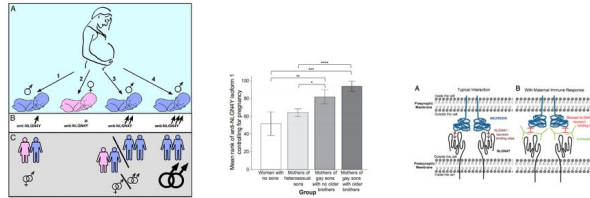
Possible scenarios underlying insufficient feminization. During normal feminization, sufficient estrogen is present in the fetal environment. The estrogen is recognized by fetal cells and triggers the development of a female fetus. In Scenario 1, very little estrogen is present in the fetal environment. Even though the fetal cells are capable of sensing estrogen, very little enters the fetal environment and the fetus is insufficiently feminized. In Scenario 2, there is enough estrogen in the fetal environment, but fetal cells are effectively “deaf” to the estrogen and the fetus is insufficiently feminized.

More recent studies have shown effects of immune reactions to previous male pregnancies on the development of subsequent male fetuses.

Practice question: What biological factors could contribute to non-binary gender identity?  
Hormonal mile in utero, maternal immunity to boys caused by pregnancies of older brother, your guess is as good as mine....



## Maternal immunity to sons??



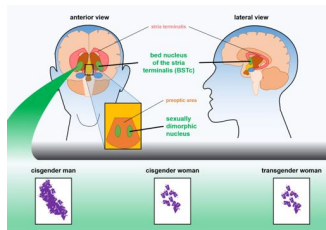
Bogaert et al. *PNAS* 2017

Birth order effect on likelihood that a man is gay.

Practice question: How could having several older brother influence sexual orientation?

Maternal antibodies to Y-chromosome encoded brain proteins (e.g. NLGN4Y) could influence brain development in later male fetus.

## Factors that could influence gender identity



<http://shs.hms.harvard.edu/flash/2016/gender-lines-science-transgender-identity/>  
Katherine J. Wu  
figures by Brad Wierbowski

Transgender women tend to have brain structures that resemble cisgender women, rather than cisgender men. Two sexually dimorphic (differing between men and women) areas of the brain are often compared between men and women. The bed nucleus of the stria terminalis (BSTc) and sexually dimorphic nucleus of transgender women are more similar to those of cisgender woman than to those of cisgender men, suggesting that the general brain structure of these women is in keeping with their gender identity. Strong evidence that we can have brains that are mismatched with the sex of our bodies.

## Male and Male to Female Transsexual brains

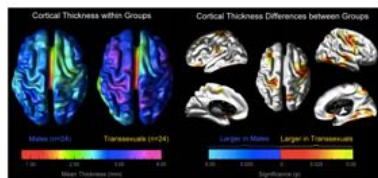


Figure 1. Increased cortical thickness in MTF transsexuals. Left panel: The brain maps illustrate the mean cortical thickness within MTF transsexuals and within control men, separately. The brain surfaces are color-coded according to the color bar where thickness is shown in millimeters (mm). Right panel: The brain maps illustrate where the cortex is significantly thicker in MTF transsexuals than in control men. The brain surfaces are color-coded according to FDR-corrected significance. Gray color indicates regions where both groups did not differ significantly. Cerebellar, subcortical, and midbrain regions have been excluded on the medial aspects of the surface.

Copyright © 2012 Schilke.

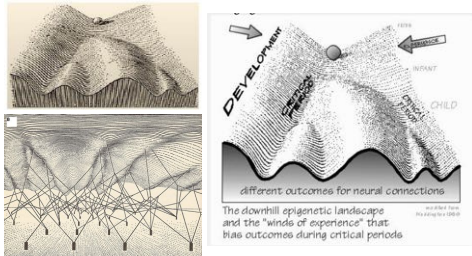
JBB5

Differences in cortical thickness.

## Developmental Canalization

Waddington, 1957

developmental trajectory represented by rolling ball

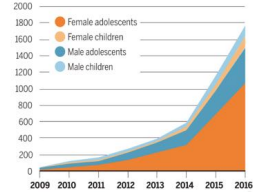


Waddington's 'developmental landscape'. (a) The developmental trajectory of the organism, represented by the rolling ball, is determined by a landscape representing the developmental dynamics of the organism. (b) The shape of this landscape is determined by genes, here represented by pegs pulling the landscape into shape via strings, and by epistatic interactions between genes, here represented by connections between strings. From Waddington (1957: 36).

## gender Dysphoria: ROGD or not ROGD??

### Transgender identities on the rise

The number of young people referred to a U.K. transgender service is growing rapidly. Most adolescents were designated female at birth.



Lisa Littman, psychologist at Brown

PLOS ONE PUBLISH ABOUT BROWSE

OPEN ACCESS PEER REVIEWED

RESEARCH ARTICLE

Parent reports of adolescents and young adults perceived to show signs of a rapid onset of gender dysphoria

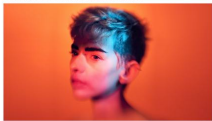
Lisa Littman

Published: August 16, 2018 • <https://doi.org/10.1371/journal.pone.0200330>

GRAPHIC: N. DE GRAAF ET AL., ARCHIVES OF SEXUAL BEHAVIOR 47:5, 1301, (2018), ADAPTED BY A. CUADRA/SCIENCE

## Rapid Onset Gender dysphoria

Atlantic  
When Children Say They're Trans



Steve says he's happy with the changes to Steve's body, but in his message to his mother, he says he's still struggling with his identity. (Steve 2018)

In some cases, a child might be capably navigating a liminal period of gender exploration; it's the parents who are having trouble not knowing whether their kid is a boy or a girl.



Steve, 16, says he's happy with the changes to Steve's body, but in his message to his mother, he says he's still struggling with his identity. (Steve 2018)

One clinician said her trans clients talk openly about peer influence, saying things like *Oh, Steve is really trans, but Rachel is just doing it for attention.*

Lisa Littman. Rapid-onset gender dysphoria in adolescents and young adults: A study of parental reports. *PLOS ONE*, 2018; 13 (8):

Vivid conversations are ongoing about how to best address "rapid onset gender dysphoria" without compromising the future health (mental and physical) of young people.

## Australian Rites of passage



subincision ceremony of the Wamarrungu Tribe near Alice Springs (1904)



The Kuntjara Ceremony or re-opening of the subincision. The urethra is being cut deeper by an elder with a sharp blade of stone to further strengthen the bands of keratin. The Wamarrungu Tribe

“Cultural reverse spotted hyenas?”

Men in several Australian aboriginal tribes practiced sub incision, essentially turning their penises into a mimic of a vagina. This was part of initiation and the cutting was repeated during ceremonies.

## Money for Women

WOMEN 2019/2018 11/18 AM PT

### Bill And Melinda Gates Pledge \$170 Million To Women's Economic Empowerment

"When money flows into the hands of women who have the authority to use it, everything changes."

By Anne Hays



Photograph: Melinda and Bill Gates have pledged a massive sum toward women's empowerment worldwide. The full photo of the couple was seen at the Aspen Press in Aspen, Colorado on April 21, 2019.

Everything changes when women have money.

Important philanthropist have noticed the strong impact of empowering women. The roots of male domination in most traditional societies have yet to be fully explained. But male fear of female power, or jealousy of women's capacity to give birth might be one of the reasons.....

## Summary



Notions of gender and race are extremely powerful socio cultural realities.

Both are rooted in biological realities, but both reflect attempts of binning natural variation into discrete norms.

Scientific racism continues to exert a huge cost.

A strict view of sex/gender as absolutely binary also exerts costs.

A more tolerant view of gender, including biological sex and gender identity can prevent harm to individuals and their families, but is seen as an overt attack on traditional views anchored in age-old beliefs.

The development of biological sex and gender identity remains incompletely understood.

A better understanding will hopefully contribute to less intolerance of fellow humans, who's sexuality appears ambivalent or falls outside our lived experience.

Medical interventions for gender dysphoria can be indicated, but we do not know how early is ideal.

**Culture as partner in the production of body systems, commonly referred to as biology!**