



STANFORD

SCHOOL OF  
HUMANITIES AND SCIENCES



**Londa Schiebinger**  
**John L. Hinds Professor of History of Science**

**Director, Gendered Innovations in Science, Health  
& Medicine, Engineering, and Environment**

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## Global History of Women and Gender in Science

科学における女性とジェンダー  
に関するグローバル・ヒストリー

Questions and methods

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## Global History of Women and Gender in Science

- Few historians have taken the challenge because most of us are trained in national history. Few scholars compare women scientists across culture, and, indeed, for many countries, there are no comprehensive analyses of gender in scientific culture from which we could draw comparative perspectives. This is something that should be remedied!

科学における女性とジェンダーに関するグローバル・ヒストリー  
女性科学者について文化横断的な研究はほとんど見られない。 <sup>3</sup>

## Global History of Women and Gender in Science

- Today, I would like to set out a few questions and methodologies for a comparative global history of women and gender in science. It would be exciting for someone, with good funding, to support such a study to be done collaboratively. We need experts from each country or global region.

比較グローバル・ヒストリーについて、問題と方法論を提起。  
そうした比較を行うには、資金はもとより各国からの専門家が必要。

## Western or non-Western Science?

The first question we need to ask: Is this a Comparative Global History of Women and Gender in Western or non-Western science? In this talk, I will focus on Western science that developed in Europe from the 17<sup>th</sup> century forward and then spread to many parts of the world. Along with Western science, Europe exported common structural problems for women's participation and specific cultural attitudes toward gender.

Admittedly, this approach is problematic in that I am relying on concepts developed in the US and Europe—because that is what I know.

西洋科学または非西洋科学における女性とジェンダー。17世紀以降の西洋科学に焦点。ただし、このアプローチには限界あり。ヨーロッパは、西洋科学とともに、女性参加に関する構造的な問題、ジェンダーに向けられる文化特異的な態度も伝播させた。

## Western or non-Western Science?

We can also consider sciences (ways of knowing nature) from around the world. China was the first to invent the compass, paper, gunpowder, and acupuncture. Ancient Islamic medical traditions are famous. Women throughout the world developed birthing and birth control techniques. Across the Americas, women developed new crops by exchanging and managing seeds.

To do a comparative global history of women and gender, we would want to step outside Western scientific traditions.

But today I will focus on what I know: Western Science. I hope this will be fun and stimulating. I very much look forward to our discussion.

世界の科学。中国の羅針盤、紙、火薬、鍼術。古代イスラムの医学的伝統。世界中で女性は出産や避妊の技術を発達させた。南北アメリカで女性は穀物の育種を行った。女性とジェンダーの比較史に向けて、西洋科学の伝統から抜け出る必要がある。しかし、私からは西洋科学の文脈で話題提供をし、後の議論を期待する。

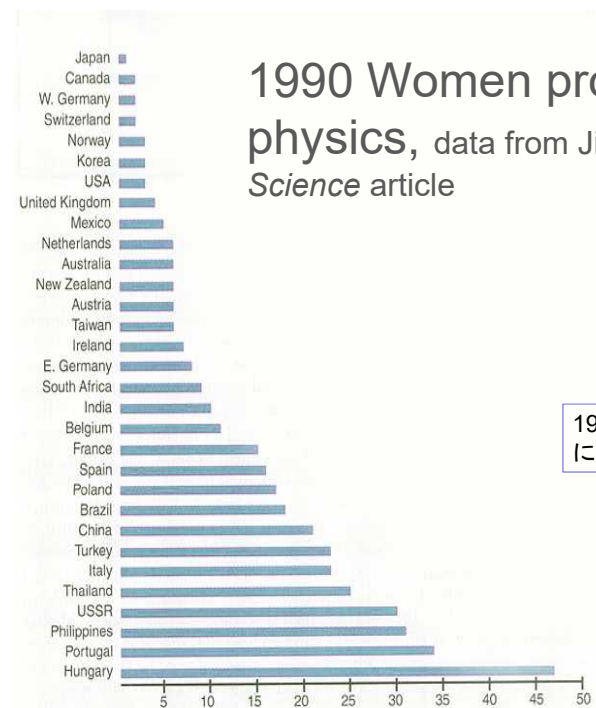
## “Women in Science '94. Comparisons across Cultures.” *Science* 263 (1994): 1389-93 & 1467-96.

I was excited to see this article in 1994. Here are the categories set out for comparison:

1. Report the numbers of women scientists by country  
国ごとの女性科学者の数
2. Status of science in a particular country  
特定の国における科学の地位（威信）
3. Political structure of a nation (LS modified)  
国の政治的構造（著者が少し変更）
4. Class structure, or social economic status (SES)  
階層構造、すなわち社会経済的状況
5. Educational system  
教育制度
6. Support for combining work and family life  
仕事と家庭生活の両立支援

The goal was to explain this type of chart.

## 1990 Women professors of physics, data from Jim Megaw in the 1994 *Science* article



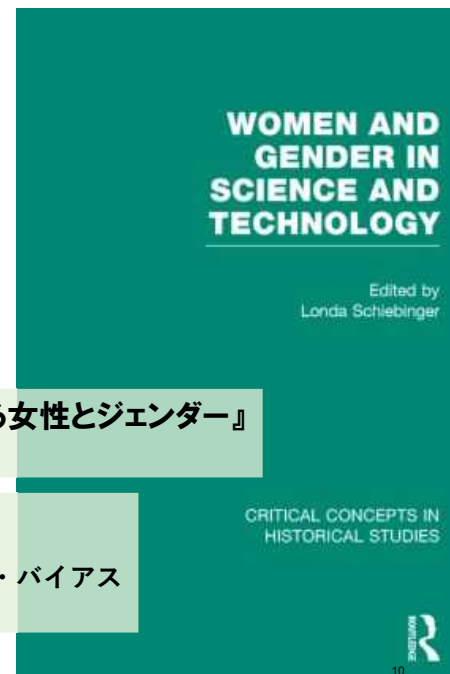
1990年における物理学の教授に占める女性割合の国際比較

# More questions—1994-2018

- |  |                      |
|--|----------------------|
| 7. Gendering of fields of science  | 科学諸分野のジェンダー          |
| 8. Gender equality index   | ジェンダー平等指数            |
| 9. Funding policies to support   | 女性研究者の助成政策           |
| a. fixing the numbers of women   | 女性数の確保               |
| b. fixing the institutions   | 制度の整備                |
| c. fixing the knowledge  | 知識の再検討               |
| 10. Ethnic diversity   | 民族的多様性               |
| 11. Development of gender studies  | ジェンダー学の発展            |
| 12. Gender norms in particular cultures  | 特定文化のジェンダー規範         |
| 13. Understanding of unconscious gender bias   | 無意識のジェンダー・バイアスに関する理解 |
| 14. Understanding of gender bias in science  | 科学におけるGB理解           |
| 15. Integrating sex and gender analysis into science, or<br><a href="#">Gendered Innovations</a> | セックス／ジェンダー分析を科学に     |

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We will take each question in turn—showing results and citing classic articles. For more classic articles, see this 2014 book in four volumes.



## シービンガー編『科学技術における女性とジェンダー』 全4巻の各巻の内容

- ① 科学／技術における女性
- ② ボディ・ポリティックス
- ③ 科学／技術におけるジェンダー・バイアス
- ④ ジェンダード・イノベーション

CRITICAL CONCEPTS IN  
HISTORICAL STUDIES



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## #1. Report the numbers of women scientists by country

- **1982 US Report on Women and Minorities in Science and Engineering.** The NSF published the first congressionally-mandated report on diversity in science and engineering fields. Persons with disabilities were added in 1984. This report revealed that women and African-American men were significantly underrepresented in technical fields.

US科学技術分野における女性とアフリカ系アメリカ人男性の参画の少なさ。

- **2003 EU She Figures.** EU-wide data on women in science, starting from tertiary education through to employment.

EUの統計書She Figuresで第3期の教育から雇用に至る女性研究者のデータ。

- My impression is that most countries have such figures. US、EU以外の国もそのようなデータを蓄積している。

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## Combine #1. with #. 10 Ethnic diversity

科学分野における女性数（#1）と民族的多様性（#10）とを結びつける

In the US, we are interested in the participation of African-Americans, Asians, Latinx and other minorities. (Related to “Intersectionality” below.)

アメリカにおいては、アフリカ系アメリカ人やアジア人、ラテンアメリカ系の研究者およびそのほかのマイノリティーの参画に関心がもたれている。

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## #2. Status of science in a particular country

科学の威信は国によって違う

- Why do Portugal, the Philippines, Hungary, Turkey, etc. have high numbers of women scientists and countries such as Japan, Canada, the US, and Germany do not?

なぜポルトガルやフィリピンに女性科学者多く、日本、カナダ、アメリカ、ドイツに少ないのか。

- Does this general principle hold?: Where the status of science is low and jobs in science are poorly paid, we find more women. Perhaps not true any more because of new funding policies. Public policy can improve the status of women in science.

この一般原則有効？科学の威信が低くて給料安い国は女性研究者多い。新たな助成政策のためではない。公共政策は科学における女性の地位向上につながる。

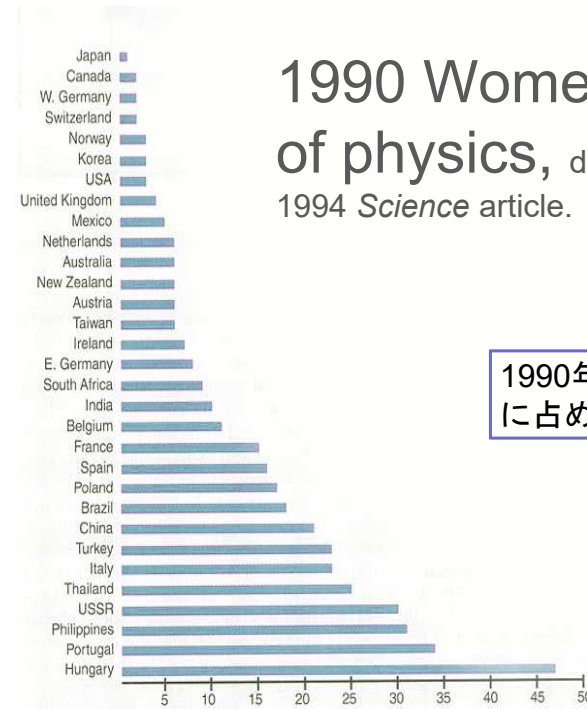


Women  
Men

Women's representation in science (measured by names on publications). *Gender in the Global Research Landscape*. Elsevier, 2017.

著者名によってカウントした科学分野での女性の活躍状況

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1990 Women professors of physics, data from Jim Megaw in 1994 *Science* article.

1990年における物理学の教授に占める女性割合の国際比較

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Available in Japanese!

- Gender in the Global Research Landscape Report (2017)* -- Japan-Focused Infographic (one page).

『グローバル研究におけるジェンダーの現状報告』2017年インフォグラフィック（訳注：情報、データ、知識の視覚的表現）に焦点を定めて。

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### #3. Political Structure of a Country

Foundings of democracies were challenging for women in science. Closed pathways. Schiebinger, L. (1989). *The mind has no sex?: Women in the origins of modern science*. Harvard University Press. 邦訳『科学史から消された女性たち』

女性研究者にとって民主主義が要。閉ざされた進路。

China pre- and post-Cultural Revolution changed the position of women in science

文化大革命前後で中国の女性研究者の地位に変化。

Soviet Union. Ideologically, women were considered equal. There are many problems with that view, but more women held positions in math and physics, for example, than in the West.

ソ連：イデオロギー上、女性は平等。問題はあるが西洋に比べ層多くの女性が数学や物理学でポストに。<sup>17</sup>

### #3. Political Structure of a Country

- Another aspect is national legislation supporting women in general in a country. We could chart passage of legislation supporting equal rights for men and women and equal pay for men and women, for example.

もう一つの視点は、女性を支援する国家の法体系である。男女同権や男女平等賃金といった国内法の制定の比較。

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### #4. Class structure or social economic status (SES)

In 20<sup>th</sup> century Latin America, social class tended to counterbalance gender. In Mexico, for example, education is limited to the upper classes. The advantages of class outweigh the disadvantages of gender. "Women in science'94. Comparisons across cultures." *Science* 263 (1994): 1389-1394 & 1467-1496.

20世紀ラテンアメリカでは、ジェンダーより社会階層。メキシコでは階層の有利がジェンダーの不利を凌駕。

In 18<sup>th</sup> century France, Émilie du Châtelet traded her upper-class standing for access to learning. Schiebinger, L. (1989). *The mind has no sex?: Women in the origins of modern science*. Harvard University Press. 邦訳：『科学史から消された女性たち』工作舎

18世紀フランスでは、エミリー・デュ・シャトレは上流階級の地位にものを言わせて学問にアクセスできた。

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### #5. Educational system 教育制度

- When did universities open to women students? In the US, it was in the second half of the nineteenth century. 大学はいつ女性に門戸を開放したか。USでは19世紀後半。
- I have chosen to note here the article by my colleague, Mariko Ogawa, on the History of Women's participation in STEM fields in Japan. We see that women were admitted to bachelor degrees beginning in 1913, and to PhD programs in the 1920s. 日本の大学門戸開放1913年、博士取得者の誕生1927年から。

Ogawa, M. (2017). History of Women's Participation in STEM Fields in Japan. *Asian Women*, 33(3).

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## 1913～1945年間の理系女性学士の数

大学名	東北	北海道	大阪	九州	名古屋	総数
受入認可	1913	1930	1931	1939	1942	
実際入学	1913	1930	1935	1942	1943	
数学	10	10	5	1	4	30
化学	4	2	0	2	1	9
物理学	1	3	0	0	0	4
生物学	10	5	0	0	0	15
地球物理学	1	0	0	0	0	1
地質学	0	3	0	0	0	3
総数	26	23	5	3	5	62

出典：Mariko Ogawa, "History of Women's Participation in STEM Fields in Japan," *Asian Women*, 33: 65-85, 2017

## 戦前における女性の博士取得者

	1927 - 1937	1938 - 1945	Until the end of WWII	Percentage
医学	14 (age 39) +2*	79	95	86%
理学	3 (age 44)	7	10	9%
農学	2 (age 45) +1*	1	4	4%
薬学	1 (age 50)	0	1	1%
全体	20 +3*	87	110	100%

出典：Mariko Ogawa, "History of Women's Participation in STEM Fields in Japan," *Asian Women*, 33: 65-85, 2017

訳注：1913年に東北帝国大学は日本で初めて3人の女性の入学を許可。当時、帝国大学医学部は女性に門戸を開いていなかった。そのため専門学校や私大でまずは医学を修め、研鑽を続け、概ね帝国大学に博士請求論文を提出して、博士号を取得。<sup>22</sup>

## #5. Educational system

- When did universities open to women professors? How many are there?
- We know that Laura Bassi was the first professor (of physics) in Europe in 1732. But she was an exception. Women did not become professors in Europe or the US until the late nineteenth century, and most since about 1960.
- Universities now publish their statistics on how many women professors they have by rank. In 2017, Stanford University has 29% women professors across all ranks, and 24% full professors.

日本初の女性教授は？ ヨーロッパはラウラ・バッシの1732年の物理学教授就任が例外的に早い。欧米一般は1960年あたり。スタンフォード大学では2017年女性教授は29%。24%は正教授。

## #5. Educational system

- Many years ago, Margaret Rossiter discussed segregation in the US: As the prestige of the university goes up, the number of women professors goes down.

Rossiter, M. W. (1984-2012). *Women scientists in America*, 3 vols. JHU Press.

マーガレット・ロシターは、一流大学であるほど女性教授の数は減少することを仄めかしていた。

## #5. Educational system

- Should math and science be required? Or electives?

数学と科学は必修とすべきか、選択か。

- The 1994 *Science* article focused on countries such as Italy or Poland, where all students are required to continue in math and science throughout secondary education. In the US, where math is an elective, girls often drop out of math before they know what their future interests might be.

1994年の『サイエンス』誌によれば、イタリアやポーランドなどでは、中等教育を通して数学と科学必修。USでは、数学は選択で、女子は将来の適性を知る前に数学を投げ捨ててしまっていることが少なくない。

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## #5. Educational system

- Should there be all girls schools? This was much debated in the 1990s. In the US, we learned that a large percentage of our women science had graduated from the all women universities in the Northeast—Wesley, Smith, Radcliffe, etc. One problem with this finding is that these are also elite schools, and students there would have had privileged educations from a young age.

女子校は存続すべきか？1990年代論争。USでは女子大卒が科学で活躍。ただしそれら女子大エリート校への進学者は、幼少期から十分な教育に恵まれていたとも言えよう。

- One idea driving the push for all girls schools is that adolescent girls suffer from a lack of confidence and easily fall prey to gender norms that put boys in positions of leadership. In a lab, boys will lead and girls will take notes. The idea is that if no boys are around during this impressionable period for girls, girls will turn in to women who lead in science.

思春期の女子は自信に欠け、男子生徒がリーダーシップを発揮するジェンダー規範の餌食になりやすいが、女子校だとこれを回避できる。実験室では男子が操作をして、女子が記録係。多感な時期に男子不在の環境なら女子は科学でリーダーシップを発揮するチャンスを得られる。

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## #6. Support for combining work and life

### 仕事と家庭生活の両立支援

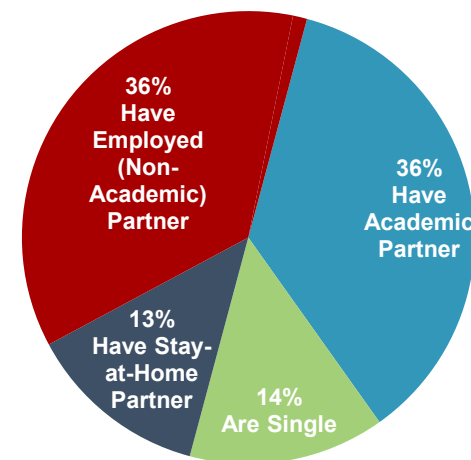
- Family-friendly policies, such as...

- |                         |              |
|-------------------------|--------------|
| ▪ Stop the tenure clock | テニユア・クロックの停止 |
| ▪ Parental leave        | 母親や父親の育児休暇   |
| ▪ On-site child care    | 現場での育児支援     |
| ▪ Housework benefits    | 家事手当         |
| ▪ Dual-career hiring    | 配偶者雇用        |

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## #6-1. Dual-career hiring policies

### Partner Status of U.S. Academic Workforce



### 研究者の配偶者の就労状況調査

9,043 Full-Time Faculty from 13 Leading Research Universities

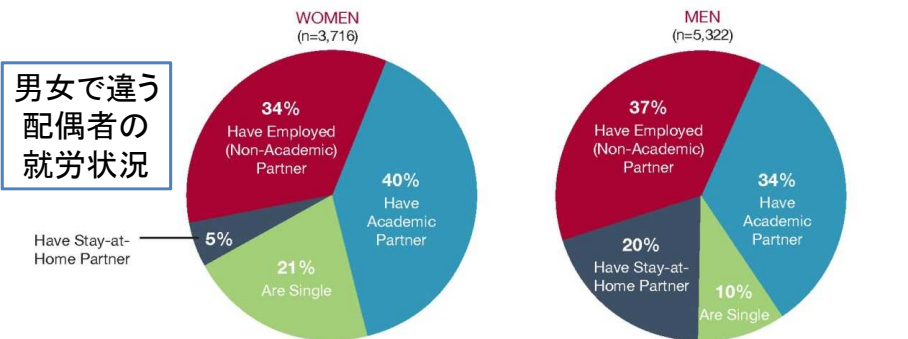
Seventy-two percent of full-time faculty in this study have employed partners.

Thirty-six percent have academic partners.

Percentages do not add to 100 due to rounding.

# #6-1. Dual-career hiring policies

## Men and Women Have Different Partnering Patterns

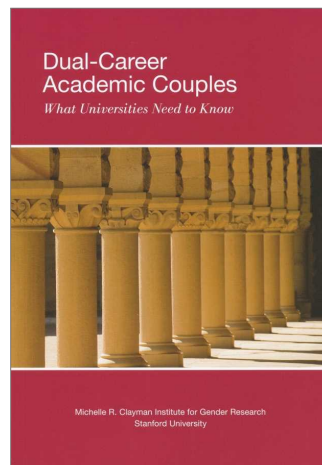


Women are more likely than men to have academic partners. Men are more likely than women to have stay-at-home partners, whereas women are more likely to be single.

Percentages do not add to 100 due to rounding.

訳注: 日本ではグラフ右側の無職の妻をもつ男性研究者の比率が50%以上を占める。

# #6-1. Dual-career hiring policies

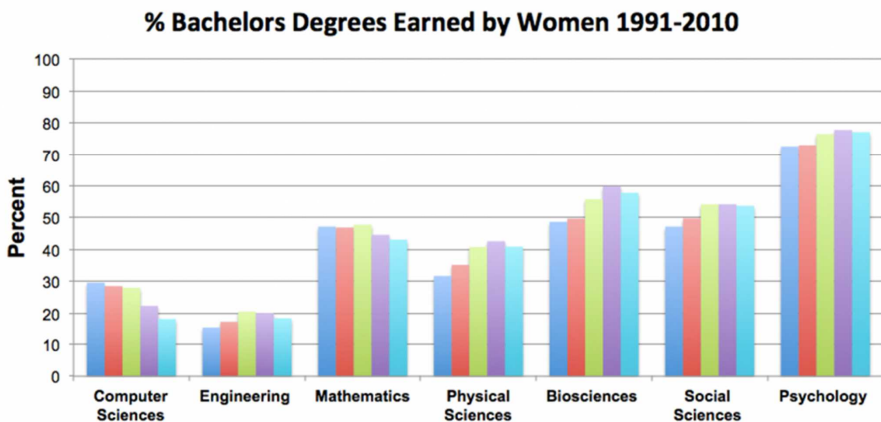


Schiebinger, L. L., Henderson, A. D., & Gilmartin, S. K. (2008). *Dual-career academic couples: What universities need to know*. Michelle R. Clayman Institute for Gender Research, Stanford University.

配偶者雇用（帯同雇用）政策

# #7. Gendering fields of science

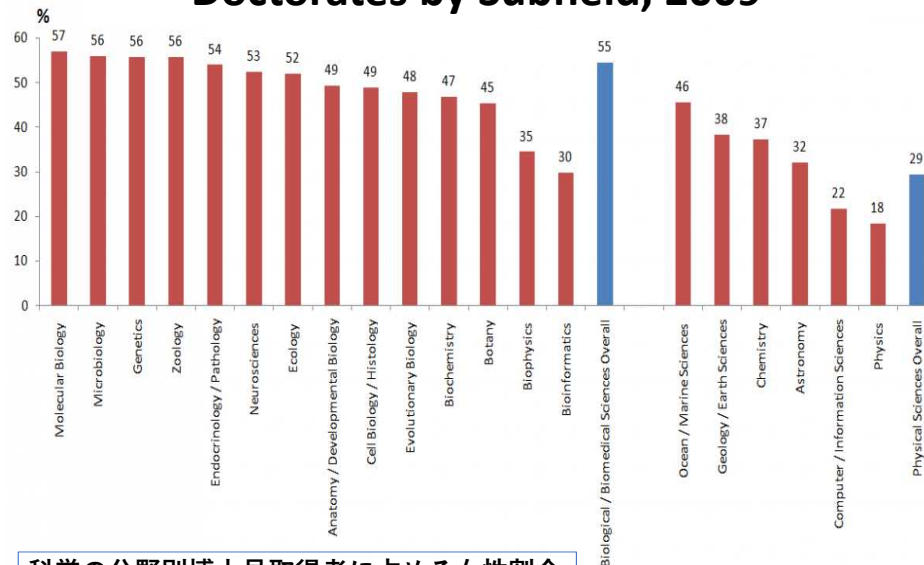
1991-2010年における女性の学士取得状況



Blue - 1991; Red - 1995; Green - 2000; Purple - 2005; Aqua - 2010

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics

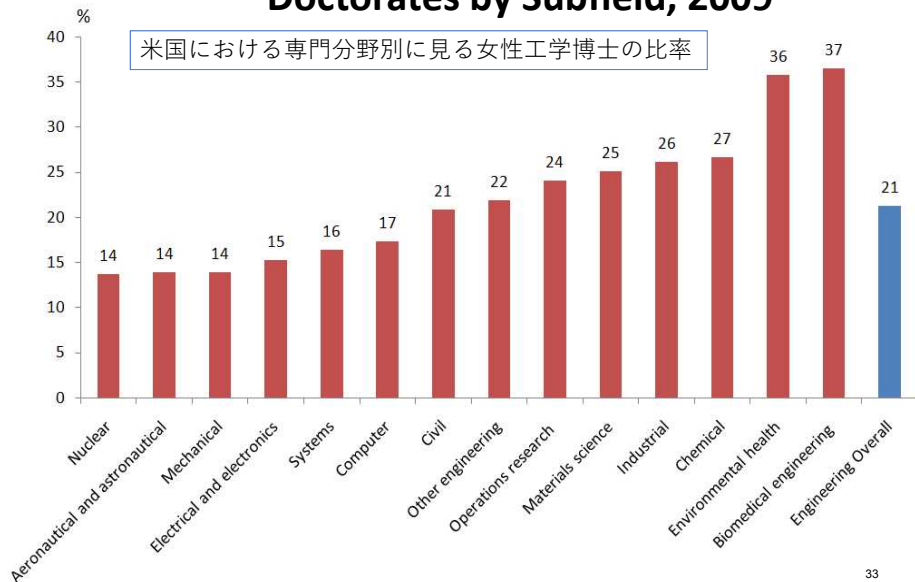
# U.S. Women's Shares of Science Doctorates by Subfield, 2009



科学の分野別博士号取得者に占める女性割合

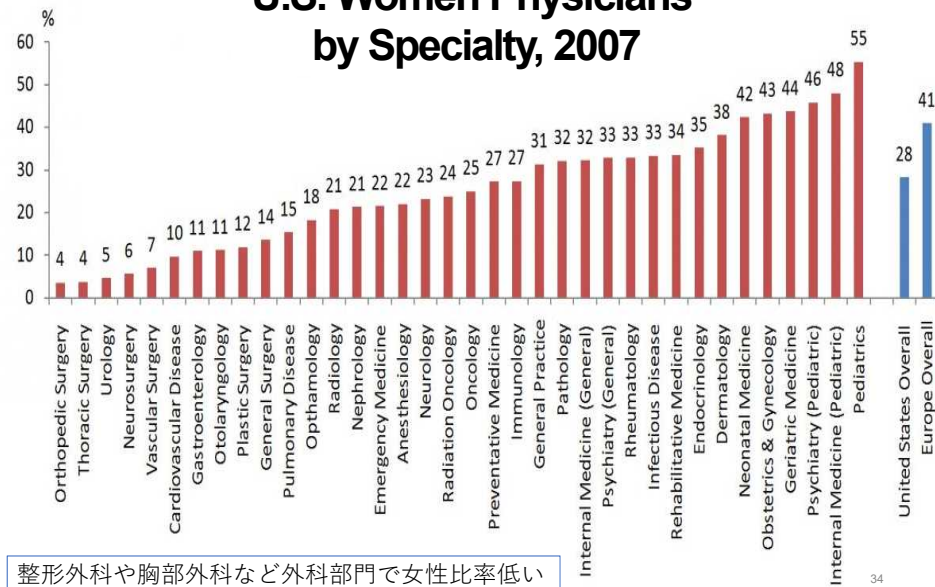


## U.S. Women's Shares of Engineering Doctorates by Subfield, 2009



## 専門分野別に見る医師の女性比率

## U.S. Women Physicians by Specialty, 2007



## # 8. Gender equality indices

### ジェンダー平等指数

- Gender Inequality Index from the United Nations Human Development Report

国連人間開発報告書のジェンダー不平等指数。  
 訳注：国家の人間開発の達成が男女の不平等によってどの程度妨げられているかを明らかにするもの

- <http://hdr.undp.org/en/composite/GII>

訳注：男女共同参画に関する国際的な指数としては、人間開発指数HDI、ジェンダー開発指数GDI、ジェンダー不平等指数GII、ジェンダー・ギャップ指数GGIなど <sup>35</sup>

## Gender Inequality Index from the United Nations Human Development Report

- Compares countries on the basis of maternal mortality, adolescent birth rate, share of seats in the parliament, education, and participation in the work force.

産婦死亡率、出産の未成年者率、女性議員比、教育、就労

- Switzerland, Denmark, and the Netherlands rank very high. Japan ranks # 21. The US ranks low (#43) because of our high maternal mortality rates and poor representation of women in Congress.

スイス、デンマーク、オランダは高ランク。日本21位。

USのランクを落としているのは、産婦死亡率、女性議員比

## # 8. Gender equality indices

- Global Gender Gap Index, 2016 by the World Economic Forum
- <http://reports.weforum.org/global-gender-gap-report-2016/rankings/>

世界経済フォーラムのジェンダー・ギャップ指数<sup>37</sup>

## #9. Funding policies to support

女性研究者支援の助成政策

- a. fixing the numbers of women 数を増やす
- b. fixing the institutions 制度の見直し
- c. fixing the knowledge 知識の再検討

<http://genderedinnovations.stanford.edu/sex-and-gender-analysis-policies-major-granting-agencies.html>

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## Global Gender Gap Index

- Slightly different measures: workforce participation, literacy, health and survival, political empowerment  
労働力率、識字率、健康、政治的エンパワーメント
- Japan ranks high for education and health, and low for politics and economy—overall #111. Iceland, Finland, and Norway top the list. US ranks #45.

日本は教育と健康で高く、政治と経済で低く、111位。  
アイスランド、フィンランド、ノルウェーがトップクラス。  
USは45位。

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## #11. Development of Gender Studies

Distinguished sex and gender

セックスとジェンダーの区別

- **Sex** refers to biological characteristics
- **Gender** refers to cultural attitudes and behaviors

The term gender was introduced in the late 1960s to reject biological determinism that links biology with rigid sex roles and expectations. "Gender" is used to distinguish socio-cultural factors shaping behaviors and attitudes from biological factors related to sex. Gendered behaviors and attitudes are *learned*; they differ by cultures.

ジェンダーという用語は、生物学的決定論に反対して1960年代末に導入。  
「ジェンダー」は行動や態度を形成する社会文化的要素を、性別に関する生物学的要素から区別して使用された。ジェンダー化された行動や態度は学  
習されるものであり、したがって文化によって異なる。

# Analyzing Gender

## Points to Keep in Mind:

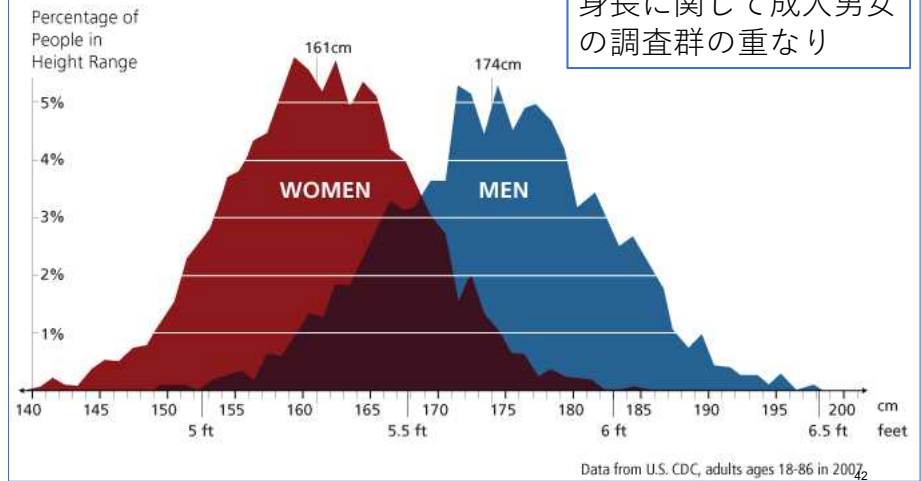
- Gender consists of:
  - Gender Norms** (spoken and unspoken cultural rules in the family, workplace, society, institutional or global culture that influence individual attitudes and behaviors).
  - Gender Identity** (how individuals and groups perceive and present themselves in relation to gender norms).
  - Gender Relations** (the power relations between individuals of different gender identities).
- Gender attitudes and behaviors vary by culture, historical era, ethnicity, socioeconomic status, geographic location, and other factors. For example, gender norms may be very different on the US West coast vs. East coast, or in Japan vs. India.
- Investigators should recognize within group variations (differences in attitudes and behaviors among women or among men) and between-group overlap (overlap in attitudes and behaviors between women and men).
- It is important to consider factors intersecting with sex and gender (e.g., age, socio-economic status, or ethnicity).
- There is no necessary relationship between gender characteristics and sex.

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# Consider difference and overlap

## Height of Adult Women and Men

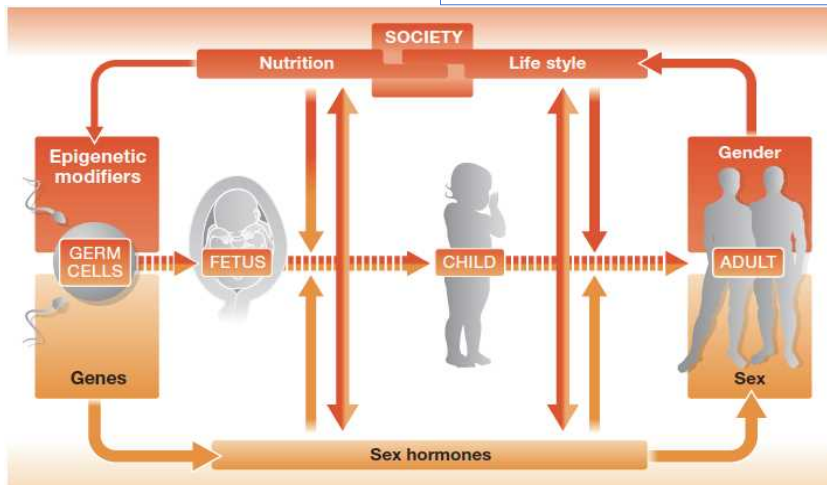
Within-group variation and between-group overlap are significant



# Sex and Gender Interact

Regitz-Zagrosek, V. (2012). Sex and Gender Differences in Health. *EMBO Reports*, 13 (7): 596-603.

## 性別とジェンダーの相互作用



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# Sex and Gender Interact

- Classic texts:

Fausto-Sterling, A. (2005). The bare bones of sex: Part 1—sex and gender. *Signs: Journal of Women in Culture and Society*, 30(2), 1491-1527.

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# Reconceptualizing Sex

## 性別の再概念化

Male  
Female  
Intersex

Fausto - Sterling, A. (1993). The five sexes. *The sciences*, 33(2), 20-24.

Ainsworth, C. (2015). Sex redefined: The idea of two sexes is simplistic. *Nature*, 518(7539), 288.

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アメリカの統計数値

## Statistics for US

	Percentage	Population
Female	51%	163 mill.
Male	49%	157 mill.
Intersex	0.06-1.7%	190,000-5.5 mill.
Transgender	0.6%	~1.9 mill.
Gender-fluid	unknown	unknown

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## Countries that allow a third option on birth certificates or legal documents

Austria  
Australia  
Bangladesh  
Germany (limited to 3 months after birth)  
India  
Malta  
Nepal  
New Zealand  
Pakistan  
Denmark  
Argentina  
Colombia  
Canada  
Scotland  
Some states in the US: California, Washington, Oregon

出生証明書あるいは公文書について  
第3の選択肢を容認している国々

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## Reconceptualizing Gender

### ジェンダーの再概念化

Gender as a spectrum assumes ideal endpoints of masculinity and femininity. Our goal is to get rid of these categories.

スペクトラムとしてのジェンダーは、男らしさと女らしさの理想のゴールを想定している。我々のゴールは男女のこれらのカテゴリーを除くことである。

2014 [Facebook's 51 gender options](#)

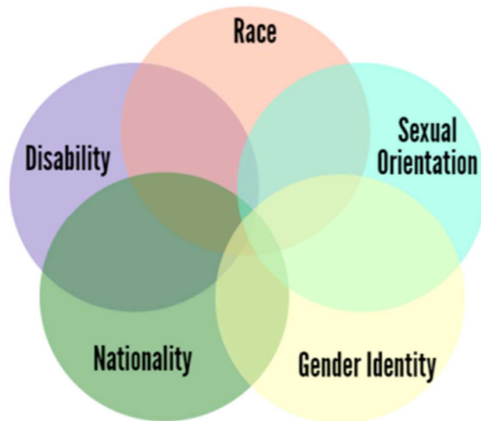
2018 New visualizations are required

Japan??

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“Intersectionality” considers factors that intersect with sex and gender, such as ethnicity, social economic status, abilities, etc.

Classic article: Crenshaw, Kimberle. "Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics," University of Chicago Legal Forum: Vol. 1989: Iss. 1, Article 8.



「重複部分」はたとえば民族性や社会経済的地位や能力などである、性とジェンダーと交差する要素を考慮に入れている。

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## #12. Analyzing Gender Norms

### ジェンダー規範の分析

- Modern Western gender norms were developed in the 18<sup>th</sup> century as a solution to the “Woman Question” in the founding of democratic states.

近代西洋ジェンダー規範は、民主的な国家を設立するに際し、「女性問題」の解決として18世紀に発達。

- Science served to set gender norms on a supposedly objective natural basis.
- Classic text: Schiebinger, L. (1989). *The mind has no sex?: Women in the origins of modern science*. Harvard University Press. 邦訳『科学史から消された女性たち』小川真里子・藤岡伸子・家田貴子訳 工作舎

科学は、客観的で自然な基盤に基づくと想定されるジェンダー規範の作るのに貢献。

## #12. Gender Norms: Stereotypes in Western Culture reflect and reinforce physical, domestic, and cognitive divisions of labor

ジェンダー規範：西洋文化におけるステレオタイプは様々な分業を強化

### 18<sup>th</sup> century consolidation: 18世紀における規範強化

Reason 理性	Feeling 感情
Objective 客観的	Subjective 主観的
Self- Assertive 自己主張	Socially Sensitive 社会的な気遣い
Profession 職業	Home 家庭・家事
Public 公的	Private 私的
Male 男らしさ	Female 女らしさ
Science 科学	Not Science 非科学

### 21<sup>st</sup> century: rapid change

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## #12. Gender Norms 日本の規範について講演者から質問

### 日本のジェンダー規範（三成教授から回答）

- 近代日本のジェンダー規範
  - 父権的家父長制（男尊女卑+天皇制家族国家+家制度）→ 戦後改革で否定
    - 戸主権（婚姻等には戸主の同意が必要）
  - 夫権的家父長制（夫の決定権+性別役割分業）
    - 戦後改革で夫の決定権は否定+戦後経済発展で性別役割分業が強化
- 戦後日本
  - 「近代家族」（核家族）を法的単位として設定
    - 法的な男女平等の達成は早い（1946-47年憲法24条+家族法改正）
    - 高度経済成長（1955-73年）による核家族型専業主婦世帯（夫＝稼ぎ主/妻＝専業主婦兼パート労働者）の拡大
  - 「日本型福祉社会」（家族を福祉の代替者に）への転換（1978年）
    - 男女雇用機会均等法（1985年）と専業主婦優遇政策が同時進行
  - 21世紀 ジェンダー主流化と「家族主義」（法律婚嫡出親子関係を規範化してケアを家族に委ねることを美化し、シングルマザーや事実婚・同性婚など家族の多様化を阻止しようとする立場）強化という矛盾
    - ジェンダー平等の停滞と家族主義の強化による個人主義の抑制



## #13. Unconscious Gender Bias

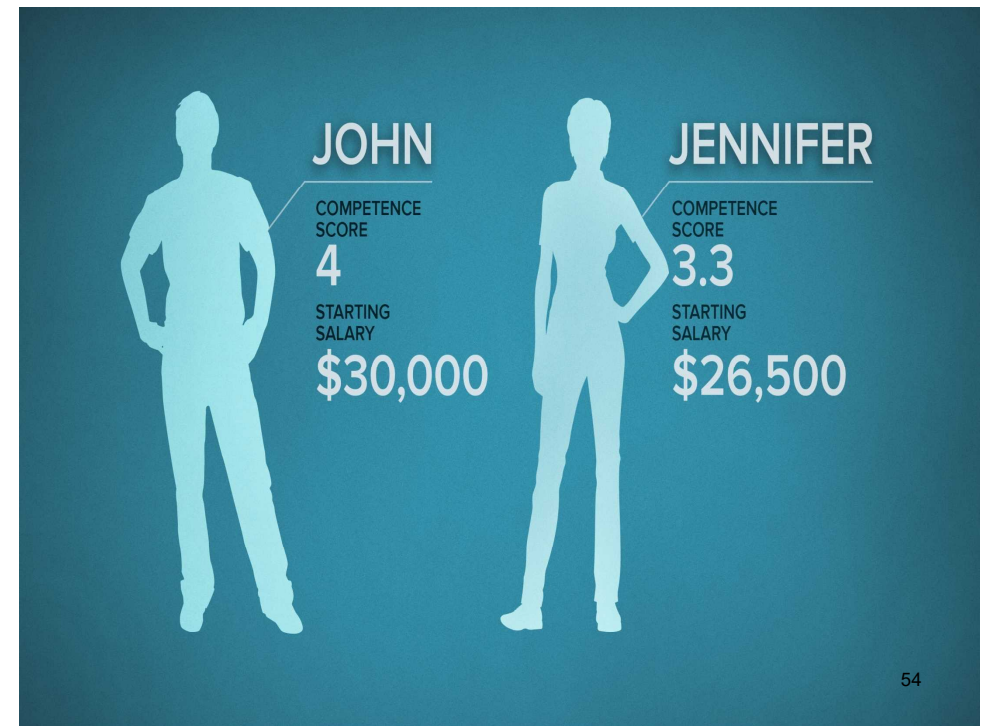
### 無意識のジェンダー・バイアス

**Hiring:** Both women and men are significantly more likely to vote to hire a man applicant versus a woman applicant with the same academic record.

雇用：同じ業績であれば、女性志願者よりも男性志願者の雇用を、男女ともが支持する傾向にある。

Moss-Racusin, C., Dovidio, J., Brescoll, V., Graham, M., & Handelsman, J. (2012). Science Faculty's Subtle Gender Biases Favor Male Students. *Proceedings of the National Academy of Sciences of the United States of America*, 109 (41), 16474-16479.

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## #13. Unconscious Gender Bias

### 無意識のジェンダー・バイアス

**Hiring:** Women may be penalized more than men for initiating negotiations for salary and resources.

雇用：給与等の雇用条件に関する交渉を切り出すと女性は男性に比べ不利に扱われる傾向にある。

Bowles, H., Babcock, L., & Lai, L. (2007). Social Incentives for Gender Differences in the Propensity to Initiate Negotiations: Sometimes it Does Hurt to Ask. *Organizational Behavior and Human Decision Processes*, 103, 84-103.

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## #13. Unconscious Gender Bias

### 無意識のジェンダー・バイアス

**Hiring:** Gender bias may extend to letters of recommendation.

雇用：ジェンダー・バイアスは推薦書にも及んでいるようだ。

Trix, F., & Psenka, C. (2003). Exploring the Color of Glass: Letters of Recommendation for Female and Male Medical Faculty. *Discourse and Society*, 14 (2), 191-220.

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## #13. Unconscious Gender Bias

無意識のジェンダー・バイアス

### Stereotype threat

ステレオタイプ脅威（固定観念によってもたらされるマイナス）

### Imposter syndrome

インポスター症候群（自分の達成を内面的に肯定できない劣等感）

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## #13. Unconscious Gender Bias

無意識のジェンダー・バイアス

以下のサイトも参照してください。

- For the US, we have summarized this literature here:  
<http://genderedinnovations.stanford.edu/institutions/bias.html>
- This literature may be different for different countries.

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## Transformative Programs

変革プログラム

- In the US, many institutions have developed trainings to overcome these problems. One transformative program was the **STRIDE** program developed at the University of Michigan and funded by the **NSF ADVANCE** program. By overcoming unconscious gender bias in the hiring process, the School of Engineering was able to dramatically increase the numbers of women hired.

USでは多くの研究機関でバイアス克服のトレーニングがなされている。変化に向けたプログラムの一つは、ミシガン大学で開発され、NSFの助成でなされたSTRIDE。雇用過程における無意識のジェンダー・バイアスの克服によって、同大学工学部は雇用女性権者数を劇的に増加させ得た。

Danielle LaVaque-Manty et al., "A Very Scholarly Intervention: Recruiting Women Faculty in S&E," *Gendered Innovations in S&E*, ed. Londa Schiebinger (Stanford UP, 2008), 165-181.

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## #14. Understanding gender bias in science

科学におけるジェンダー・バイアスを理解する

The science of sex and the female body. Western science developed a vast literature to explain why women innately can not do great science. First it was the distinctive skeleton, next it was raging hormones, now it's differences in the brain.

西洋科学は、女性に科学は生来無理だとしてきた。まずは骨格、次に荒れ狂うホルモン、最近は脳の差。

A few classic texts:

- Tuana, N. (1993). *The less noble sex: Scientific, religious, and philosophical conceptions of woman's nature*. Indiana University Press.
- Schiebinger, L. (2000). *Feminism and the body*. Oxford University Press.
- Fausto-Sterling, A. (2008). *Myths of gender: Biological theories about women and men*. Basic Books. 邦訳『ジェンダーの神話』池上千寿子・根岸悦子訳 工作舎（ただし1985年版）

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## #14. Understanding gender bias in science

Bias in the substance of science. Historians document how biased notions of sex and gender constructed partial and inaccurate science.

### A few classic texts:

- Schiebinger L. (1993). *Nature's Body: Gender in the making of modern science*, Beacon Press. 邦訳：『女性を弄ぶ博物学』工作舎
- Spanier, B. (1995). *Im/partial science: Gender ideology in molecular biology*. Indiana University Press.
- Hager, L. D. (Ed.). (1997). *Women in human evolution*. Psychology Press.
- Oudshoorn, N. (2003). *Beyond the natural body: An archaeology of sex hormones*. Routledge.
- Richardson, S. S. (2013). *Sex itself: The search for male and female in the human genome*. University of Chicago Press.

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## #15. Integrating sex and gender analysis into science, or [Gendered Innovations](#)

**Purpose:** To create excellent science by integrating sex and gender analysis in research design (at the beginning of the process)

**Methods:** develops practical methods of sex and gender analysis for scientists and engineers. These are methods currently not included in science and engineering curricula. They are methods developed by History of Science and Gender Studies of Science over the past several decades.

**Outcomes:** provides case studies as concrete illustrations of how sex and gender analysis leads to discovery and innovation.

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## #15. Integrating sex and gender analysis into science, or [Gendered Innovations](#)

Basic Science

Health & Medicine

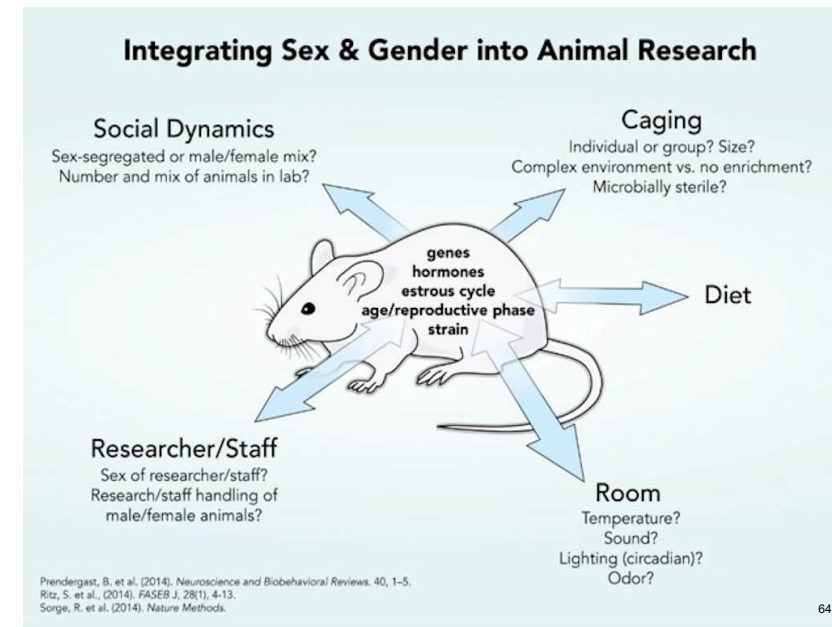
Engineering

Environment

訳注：スタンフォード大学のGendered Innovations サイトには事例研究として上記4項目が立てられ、それぞれに5から6個の事例報告が掲載されている。

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### #15-1. Basic Science



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## Example: “Male–Observer Effect”

実験で男性観察者によってもたらされる効果

This example reveals interactions in the animal lab—in this case between animals in the lab and the sex of the researcher. An important study by Sorge et al. discusses the impact of experimenter sex! This example focuses on pain research. The researchers induce pain in rats and mice. What they found is amazing. They found that rats and mice don't show their pain to men researchers. This is really important because the researchers are studying sex differences in pain response. Animals don't show their pain when a man is in the room, as compared to an empty room, but they show their pain when a woman is in the room. Both male and female mice displayed this “male–observer effect.”

What's going on? The animals smell the men, they smell male pheromones. According to Jeff Mogil, this phenomenon may throw into question all prior results from pain research. This demonstrates that sex/sex interaction is important. The GI method used here is [Analyzing Sex](#).

Sorge, R., Martin, L., Isbester, K., Sotocinal, S., Rosen, S., ... & Mogil, J. (2014). Olfactory Exposure to Males, Including Men, Causes Stress and Related Analgesia in Rodents. *Nature Methods*, 11, 629–632.

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## #15–2. Health & Medicine



Osteoporosis Research in Men :  
Rethinking Standards and  
Reference Models

### 男性骨粗しょう症患者の研究： スタンダードの再考と参照モデル

訳注：骨粗しょう症は長らく閉経後の女性の病気とされてきたために、見過ごされがちであった男性の骨粗しょう症患者の見直しとジェンダーを踏まえた参照モデルの構築を意図。

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## #15-2. Health & Medicine

### Example: [Osteoporosis Research in Men](#)

#### The Challenge

Men account for nearly a third of osteoporosis-related hip fractures in Europe and the U.S. (Dhanwal et al., 2010). Nonetheless, osteoporosis is considered primarily a disease of postmenopausal women, and men are rarely evaluated or treated for it (Szulc et al., 2012).

#### Method: [Rethinking Standards and Reference Models](#)

Research in many fields—for example, heart disease—has relied on reference models that treat men as the norm. Women are often studied as deviations from that norm. In the case of osteoporosis, however, diagnostic models have been developed for women using bone mineral density (BMD) norms of healthy young white women, and criteria to identify risk in men are not well established. Researchers are improving these reference models and opening new areas of research by considering disease progression in both women and men, and by evaluating risk using sex-specific reference models.

#### Gendered Innovations:

1. **Establishing Male Reference Populations:** By 1997, evaluation of men's bone quality was based on BMD norms of healthy young men rather than healthy young women (Looker, 1997). More work needs to be done to redefine diagnostic cutoffs for both women and men (Binkley et al., 2010).
2. **Creating New Diagnostics Based on Secondary Contributors to Osteoporosis and Metabolic Bone Disorders:** Researchers have identified medical conditions (such as hypogonadism and hypercalciuria) and treatments (such as chemotherapeutics and anticonvulsants) that correlate with osteoporotic fracture, especially in men. New diagnostics take SECObS into account—along with variables such as BMD, sex, and lifestyle. Accounting for these factors improves diagnosis in both women and men.

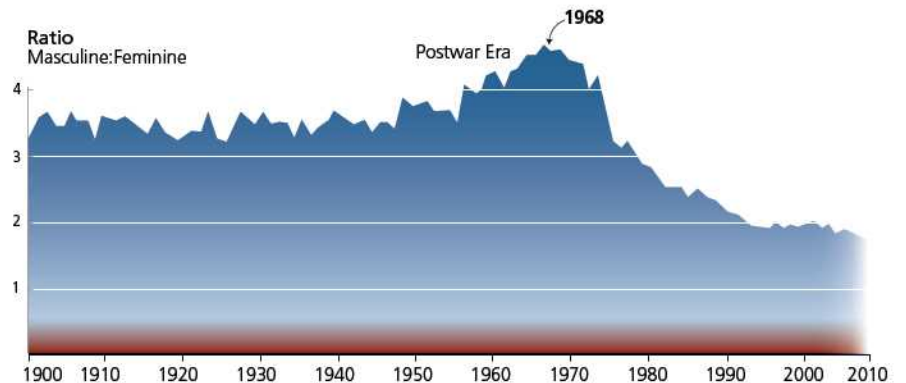
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## #15–3. Engineering

男性代名詞は、女性代名詞に比べ  
3から4倍の頻度で書籍に登場していた。

### Ratio of Masculine to Feminine Pronouns in U.S. Books, 1900-2008

Changes parallel increases in women's labor force participation, education, age at first marriage, etc.



The ratio of masculine pronouns (“he,” “him,” “his,” “himself”) to feminine pronouns (“she,” “her,” “hers,” “herself”) peaked at over 4:1 in 1968. By 2000 the ratio dropped dramatically to 2:1 (Twenge et al., 2012).

Data from American English corpus of the Google Books database (~1.2 million books).  
Reproduced from Twenge et al. 2012.



## Example: [Machine Translation](#) 機械翻訳

### The Challenge

Machine translation (MT) becomes increasingly important in a global world. Although error rates are still high, MT system accuracies are improving incrementally. Some errors in current systems, however, are based on fundamental technological challenges that require non-incremental solutions. One such problem is related to gender: State-of-the-art translation systems like Google Translate or Systran massively overuse masculine pronouns (he, him) even where the text specifically refers to a woman (Minkov et al., 2007). The result is an unacceptable infidelity of the resulting translations and perpetuation of gender bias.

### Method: [Analyzing Gender](#)

The reliance on a "masculine default" in modern machine translation systems results from current systems that do not determine the gender of each person mentioned in a text. Instead, the translation is produced by finding all the possible matches for a given phrase in large collections of bilingual texts, and then choosing a match based on factors such as its frequency in large text corpora (or bodies of text). Masculine pronouns are over-represented in the large text corpora that modern systems are trained on, resulting in over-use in translations. In July 2012 the Gendered Innovations project convened a workshop to discuss potential solutions. Improving feminine-masculine pronoun balance in these corpora, for example, would still not fix the problem, since it will simply cause both women and men to be randomly referred to with the wrong gender. Instead, it is crucial to develop algorithms that explicitly determine the gender of each person mentioned in text and use this computed gender to inform the translation. Such algorithms could avoid the masculine default and also increase the quality of translation overall.

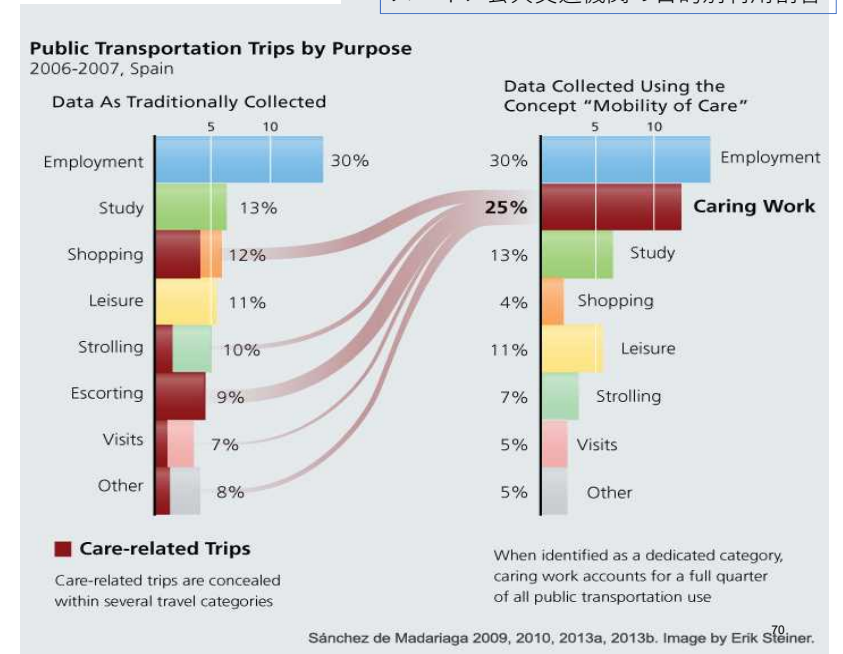
### Gendered Innovations:

1. Studying the Male Default in Machine Translation
2. Detecting the Gender of Entities to Improve Translation Algorithms (research in progress)
3. Integrating Gender Analysis into the Engineering Curriculum

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## #15-4. Environment

スペイン公共交通機関の目的別利用割合



## #15-4. Environment

### Example: [Public Transportation](#)

### The Challenge

Categories used in transportation surveys—and, hence, the way statistics are gathered and analyzed—may not properly account for caring work—that is unpaid labor performed by adults for children or other dependents, including labor related to the upkeep of a household. Public transport systems are typically designed around the needs of commuters (people traveling between their homes and places of paid employment). The mobility associated with caring work, including childcare and elder care, has typically not figured into transportation design.

### Method: Rethinking Concepts and Theories

The innovative concept "mobility of care" provides a perspective for "recognizing and revaluing care work" (Sánchez de Madariaga, 2009). Incorporating "caring work" into user surveys helps to identify the significant number of trips that women and men make for this purpose. Understanding gender differences in public transportation is important for understanding [climate change](#) and planning efficient [housing and neighborhoods](#).

### Gendered Innovations:

1. Adding the concept, "mobility of care", to data collection variables may render public transportation more responsive to users' needs.
2. Understanding gender differences in travel has led to the concept of "trip chaining" with ramifications for the design of public transport systems.
3. Gathering data disaggregated by sex and other factors intersecting with sex and gender (such as income, family status, etc.) improves transportation research and policy.

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## Global History of Women and Gender in Science

- These are the 15 categories of analysis I suggest.
- I'm excited to hear your suggestions! Would these categories be relevant for Japan? Asia more generally?

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