

# Women, Gender, and Feminist Theory in Science

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# Introduction

- Feminist Science Studies examines:
  - the historical emergence, development and dissolution of particular scientific disciplines
  - the dynamics of science as a social, economic, and political institution
  - and the epistemological foundations of scientific knowledge claims
- **How social values permeate the practices, processes, and products of scientific research**

# New Generation of Feminist Science Studies

- Aims to incorporate critiques of science but also participate in production of scientific knowledge
- Develops feminist and scientific practices to “better know the world”
- Aware of the co-constitution of science and culture
- **Ready to think about “*science as feminism*”**  
(Murphy 2012, 100)

# Gender-Sensitive Research

- Aims to overcome androcentric bias
- Be socially inclusive
- Guarantee gender balance in research
  
- By being more inclusive, the sciences will be invigorated by “non-usual” points of view

(EGERA Workshop, 2015)

- *How we think about the concept of gender, and the meanings of difference, will deeply influence what scientific questions we ask and how we design our experimental frameworks.*
- *Can we learn both from and within the sciences, to engage more critically and ethically with our treatments of “difference”?*

# Part I: The “Women Question” in Science

- Early analyses led to discussions of androcentrism and misogyny in scientific discourses
- Feminist science studies scholars have illuminated the specific practices in the sciences that have led to the devaluation, marginalization, and exclusion of women
- These exclusions have been linked to relations of power organized through categories of gender, race, class, sexuality, disability, and systems of colonialism.

# Clinical Trials and Health Implications

The screenshot shows the FDA website's 'Drugs' section. The header includes the U.S. Department of Health & Human Services logo, the FDA logo, and the text 'U.S. Food and Drug Administration Protecting and Promoting Your Health'. A search bar and a 'SEARCH' button are visible. A navigation menu contains links for Home, Food, Drugs, Medical Devices, Radiation-Emitting Products, Vaccines, Blood & Biologics, Animal & Veterinary, Cosmetics, and Tobacco Products. The 'Drugs' section is active, with a breadcrumb trail: Home > Drugs > Drug Safety and Availability. A sidebar on the left lists various drug-related topics, with 'Drug Safety and Availability' selected. The main content area features a headline: 'FDA Drug Safety Communication: FDA approves new label changes and dosing for zolpidem products and a recommendation to avoid driving the day after using Ambien CR'. Below the headline is a link 'en Español'. The text of the communication states: 'This update is in follow-up to the FDA Drug Safety Communication: Risk of next-morning impairment after use of insomnia drugs; FDA requires lower recommended doses for certain drugs containing zolpidem (Ambien, Ambien CR, Edluar, and Zolpimist) issued on 1/10/2013.' It is followed by a 'Safety Announcement' dated [5-14-2013], which details the FDA's approval of new dosing recommendations for zolpidem products (Ambien, Ambien CR, and Edluar) to reduce the risk of next-morning impairment. The announcement explains that the lower doses (5 mg for immediate-release, 6.25 mg for extended-release) are not effective, and the dose can be increased to 10 mg for immediate-release products and 12.5 mg for zolpidem extended-release. However, use of the higher dose can increase the risk of next-day impairment of driving and other activities that require full alertness. The communication concludes with a link to access the latest drug labels.

U.S. Department of Health & Human Services

FDA U.S. Food and Drug Administration  
Protecting and Promoting *Your* Health  
FDA, U.S. Food and Drug Administration

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SEARCH

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## Drugs

Home > Drugs > Drug Safety and Availability

Drug Safety and Availability

- Counterfeit Drugs
- Drug Alerts and Statements
- Medication Guides
- Drug Safety Communications
- Drug Shortages
- Postmarket Drug Safety Information for Patients and Providers
- Information by Drug Class
- Medication Errors
- Drug Safety Podcasts
- Safe Use Initiative
- Drug Recalls
- Drug Supply Chain Integrity

### FDA Drug Safety Communication: FDA approves new label changes and dosing for zolpidem products and a recommendation to avoid driving the day after using Ambien CR

[en Español](#)

This update is in follow-up to the [FDA Drug Safety Communication: Risk of next-morning impairment after use of insomnia drugs; FDA requires lower recommended doses for certain drugs containing zolpidem \(Ambien, Ambien CR, Edluar, and Zolpimist\)](#) issued on 1/10/2013.

#### Safety Announcement

**[5-14-2013]** The U.S. Food and Drug Administration (FDA) is notifying the public that FDA has approved label changes specifying new dosing recommendations for zolpidem products (Ambien, Ambien CR, and Edluar), which are widely prescribed sleep medications. FDA has approved these changes because of the known risk of next-morning impairment with these drugs.

FDA is also warning that patients who take the sleep medication zolpidem extended-release (Ambien CR)—either 6.25 mg or 12.5 mg—should not drive or engage in other activities that require complete mental alertness the day after taking the drug because zolpidem levels can remain high enough the next day to impair these activities. This new recommendation has been added to the *Warnings and Precautions* section of the physician label and to the patient Medication Guide for zolpidem extended-release (Ambien CR).

Also included in the updated label are the dosing recommendations previously stated in FDA's [January 2013 Drug Safety Communication](#): The recommended initial dose of certain immediate-release zolpidem products (Ambien and Edluar) is 5 mg for women and either 5 mg or 10 mg for men. The recommended initial dose of zolpidem extended-release (Ambien CR) is 6.25 mg for women and either 6.25 or 12.5 mg for men. If the lower doses (5 mg for immediate-release, 6.25 mg for extended-release) are not effective, the dose can be increased to 10 mg for immediate-release products and 12.5 mg for zolpidem extended-release. However, use of the higher dose can increase the risk of next-day impairment of driving and other activities that require full alertness.

Health care professionals and patients can access the latest drug labels below.

# "Sex-balanced" animal and cell model research

U.S. Department of Health & Human Services

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## THE NIH DIRECTOR

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### NIH Takes Steps to Address Sex Differences in Preclinical Research

May 14, 2014

Over the past two decades, we have learned a great deal about how men and women respond differently to medications. This knowledge came after a concerted effort in the early '90s to increase the number of women in NIH-funded clinical research. Today, just over half of NIH-funded clinical research participants are women. Unfortunately, experimental design in cell and animal research has not always followed suit. An over-reliance on male animals, and neglect of attention to the sex of cells, can lead to neglect of key sex differences that should be guiding clinical studies, and ultimately, clinical practice. NIH is taking action to address this shortfall as outlined by Janine A. Clayton, M.D., Director of the NIH Office of Research on Women's Health, and me in the *Nature* Comment below.

Francis S. Collins, M.D., Ph.D.  
Director, National Institutes of Health

Related Links  
ORWH Director's Blog: Filling the Gaps: NIH Enacts New Policies to Address Sex Differences

Image from <https://www.nih.gov/about-nih/who-we-are/nih-director/statements/>

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## Policy: NIH to balance sex in cell and animal studies

Janine A. Clayton & Francis S. Collins

14 May 2014

Janine A. Clayton and Francis S. Collins unveil policies to ensure that preclinical research funded by the US National Institutes of Health considers females and males.

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Subject terms: Medical research · Policy · Research management



Illustration by Katie Scott

Top story



Six challenges to stamping out Ebola

Despite a recent sharp drop in the overall number of Ebola cases, the situation remains precarious in West Africa.

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nature DRUG REVIEWS DISCOVERY

Image from <http://www.nature.com/news/policy-nih-to-balance-sex-in-cell-and-animal-studies-1.15195>



# Sex and Gender Related Research Methods

The screenshot shows the homepage of the Gendered Innovations website. The header is dark red with the title "Gendered Innovations" in white, followed by the subtitle "in Science, Health & Medicine, Engineering, and Environment". A navigation menu includes "Home", "Contributors", "Links", "Translations", and "Contact Us", along with a search bar. The main content area features a large image of a person using a prosthetic hand. A sidebar on the right lists categories: "ENVIRONMENT", "ENGINEERING", "HEALTH & MEDICINE", and "SCIENCE". The main content area has a featured article titled "Sex and Gender Methods for Design" under the "ENGINEERING" category. A left sidebar contains a navigation menu with sections like "What is Gendered Innovations?", "SEX & GENDER ANALYSIS", "CASE STUDIES", "CASE STUDIES 'IN A NUTSHELL'", "POLICY RECOMMENDATIONS", "INSTITUTIONAL TRANSFORMATION", and "VIDEOS". Below the main article, there is a "FEATURED CASE STUDIES" section with three thumbnails: "Osteoporosis" and "HIV Microbicides". A text box on the right explains the purpose of Gendered Innovations.

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

Home | Contributors | Links | Translations | Contact Us | Search The Site

What is Gendered Innovations?

SEX & GENDER ANALYSIS

Methods

Terms

Checklists

CASE STUDIES

Science

Health & Medicine

Engineering

Environment

CASE STUDIES "IN A NUTSHELL"

POLICY RECOMMENDATIONS

INSTITUTIONAL TRANSFORMATION

VIDEOS

ENVIRONMENT

ENGINEERING

HEALTH & MEDICINE

SCIENCE

ENGINEERING

**Sex and Gender Methods for Design** | Gendered Innovations

FEATURED CASE STUDIES

Osteoporosis

HIV Microbicides:

Why Gendered Innovations?  
"Gendered Innovations" employs methods of sex and gender analysis to create new knowledge.

Image from <https://genderedinnovations.stanford.edu/>

# Sex and Gender Related Research Methods

The screenshot shows the website 'Gendered Innovations' with a dark red header. The main title is 'Gendered Innovations' in white, followed by the subtitle 'in Science, Health & Medicine, Engineering, and Environment'. Navigation links include Home, Contributors, Links, Translations, and Contact Us. A search bar is labeled 'Search The Site'. The left sidebar contains a menu with categories: 'What is Gendered Innovations?', 'SEX & GENDER ANALYSIS' (with sub-items: Methods, Terms, Checklists), 'CASE STUDIES' (with sub-items: Science, Health & Medicine, Engineering, Environment), 'CASE STUDIES "IN A NUTSHELL"', 'POLICY RECOMMENDATIONS', and 'INSTITUTIONAL TRANSFORMATION'. At the bottom of the sidebar are social media icons for Print, Tweet, and Facebook. The main content area has a dark blue header with the title 'Interactions between Sex and Gender'. The text below explains that 'Sex' and 'gender' are analytically distinct but not independent terms and should be clearly defined. It provides two numbered examples: 1. Biological sex influences socio-cultural gender, with an example in Engineering about water infrastructure in Uganda. 2. Socio-cultural gendered behaviors influence sex differences in biology, with an example in Health & Medicine about osteoporosis risk.

# Sex and Gender Related Research Methods

What is Gendered Innovations?

SEX & GENDER ANALYSIS

Methods

Terms

Checklists

CASE STUDIES

Science

Health & Medicine

Engineering

Environment

CASE STUDIES "IN A NUTSHELL"

POLICY RECOMMENDATIONS

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VIDEOS

Print



Tweet

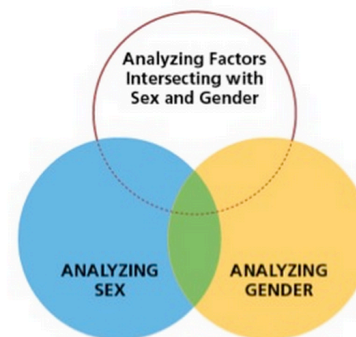


Facebook



## Analyzing How Sex and Gender Interact

"Sex" and "gender" are distinguished for analytical purposes (see [Sex and Gender are Distinct Terms](#)). "Sex" refers to biological qualities (see [Sex](#); [Analyzing Sex](#)), and "gender" refers to socio-cultural processes (see [Gender](#); [Analyzing Gender](#)). In reality, sex and gender interact (mutually shape one another) to form individual bodies, cognitive abilities, and disease patterns, for example. Sex and gender also interact to shape the ways we engineer and design objects, buildings, cities, and infrastructures. Recognizing how gender shapes sex and how sex influences culture is critical to designing quality research. Sex and gender also intersect in important ways with a variety of other social factors, including age, socioeconomic status, ethnicity, geographical location, etc.



Sex, Gender, and Factors Intersecting with Sex and Gender all interact to create individual behaviors, cognitive abilities, health outcomes, and attitudes, etc. across the life span.

Image from <http://genderedinnovations.stanford.edu/methods/how.html>

# Part II: The “Gender Question” in Feminist Science Studies

- FSS does not treat race, class, sexuality, disability, and other markers as intersectional additives to a theoretical mainframe of sex or gender analysis
- FSS questions regarding the body, matter, materiality, difference, and nature have been articulated through broader frameworks
- FSS is attentive to transnational processes of colonialism and postcolonialism, neoliberal capitalist practices of production, consumption, and commodification

# Troubling Gender, Troubling Sex

- Can we refer to a “given” sex or a “given” gender without first inquiring into how sex and/or gender is given, through what means? And what is “sex” anyway? Is it natural, anatomical, chromosomal, or hormonal, and how is a feminist critic to assess the scientific discourses which purport to establish such “facts” for us? . . . Are the ostensibly natural facts of sex discursively produced by various scientific discourses in the service of other political social interests? If the immutable character of sex is contested, perhaps this construct called “sex” is as culturally constructed as gender; indeed, perhaps it was always already gender, with the consequence that the distinction between sex and gender turns out to be no distinction at all. (Butler 1990, 10–11)

# Microprocesses as Phenomena

- [A] Deleuzian framework de-massifies the entities that binary thought counterposes against each other: the subject, the social order, even the natural world are theorized in terms of the microprocesses, a myriad of intensities and flows, with unaligned or unalignable components, which refuse to conform to the requirements of order and organization . . . Identities and stabilities are not fixed. (Grosz 1994, 181)

# Developmental Systems Theory

- Offers a framework for understanding biology and development in relation to several major factors including:
  - (i) joint determination by multiple causes
  - (ii) context sensitivity and contingency
  - (iii) extended inheritance
  - (iv) development as construction
  - (v) distributed control
  - (vi) evolution as construction

(Oyama, Griffiths, and Gray 2003).

# Intra-action

- Feminist Physicist Karen Barad states
  - The neologism “intra-action” signifies the mutual constitution of entangled agencies. That is, in contrast to the usual “interaction,” which assumes that there are separate individual agencies that precede their interaction, the notion of intra-action recognizes that distinct agencies do not precede, but rather emerge through, their intra-action. (Barad 2007, 33)



# Part III: Feminist Theory in (Neuro)Science

- From the point of view of a feminism of equality, feminisms of difference seem strangely reminiscent of the position of defenders of patriarchy: both stress women's differences from men. However, before too readily identifying them, it is vital to ask how this difference is conceived, and, perhaps more importantly, who it is that defines this difference and for whom... In the case of feminists of difference, however, difference is not seen as difference from a pre-given norm, but as pure difference, difference in itself, difference with no identity. This kind of difference implies the autonomy of the terms between which the difference may be drawn and thus their radical incommensurability. Difference viewed as distinction implies the pre-evaluation of one of the terms, from which the difference of the other is drawn; pure difference refuses to privilege either term. (Grosz 1990, 339-340)

# Four ways to approach sexual difference

- 1) There is no such thing as sexual difference
- 2) There is sexual indifference (whereby there is a perceived sexual difference that amounts to a monosexual ontology of one sex and the lack of it)
- 3) There is a binary (or fixed plurality) of sexual difference
- 4) There is an infinite multiplicity of different sexes.

(Jami Weinstein 2010, 178 note)

# New research methods for feminist neuroscience

- We connect the projects of early feminist neuroscientists such as Ruth Bleier, who believed in the limitless potentialities of the brain
- We attempt to look differently at the biological contributions of sexual difference in the brain
- In order to do this and develop “gender-sensitive” biological accounts of the brain, we must reconsider the ontological status of neuromolecular matter itself.

# Reframing Difference, Reframing the Brain

nature  
neuroscience

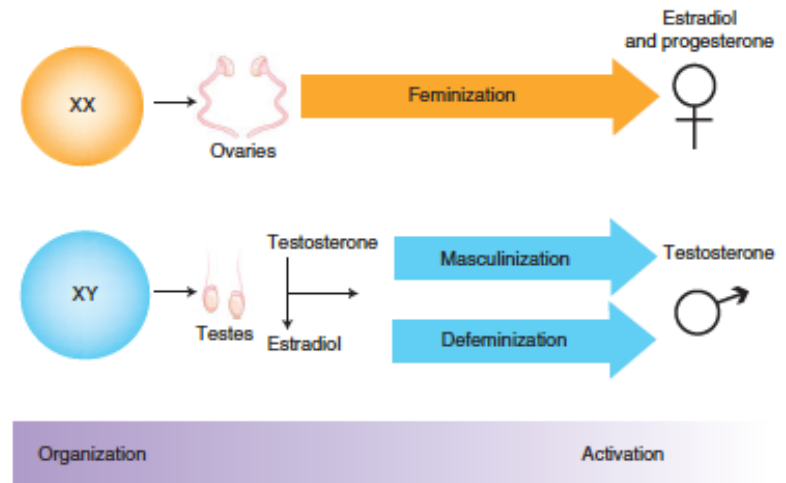
REVIEW

## Reframing sexual differentiation of the brain

Margaret M McCarthy<sup>1</sup> & Arthur P Arnold<sup>2</sup>

In the twentieth century, the dominant model of sexual differentiation stated that genetic sex (XX versus XY) causes differentiation of the gonads, which then secrete gonadal hormones that act directly on tissues to induce sex differences in function. This serial model of sexual differentiation was simple, unifying and seductive. Recent evidence, however, indicates that the linear model is incorrect and that sex differences arise in response to diverse sex-specific signals originating from inherent differences in the genome and involve cellular mechanisms that are specific to individual tissues or brain regions. Moreover, sex-specific effects of the environment reciprocally affect biology, sometimes profoundly, and must therefore be integrated into a realistic model of sexual differentiation. A more appropriate model is a parallel-interactive model that encompasses the roles of multiple molecular signals and pathways that differentiate males and females, including synergistic and compensatory interactions among pathways and an important role for the environment.

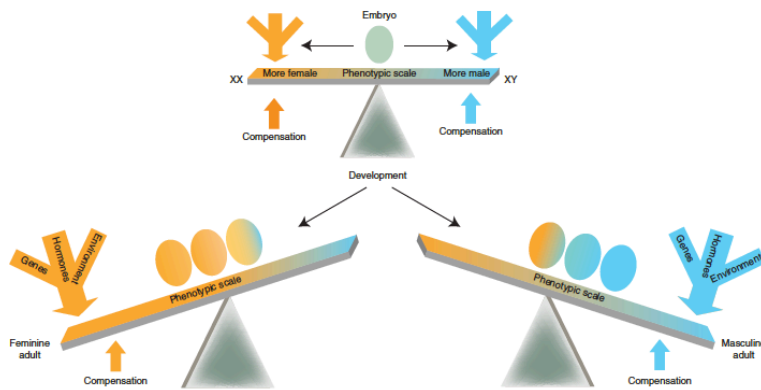
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**Figure 1** Twentieth-century linear view of sexual differentiation. For the past 50 years, the prevailing view of sexual differentiation of the brain has been a linear model in which chromosomal sex determines gonadal sex, which determines brain sex. Feminization of the brain is the default process that occurs in the absence of high levels of gonadal steroids during a perinatal sensitive period. Masculinization and defeminization are separate hormonally driven processes that organize the neural substrate to promote male-typical behaviors while suppressing female-typical behaviors. The organized neural substrate is activated by adult gonadal steroids and required for sex-typical behaviors to be expressed. This iconic model based on the organizational/activational hypothesis<sup>14</sup> has proved a sturdy framework for elucidating some, but not all, of the aspects of sexual differentiation of the brain.

# Sex difference-mediated variation and contingency

- Steroid-mediated sexual differentiation of neural circuits is not limited to direct targets of the hormone. Just as every brain cell has a genetic sex, many cell types in specific regions are organized during development by virtue of interactions with other cells in its milieu, so that any information coming into that region is integrated in the context of its sex. This concept argues against the idea that a few steroid-response neurons sit in an otherwise sexually monomorphic brain. (McCarthy and Arnold 2011, 680)



**Figure 4** Redefining sexual differentiation. In a twenty-first-century view of sexual differentiation of the brain, the importance of genetics and environment are incorporated along with the effects of hormones to provide a more nuanced portrayal of the types of variables that cause sex differences. Included in this view are the principles that hormones, sex chromosome genes and sex-specific environments have independent parallel differentiating effects that can interact with each other, often synergistically, to cause sex differences in the brain. However, there are also compensatory sex-specific variables that act to reduce sex differences rather than induce them. The result is that some aspects of male and female brain, behavior and physiology are unique from each other, whereas others are highly similar. Two important aspects of the redefined view are not illustrated here: sex differences are pervasive throughout the brain and not restricted to reproductively relevant neural circuits, and variability in the degree to which brain regions are masculinized or feminized in one individual results in a mosaic of relative maleness or femaleness and thereby greatly increases the variance between individuals of the same sex in a population.

# Dynamism and Transient Nature of Differences

Journal of Neuroendocrinology

Journal of Neuroendocrinology, 2013, 25, 1133–1140  
© 2013 British Society for Neuroendocrinology

REVIEW ARTICLE

## Epigenetic Contributions to Hormonally-Mediated Sexual Differentiation of the Brain

M. M. McCarthy and B. M. Nugent

Department of Pharmacology, School of Medicine, University of Maryland, Baltimore, MD, USA

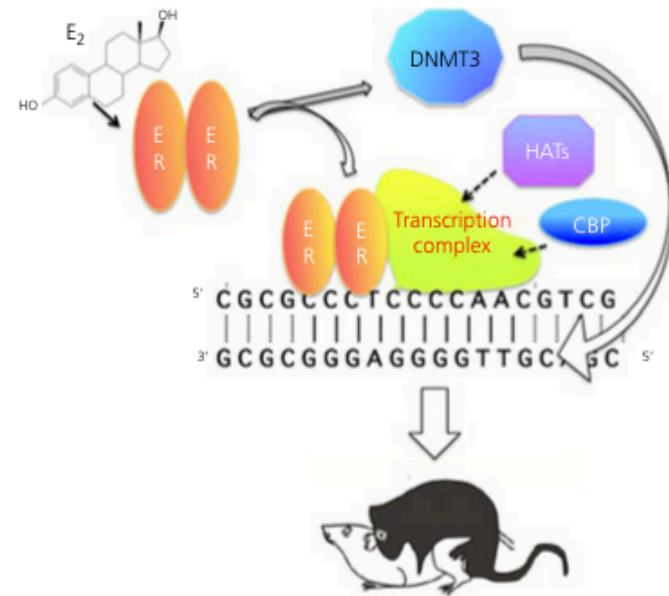
Journal of  
Neuroendocrinology

It has been long established that hormones exert enduring influences on the developing brain that direct the reproductive response in adulthood, although the cellular mechanisms by which organisational effects are maintained have not been determined satisfactorily. Recent interest in epigenetic modifications to the nervous system has highlighted the potential for hormone-induced changes to the genome that could endure for the lifespan but not be transmitted to the next generation. Preliminary evidence suggests that this is indeed possible because sex differences in the histone code and in the methylation of CpGs in the promoters of specific genes have been identified and, at times, functionally correlated with behaviour. The present review provides an overview of epigenetic processes and discusses the current state-of-the-art, and also identifies future directions.

**Key words:** oestrogens, steroids; neuroactive steroids, development, sex differences, preoptic area, hypothalamus

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doi: 10.1111/jne.12072



**Fig. 3.** Epigenetics and sexual differentiation. Oestradiol ( $E_2$ ) binds to and activates its nuclear transcription factor receptor (ER) which moves to the DNA and recruits a transcriptional complex. Included in this complex are enzymes with histone-acetylating ability to allow access to the DNA. Activated ER may also modify the activity of DNA methyl transferase (DNMT) enzymes and thereby alter the methylation status of the DNA. Taken together, these changes may provide the molecular basis for the organisational effects of early hormone exposure, which endure into adulthood and direct activational responses to sex-typic gonadal steroids. CBP, CREB-binding protein; HATs, histone acetyl transferases.

# Conclusion

- *Science as Feminism*
  - Requires a commitment to oppositional tactics of knowledge production
  - Develops tactics of the cosmopolitical kind (working with and not against different practices)
  - Promotes boundary-breaching work
  - Encourages us to ask impossible questions

# Thank you!

