

CIHR INSTITUTE OF
GENDER AND HEALTH
SHAPING SCIENCE FOR A HEALTHIER WORLD

L'INSTITUT DE LA SANTÉ DES FEMMES
ET DES HOMMES DES IRSC
FAÇONNER LA SCIENCE POUR UN MONDE EN MEILLEURE SANTÉ

NEXT GENERATION SEX AND GENDER SCIENCE AND EDUCATION IN MEDICINE

Johannes Gutenberg University, Mainz

February 23, 2023

Cara Tannenbaum, MD, MSc, CM

She/her/elle

Professor of Medicine

Université de Montréal, Canada



I'M GOING TO INVITE YOU TO REFLECT WITH ME ON:

1

A vision for the next generation of sex and gender science

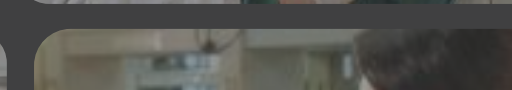
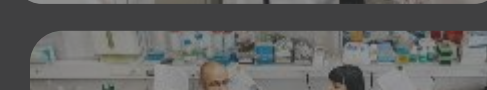
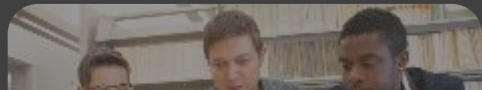
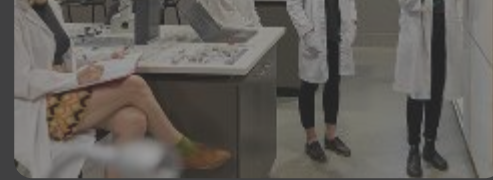
2

Why it is important to consider sex and gender in medicine

3

What actions YOU can take to make research, education and practice more rigorous, more inclusive and more impactful

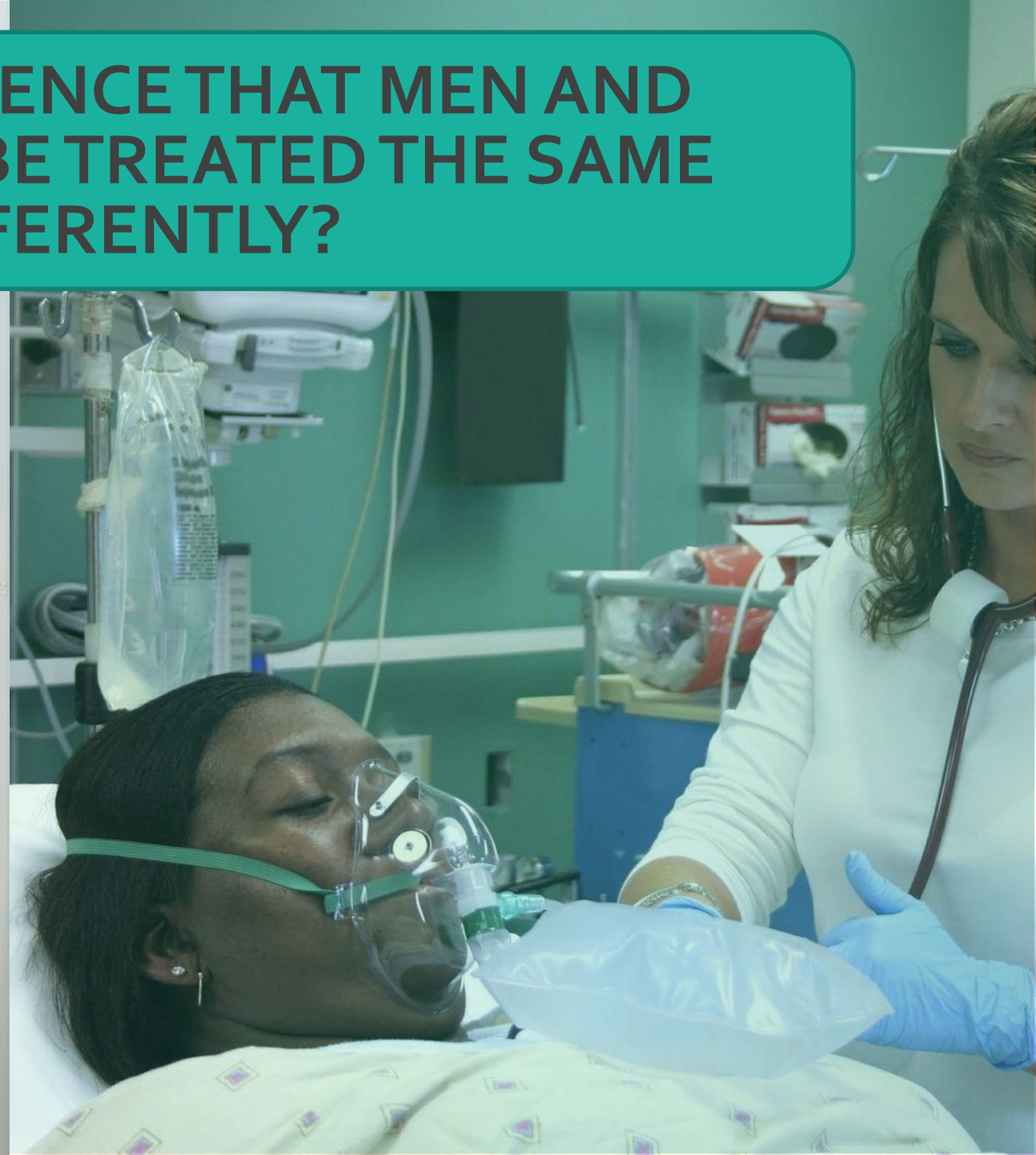
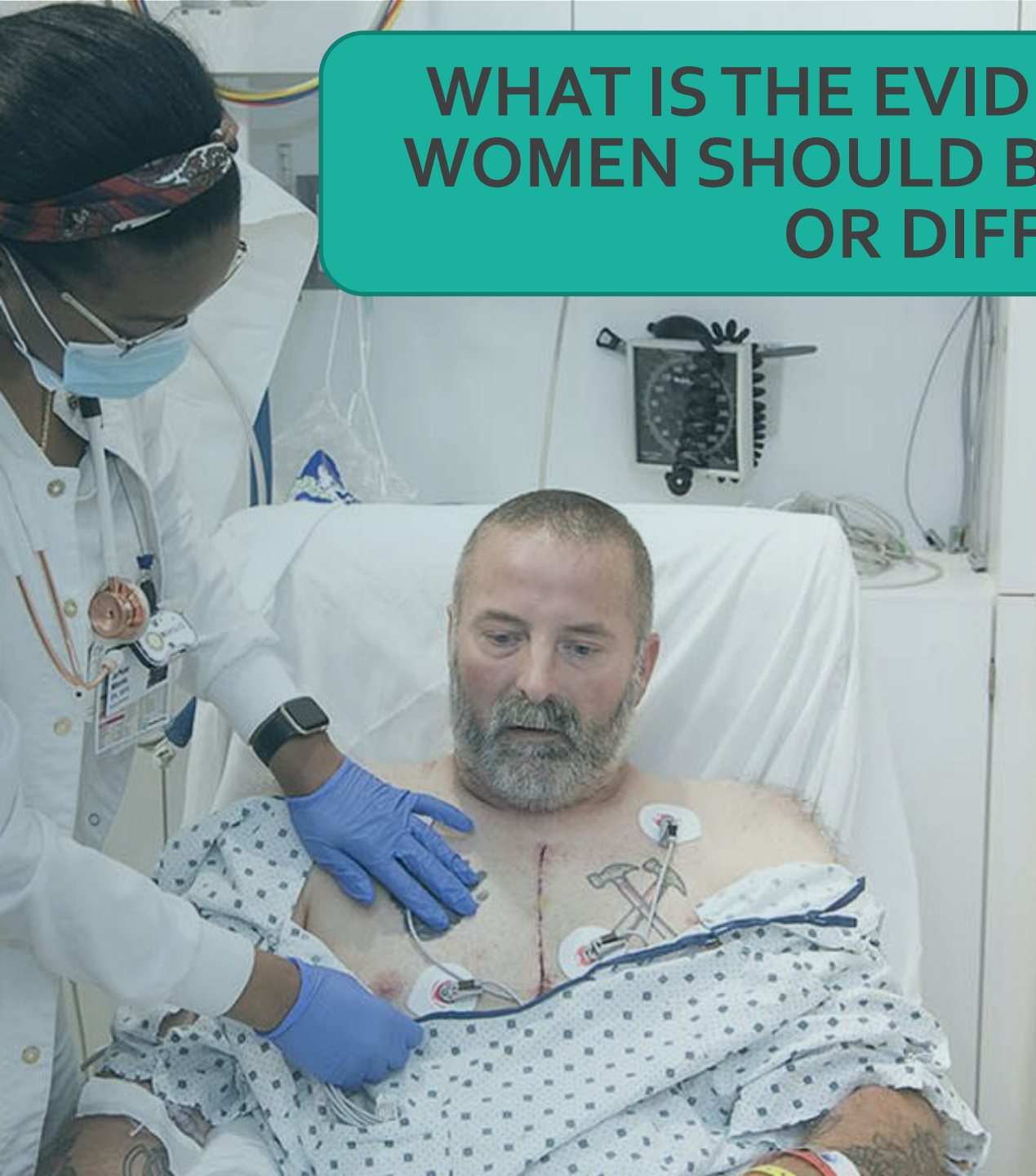
SOME ASSUMPTIONS



ASSUMPTION 1

YOU ARE ALL CURRENT OR FUTURE
LEADERS IN HEALTH RESEARCH, MEDICINE
OR EDUCATION

WHAT IS THE EVIDENCE THAT MEN AND WOMEN SHOULD BE TREATED THE SAME OR DIFFERENTLY?



ASSUMPTION 2

YOU KNOW HOW TO DISTINGUISH
BETWEEN SEX AND GENDER

SEX

Biological attributes of humans and animals, including physical features, chromosomes, gene expression, hormones and anatomy.



GENDER

Socially-constructed roles, behaviours, expressions and identities of girls, women, boys, men and gender diverse people.



Canadian Institutes
of Health Research

Instituts de recherche
en santé du Canada

Canada

GENETIC SEX IS IMPORTANT

Only 32.5% of genome-wide association studies included the sex chromosomes.

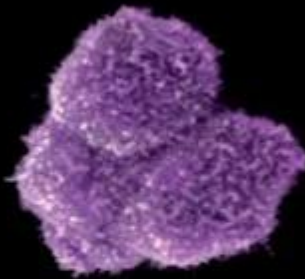
Wise et al. Am. J. Hum Genet. 2013; 92(5): 643–647.

X CHROMOSOME



1,669 genes
800 protein coding

Y CHROMOSOME



426 genes
72 protein coding

Incomplete X chromosome inactivation affects at least 23% of X-chromosomal genes.

Leads to a gene dosage imbalance between sexes.

AUTOSOMES ARE IMPORTANT PLAYERS IN SEX-BIASED GENE EXPRESSION

AAAS [Become a Member](#)

Science [Contents](#) [News](#) [Careers](#) [Journals](#)

RESEARCH ARTICLE

Conservation, acquisition, and functional impact of sex-biased gene expression in mammals

Sahin Naqvi^{1,2}, Alexander K. Godfrey^{1,2}, Jennifer F. Hughes¹, Mary L. Goodheart^{1,3}, Richard N. Mitchell⁴, David C. Page^{1,2,3,*}

+ See all authors and affiliations

Science 19 Jul 2019:
Vol. 365, Issue 6450, eaaw7317

85-90%

of genes exhibiting
sex bias in humans
are autosomal.

EVEN PROTEINS CAN BE INFLUENCED BY SEX

Cell

Article

Disentangling Genetic and Environmental Effects on the Proteotypes of Individuals

Natalie Romanov,^{1,7} Michael Kuhn,¹ Ruedi Aebersold,^{2,3} Alessandro Ori,⁴ Martin Beck,^{1,5,7,*} and Peer Bork^{1,6,8,*}

¹Structural and Computational Biology Unit, European Molecular Biology Laboratory, Heidelberg, Germany

²Department of Biology, Institute of Molecular Systems Biology, ETH Zurich, Switzerland

³Faculty of Science, University of Zurich, Zurich, Switzerland

⁴Leibniz Institute on Aging – Fritz Lipmann Institute, Jena, Germany

⁵Cell Biology and Biophysics Unit, European Molecular Biology Laboratory, Heidelberg, Germany

⁶Max Delbrück Center for Molecular Medicine, Berlin, Germany

⁷Present address: Max Planck Institute of Biophysics, Max-von-Laue-Straße 3, Frankfurt am Main, Germany

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*Correspondence: martin.beck@embl.de (M.B.), bork@embl.de (P.B.)

<https://doi.org/10.1016/j.cell.2019.03.015>

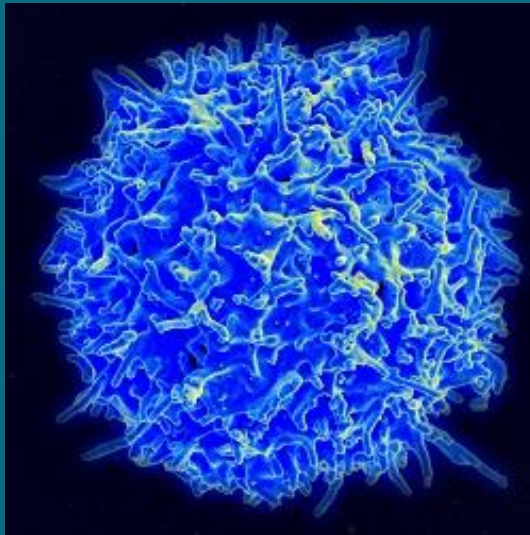
Romanov et al., 2019, Cell 177, 1308–1318

Sex can explain
13% of differences
in protein complex
abundance and
stoichiometry.

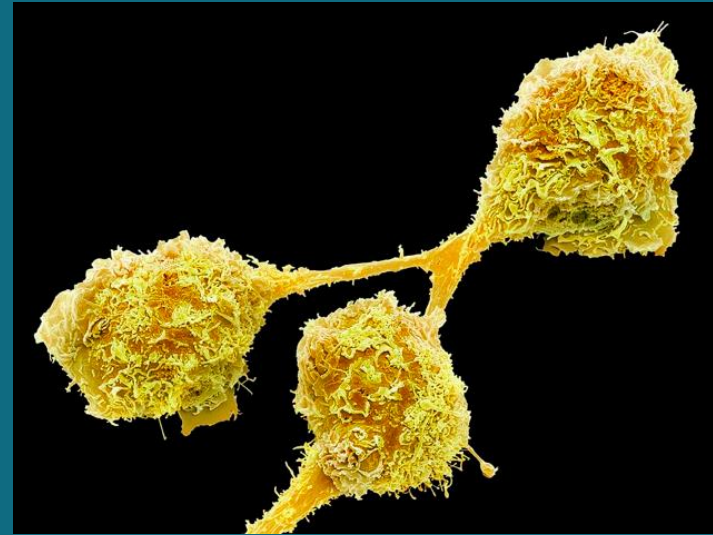
INCLUDING MALES AND FEMALES LEADS TO NEW DISCOVERIES

Chronic pain mechanisms are mediated by different
immune cells

Female Mice – T Cells

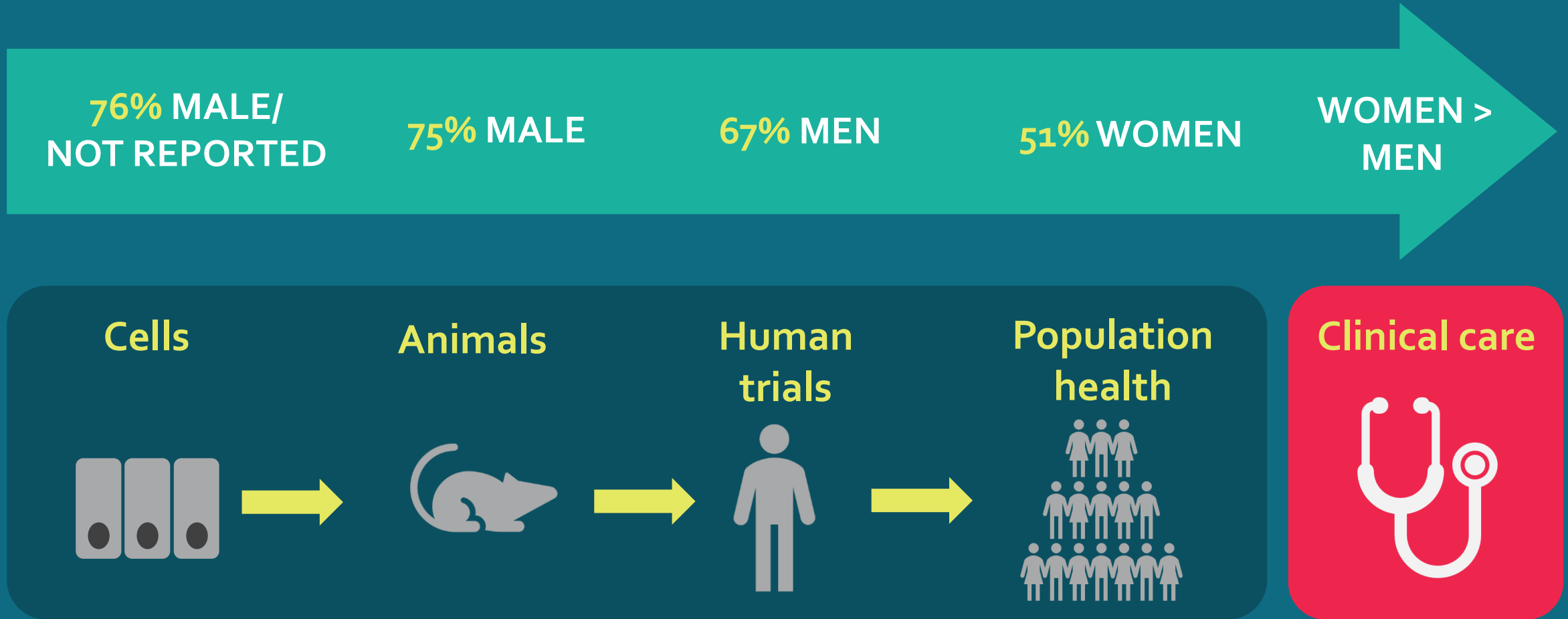


Male mice – Microglial Cells



Sorge et al. Different immune cells mediate mechanical pain hypersensitivity in male and female mice. Nat Neuroscience 2015; 31:1165-1167.

Historical representation of the research pipeline

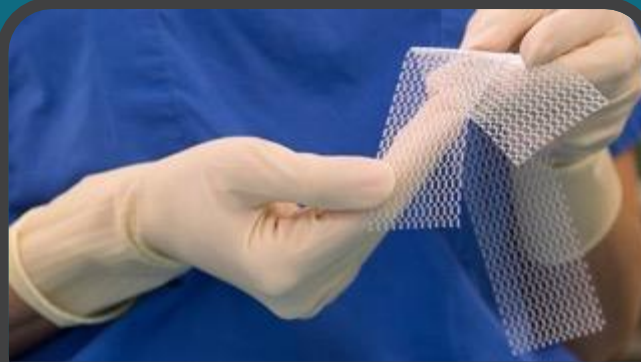


WHY IS THIS IMPORTANT?

If sex is not accounted for at both the pre-clinical and testing phases for drugs, biologics and medical devices, then the benefits may not be equal. At worst, we may be introducing harm



Abbott absorb stent



Pelvic mesh



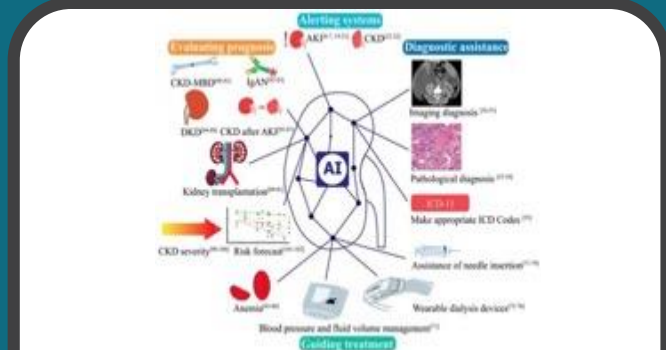
N95 Respirator



Kenek O2 pulse oximeter

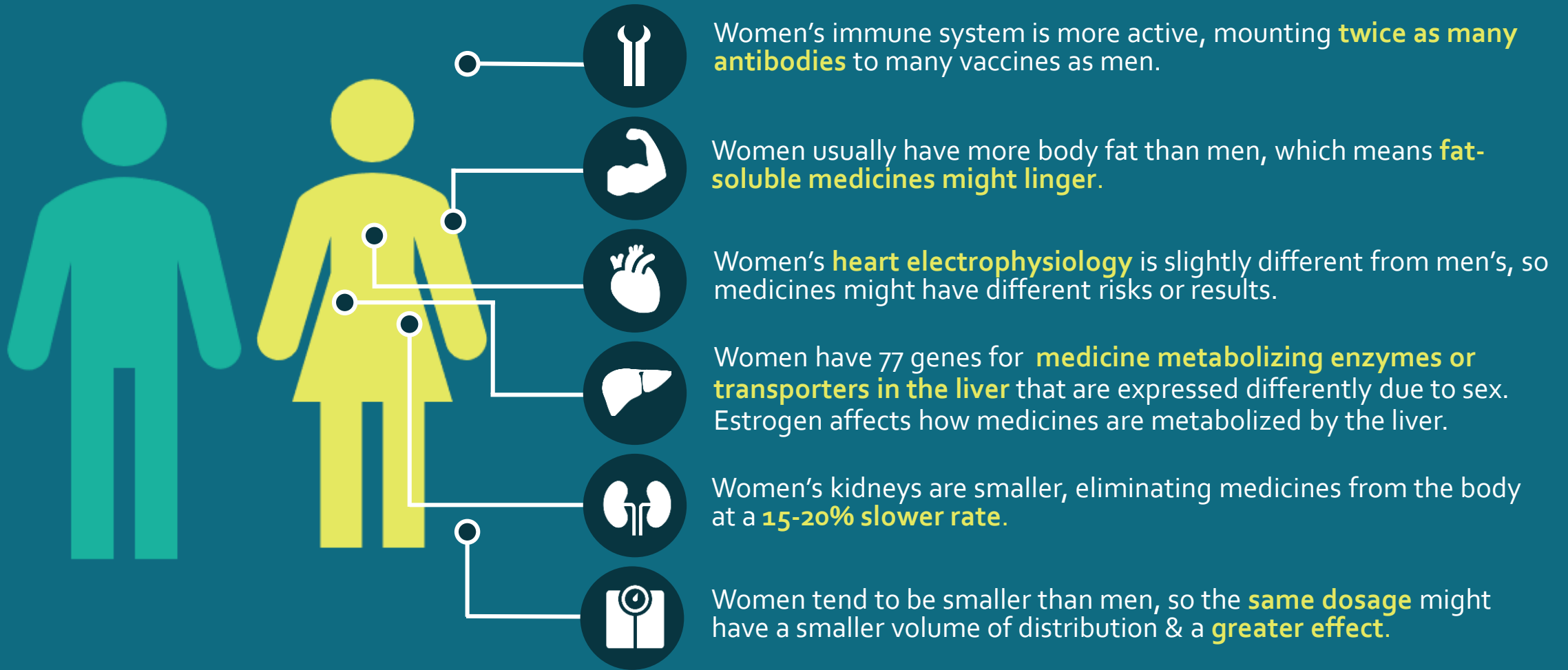


Sublinox® (zolpidem)



AI Kidney software device

Women process medicines differently than men.



SEX/GENDER MEDICINE

When research is done “properly” in males and females, we move towards safer personalized medicine: the right dose at the right time for the right person

Test 2 doses of the medicine for women to see if they can have **equal benefit** but **lower side effects** from lower dose.

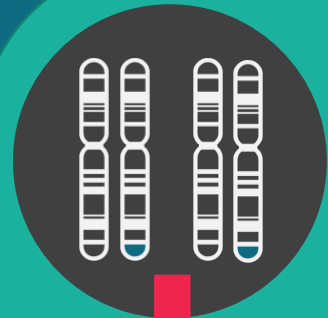


Men: 50 µg dose



Women: 25 µg dose

Women showed higher desmopressin sensitivity than men.



Desmopressin is an AVP analog drug that binds to the **arginine vasopressin (AVP) receptor** in the kidney to prevent excess urination. The AVP receptor is coded by the **AVPR2** gene, which lies on the X chromosome.



Normally in females, one of the two X chromosomes gets **randomly inactivated**. The random inactivation of one of the X chromosomes in female cells prevents differences in X chromosome gene dosage between male and female cells for most genes.



However, some X-linked genes **escape inactivation** in females (12%–20% in humans), and therefore those genes are expressed at higher levels in females than in males.

Some women may have an **overexpression of the AVPR2 gene**.



More receptors on the cells



Higher effect of AVP, more water retained, higher risk of hyponatremia

Relative female/ male sensitivity to the antidiuretic effect of desmopressin in nocturia is 2.7, corresponding to significantly **higher desmopressin sensitivity in women**.

10 medicines were withdrawn from the U.S. market between 1997 and 2000.



Pondimin®



Redux®



Seldane®



Posicor®



Hismanal®



Rezulin®



Prepulsid®



Lotronex®



Raxar®



Duract®

8

(out of 10)

of these medicines posed **greater health risks** for women than men.

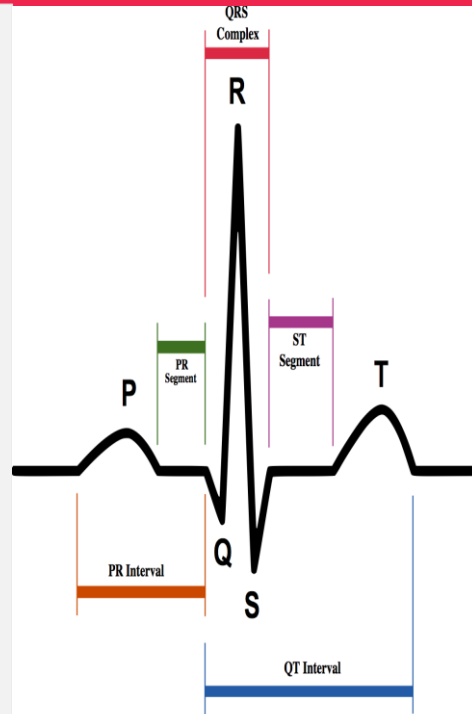


Sex AND gender played a role

Biological factors

Seldane[®],
Propulsid[®]

cause fatal
arrhythmias in
women only
because of
sex
differences in
the heart



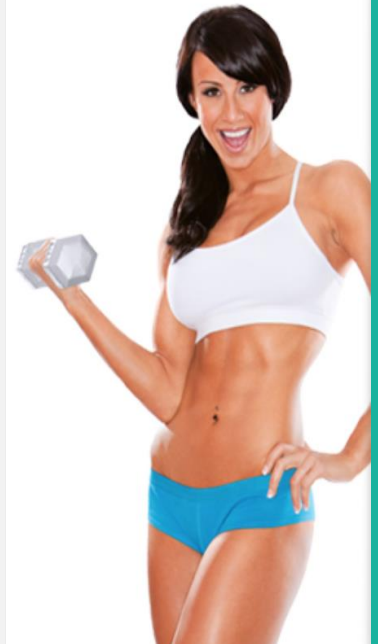
Schematic representation of normal ECG

Social factors

Redux[®], Fen-Fen
appetite
suppressants

cause valvular
heart disease
equally

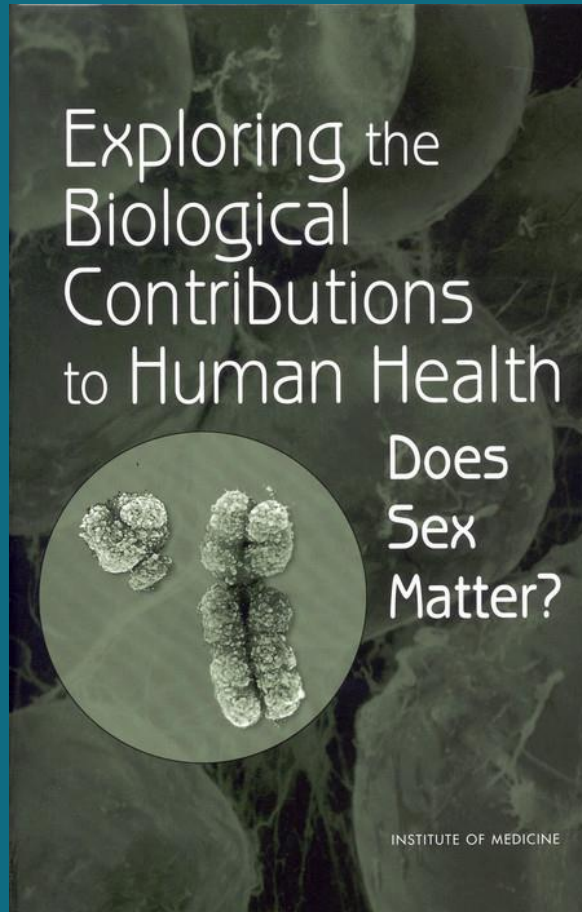
but more women
take them



ASSUMPTION 3

YOU MAY VIEW SEX AND
GENDER AS BINARY CONCEPTS

IN 2001, THE U.S. INSTITUTE OF MEDICINE DEFINED SEX AND GENDER



BOX 1-1 Definitions

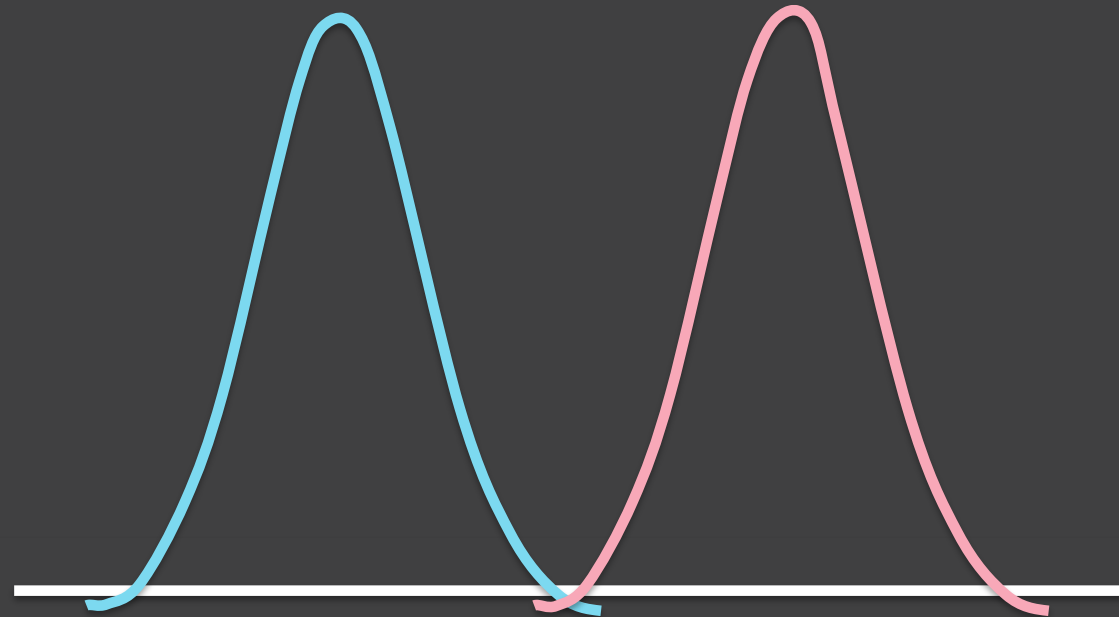
Sex: The classification of living things, generally as male or female according to their reproductive organs and functions assigned by chromosomal complement.

Gender: A person's self-representation as male or female, or how that person is responded to by social institutions based on the individual's gender presentation. Gender is rooted in biology and shaped by environment and experience.

Institute of Medicine (US) Committee on Understanding the Biology of Sex and Gender Differences; Editors: Theresa M. Witzmann and Mary-Lou Pardue. Washington (DC): National Academies Press (US); 2001.

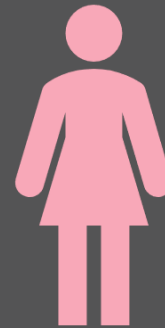
BINARY/DICHOTOMOUS TRAITS

MALE



SEX-SPECIFIC

Uterine fibroids
Ovarian cancer
Endometriosis
Menstruation
Pregnancy
Menopause



FEMALE

SEX CAN COME IN MANY DIFFERENT SHAPES AND SIZES

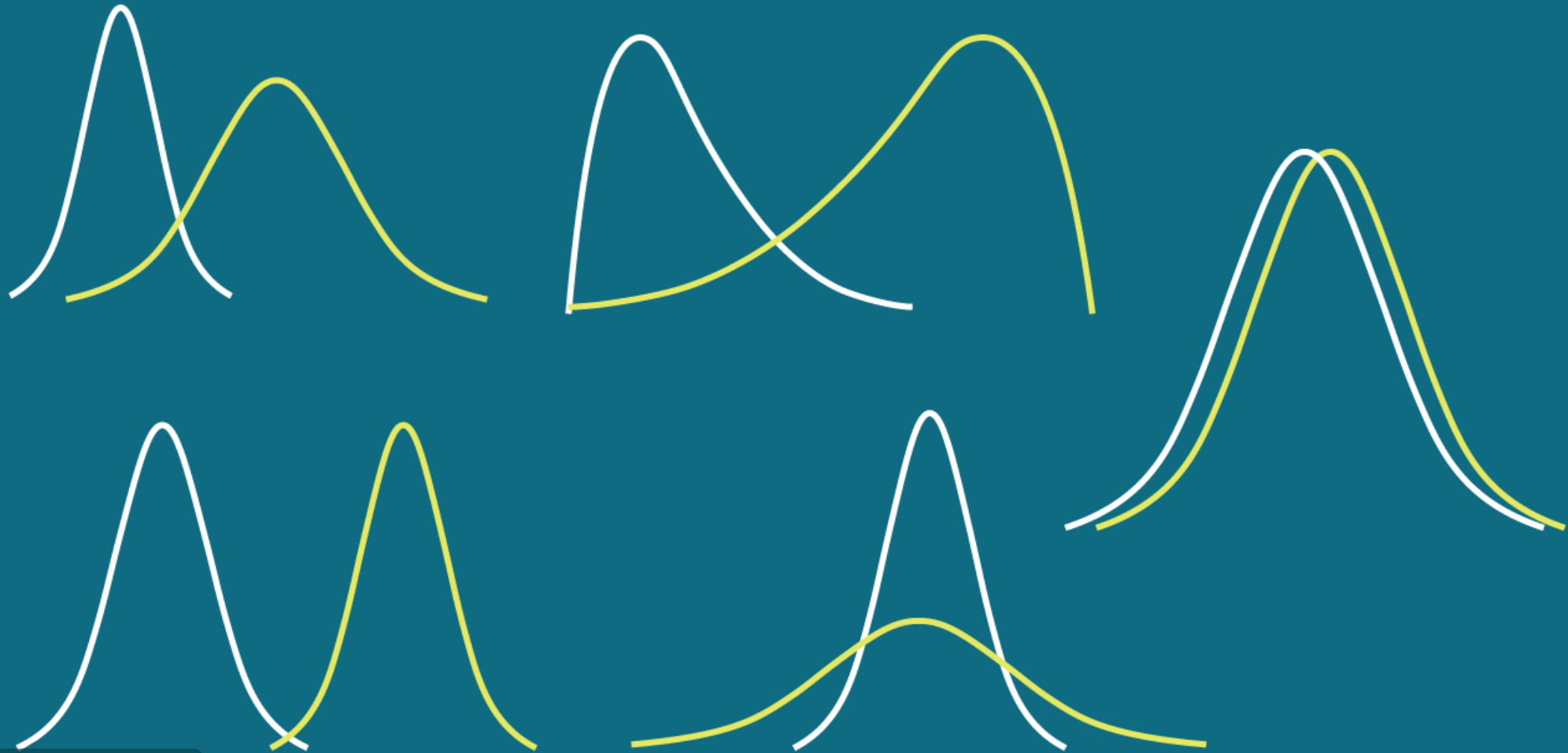
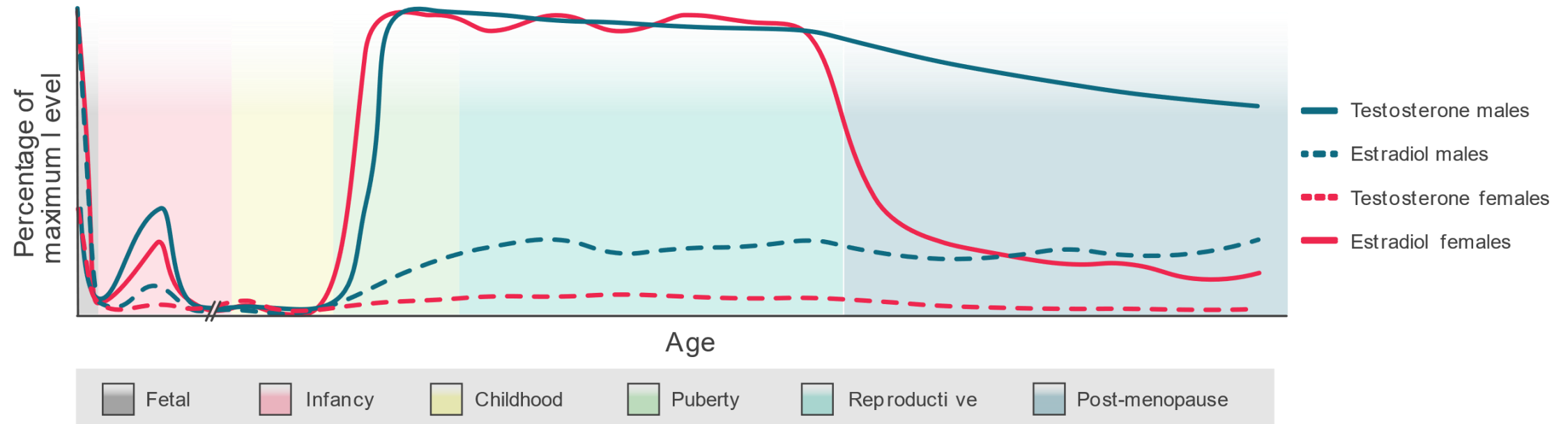


Image adapted from Dr. Stacey Ritz.

THINK ABOUT SEX HORMONES.
IS IT APPROPRIATE TO REFER TO:



ESTROGEN IS NOT A “FEMALE” HORMONE AND TESTOSTERONE IS NOT A “MALE” HORMONE



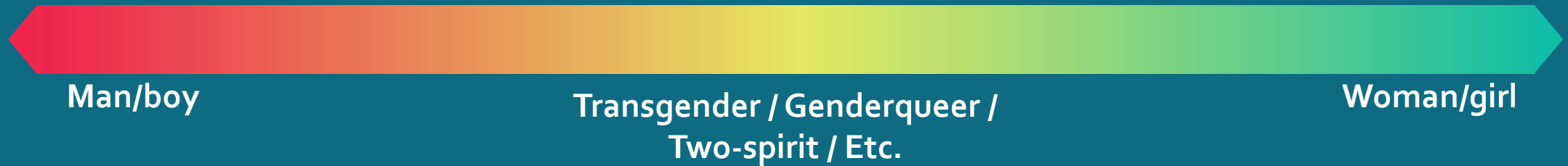
SEX EXISTS ON A SPECTRUM...

SEX



... JUST LIKE GENDER

GENDER IDENTITY



GENDER EXPRESSION



REAL-LIFE HARM & CONFUSION

CASTER SEMENYA



DUTEE CHAND



EDITORIALS

Sex, gender, and sports

New regulations challenge the evidence based, benevolent ethos that underlies medical practice

BMJ 2019 ; 364 doi: <https://doi.org/10.1136/bmj.l1120> (Published 20 March 2019)

Cite this as: BMJ 2019;364:l1120

Cara Tannenbaum *professor of medicine and pharmacy*¹², Sheree Bekker *prize research fellow*³

MULTIDIMENSIONALITY OF GENDER

IDENTITY

- ✓ Inner sense of self as masculine, feminine, both, or neither
- ✓ Cisgender, transgender or gender-nonconforming

ROLES

- ✓ Societal expectations
- ✓ Influences on everyday actions
- ✓ Career you pursue, role in family, etc.

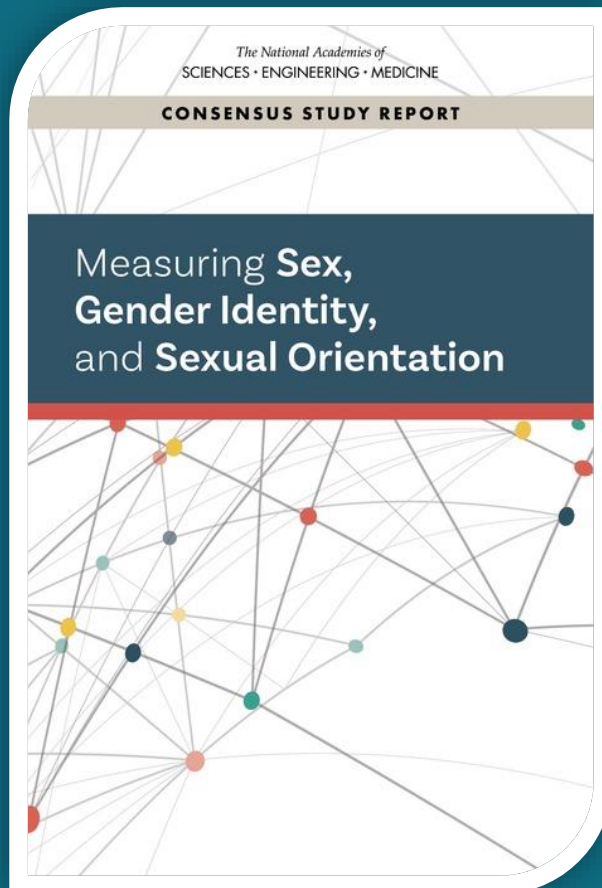
RELATIONS

- ✓ Interpersonal interactions
E.g., family, workplace dynamics

INSTITUTIONALIZED

- ✓ Distribution of power in political, educational, social institutions in society
- ✓ Shapes social norms

IN 2022, THE U.S. NATIONAL ACADEMIES OF SCIENCES, ENGINEERING AND MEDICINE EXPANDS DEFINITIONS OF SEX AND GENDER



TERMINOLOGY

Sex is a multidimensional construct based on anatomical and physiological traits (sex traits) that include external genitalia, secondary sex characteristics, gonads, chromosomes, and hormones. **Intersex** refers to people whose sex traits do not all correspond to the same sex.

Gender is a multidimensional construct that links gender identity, which is a core element of a person's individual identity; gender expression, which is how a person communicates their gender to others; and social and cultural expectations about status, characteristics, and behavior that are associated with sex traits. **Transgender** refers to people whose current gender identity is different from the sex they were assigned at birth. **Transgender experience** refers to all people who can be classified as transgender and **transgender identity** refers to people who identify as transgender. **Cisgender** refers to people whose current gender identity corresponds to the sex they were assigned at birth. **Nonbinary** is an umbrella term for gender identities that lie outside the gender binary.

National Academies of Sciences, Engineering and Medicine.
Measuring Sex, Gender Identity and Sexual Orientations. 2022

THE BIOLOGICAL AND THE SOCIAL DO NOT EXIST IN ISOLATION



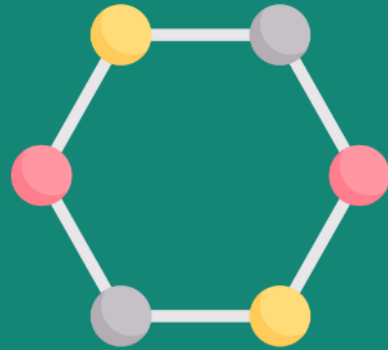
Sex

Gender

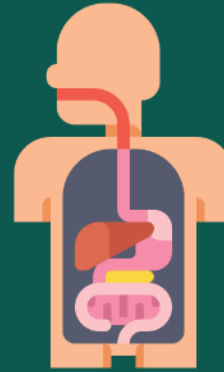
DETERMINING THE SOURCE OF VARIABILITY IN LUNG DISEASE WITH SEX AND GENDER SCIENCE



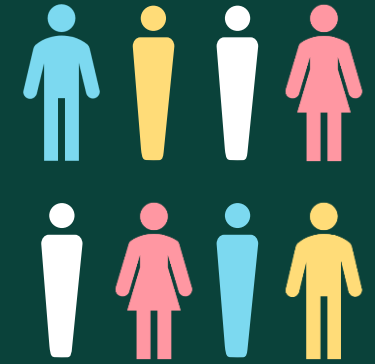
Genetic



Hormonal



Anatomical



Gender-related
exposures

COMBINING SEX AND GENDER ANALYSIS: ASTHMA AS AN EXAMPLE

Asthma is more common in males before puberty, but more common in females after puberty.



Is this due to **SEX (BIOLOGICAL)** or **GENDER (SOCIOCULTURAL/BEHAVIOURAL)** factors?

Sex-related hypotheses

- Sex differences in lung development
- Sex differences in hormone levels
- Sex differences in atopy and immune responses to allergens

Gender-related hypotheses

- Differences in gendered play and occupation
- Differences in smoking habits
- Differences in beliefs about adherence to medication, especially during pregnancy



Gendered factors can influence our biology. For example, boys may be more likely to engage in outdoor play, which influences the types of microbes and pollutants they are exposed to. These exposures can influence epigenetic processes, such as DNA methylation, histone modification, which can in turn modify gene expression between sexes.

Sex versus gender contributions are difficult to separate. Both should be factored in study designs involving humans whenever possible.

WHAT ACTIONS CAN YOU
TAKE TO APPLY A
SEX AND GENDER SCIENCE
LENS TO RESEARCH,
EDUCATION AND
PRACTICE?



IT'S **NOT** A ONE-SIZE-FITS-ALL APPROACH



General **Research** Principles



Specialized Approaches



Primary data
collection



Secondary data
analysis

STEP 1

Know your literature!

What is currently known about **sex** and/or **gender differences** in the **incidence, manifestations, mechanisms, progression** and **response to treatment** of the condition under study?

nature reviews immunology

Perspective | Published: 11 June 2020

Considering how biological sex impacts immune responses and COVID-19 outcomes

Eileen P. Scully, Jenna Haverfield, Rebecca L. Ursin, Cara Tannenbaum & Sabra L. Klein 

Nature Reviews Immunology **20**, 442–447(2020) | [Cite this article](#)



The influence of sex and gender domains on COVID-19 cases and mortality

Christina P. Tadiri, Teresa Gisinger, Alexandra Kautzky-Willer, Karolina Kublickiene, Maria Trinidad Herrero, Valeria Raparelli, Louise Pilote and Colleen M. Norris; for the GOING-FWD Consortium

CMAJ September 08, 2020 192 (36) E1041-E1045; DOI: <https://doi.org/10.1503/cmaj.200971>



Springer Canadian Journal of Public Health

Can J Public Health. 2020 Dec; 111(6): 980–983.

PMCID: PMC7523484

PMID: [32990927](#)

Published online 2020 Sep 29.

doi: [10.17269/s41997-020-00417-z](https://doi.org/10.17269/s41997-020-00417-z)

Language: English | [French](#)

Sex, gender and COVID-19: a call to action

[Sofia B. Ahmed](#)^{1,2,3} and [Sandra M. Dumanski](#)^{1,2,3}

AS A GENERAL RULE...

To integrate sex and/or gender as variables in your research, there should be **theoretical** or **empirical *rationale***.

You should integrate **SEX** into your research if there is biological plausibility to do so, for example:

- Does the phenomenon, condition or disease under study affect the sexes differently?
- Can the model system being used be differentiated by sex?
- Are there preliminary data suggesting a unique influence of sex?

You should integrate **GENDER** into your research if there is sociocultural plausibility to do so, for example:

- Does the study involve humans?
- Are there preliminary data suggesting a unique influence of gender?

STEP 2

Include males and females

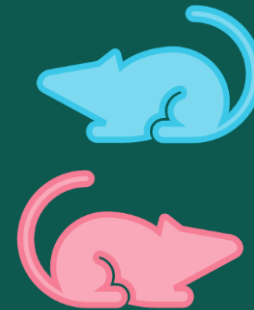
Report the sex of your cells, tissues, animals, human participants in your experiments when studying models of disease that affect all sexes.



Cells



Tissues



Animals

STEP 3

Determine which aspect(s) of gender is relevant to your research.

PRIMARY DATA COLLECTION

Design the study to measure the aspect(s) of gender based on theoretical or empirical rationale in the human population under study.

SECONDARY DATA COLLECTION

Determine if data on gender identity, or other gender-related variables, are available in the exiting data set being analysed.

TWO STEP QUESTION ON SEX AND GENDER IDENTITY

Q1. What sex were you assigned at birth, meaning on your original birth certificate?

- ☐ Male
- ☐ Female

Q2. Which best describes your current gender identity?

- ☐ Man/Boy
- ☐ Woman/Girl
- ☐ Gender-diverse
- ☐ Non-binary
- ☐ Prefer to self-describe (please write)

The two-step question on sex and gender identity can also be used when seeing patients

EXAMPLES OF OTHER GENDER-RELATED VARIABLES THAT **MAY** BE RELEVANT

ROLES



Housework responsibilities



Childcare responsibilities



Weekly work hours

RELATIONS



Civil status



Spousal support



Relationships with others

INSTITUTIONALIZED



Personal income



Education level



Status in country & community

STEP 4

Ensure appropriate sample size.

If there is theoretical or empirical rationale, the sample size should be statistically powered to allow for sex and/or gender specific sub-group analyses.

Depending on statistical power, there are three types of analyses you could do.

High statistical power

Effect modification & interaction by sex

Detect main effects within sex strata

Low statistical power

Disaggregate by sex

If **underpowered**, subgroup analyses heighten the risk for type II error, or false negatives.

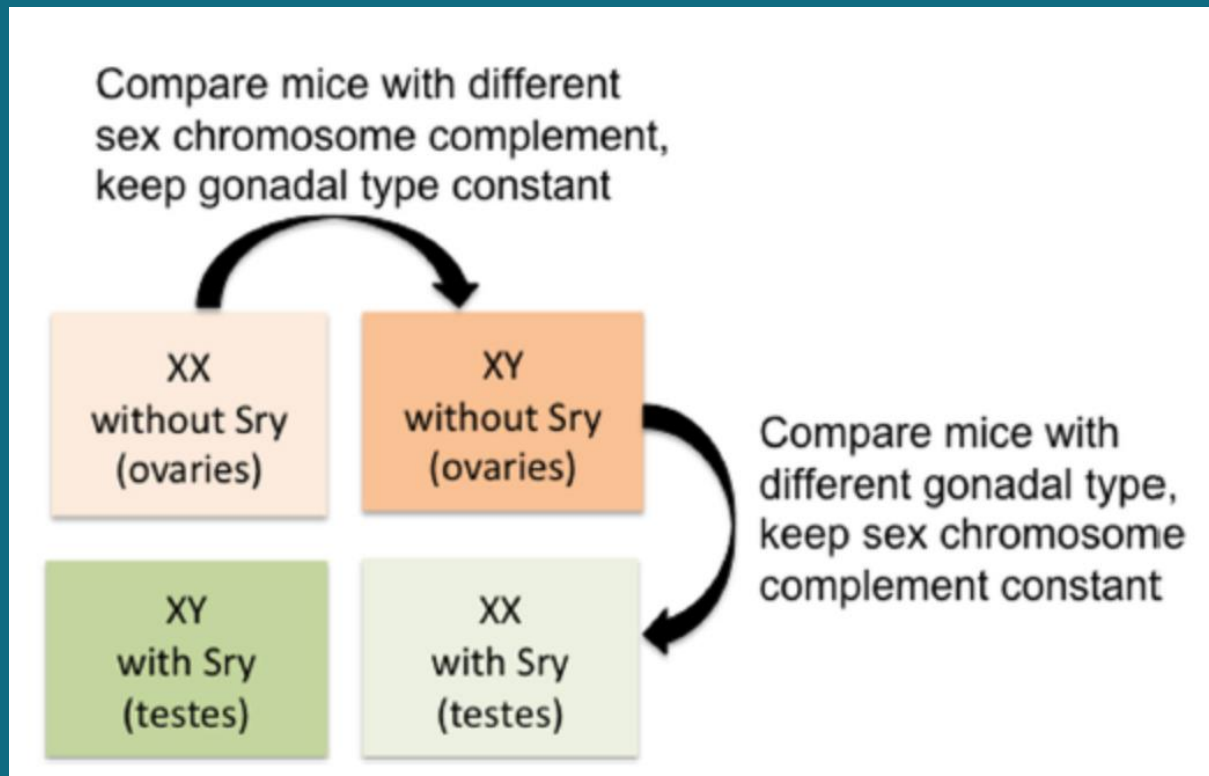


Pitfalls of not disaggregating by sex





If you find a sex difference, ask why



NEW METHODS THE 4-CORE GENOTYPES MODEL

HUMAN STUDIES: DISAGGREGATE YOUR DATA BY SEX AND GENDER

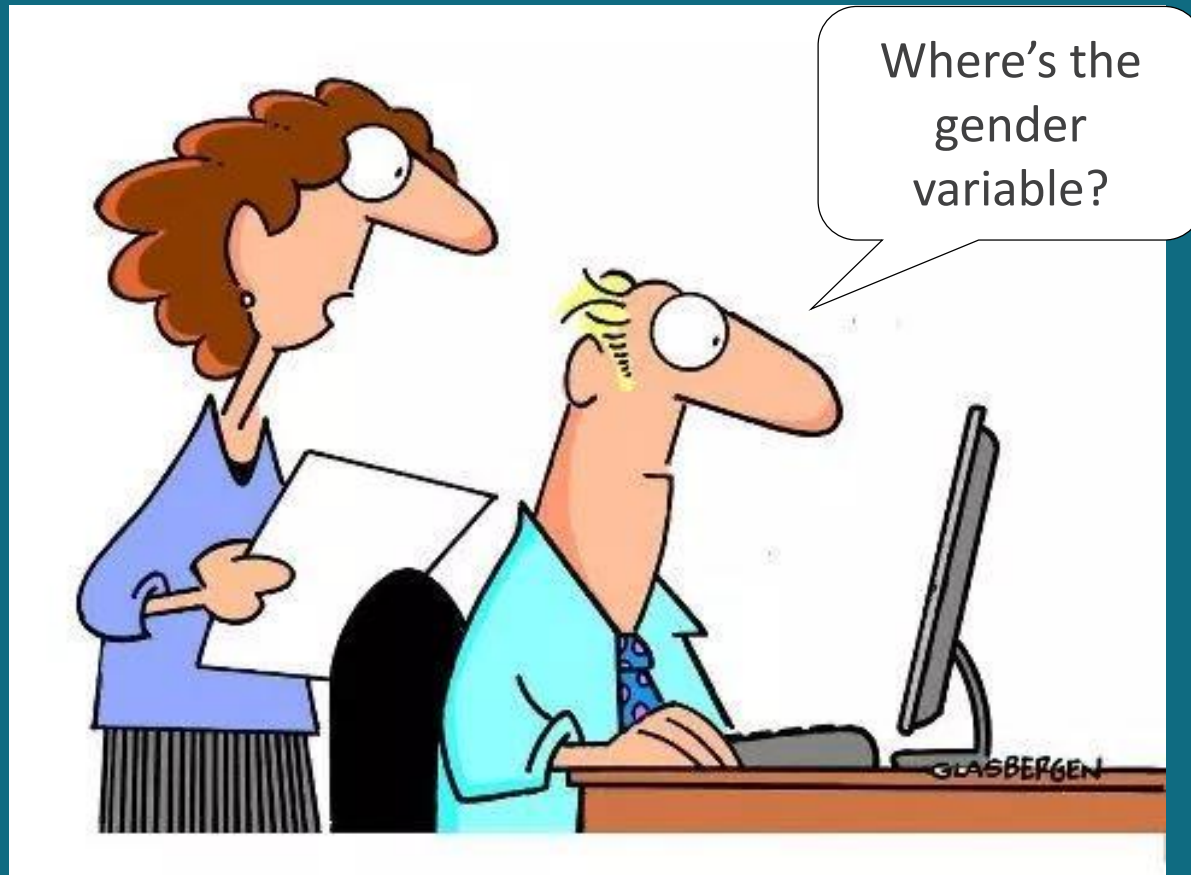


Stratify all results by sex & gender or you risk missing important differences

You can't control for women!



COULD A SEX DIFFERENCE BE EXPLAINED BY A GENDER-RELATED VARIABLE?



Income?

Housework responsibilities?

Marital status?

Education level?

Number of hours spent caregiving per week?

Work hours per week?

BEST PRACTICES FOR INCORPORATING SMALL SUBGROUPS IN QUANTITATIVE ANALYSES



For example, for sex-skewed diseases or non-binary individuals.



If possible, **oversample the underrepresented subgroup** so that the sample size will have enough power to draw statistically valid results.



Where privacy standards allow, disaggregate the raw data and **report for future meta analyses.**

GENERAL RULE

Do not exclude data even if the sample size is low - include and present the raw data, if possible.

SEX AND GENDER ONLINE TRAINING MODULES

1

SEX AND GENDER IN
BIOMEDICAL RESEARCH



2

SEX AND GENDER IN PRIMARY
DATA COLLECTION WITH HUMANS



3

SEX AND GENDER IN THE ANALYSIS OF
DATA FROM HUMAN PARTICIPANTS



<http://www.discoversexandgender.ca/>

FOCUS ON METHODS – The “why” and the “how”

CHECK OUT OUR MEET THE METHODS SERIES

Issue 1 | August 2020

MEET THE METHODS SERIES: MEASURING AND MANIPULATING SEX HORMONES IN LABORATORY ANIMALS



In basic science, sex hormones can be measured and manipulated in mice and rats using a variety of techniques. The CIHR Institute of Gender and Health asked Margaret McCarthy, Ph.D., Professor of Pharmacology at the University of Maryland, about her views on how to best integrate these methods in her research. Margaret McCarthy's research focuses on the influence of sex hormones on the developing brain, with a special emphasis on understanding the cellular mechanisms that establish sex differences. Here are Margaret McCarthy's recommendations:



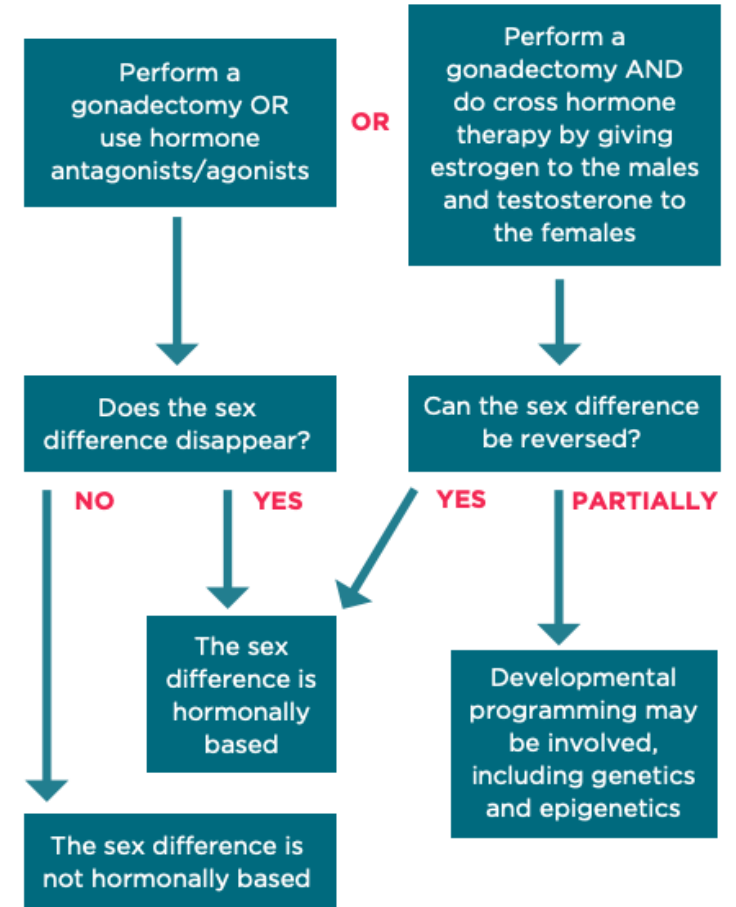
For **males**, seminal vesicle weight can be a good indicator of androgen levels. The higher the weight, the higher the androgen levels.



For **females**, uterine weight can be used as an indicator of estrogens in non-pregnant mice or rats. The higher the weight, the higher the estrogen levels.

What methods do you recommend to manipulate sex hormones in male and female mice and rats?

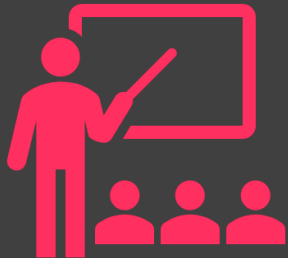
Once a sex difference is known, there are several methods to determine if the effect is driven by sex hormones:



<https://cihr-irsc.gc.ca/e/52107.html>

HOW MIGHT WE INTEGRATE SEX AND GENDER INTO

MEDICAL EDUCATION



CLINICAL PRACTICE



Ask the
students

Alberta medical students explore LGBTQ health issues

'We're talking about how to have an inclusive practice for LGBTQ patients and sexual and gender minorities'

CBC News · Posted: Mar 11, 2017 10:05 PM MT | Last Updated: March 12, 2017



Derek Fehr, U of A medical student who helped organize the conference

"We initially started the University of Alberta Inclusive Health Conference because we felt that our medical school curriculum didn't really address any of these issues that we felt were super keen to address these health disparities."



University of Alberta Inclusive Health Conference

- Started in 2010
- Led to curriculum changes
- Accredited

Dr. Njeri Thande worked with 1st and 2nd year students to change the curriculum of Yale School of Medicine

“To get the best outcomes, we need to practice individualized medicine, which must include consideration of sex and gender.”

New Opportunities in Medical Education

February 27, 2018



Dr. Njeri Thande (right) is working with WHRY and students such as Nisha Dalvie (left) to integrate a focus on sex and gender into the Yale School of Medicine curriculum.

YALE MEDICAL STUDENTS

audited 548
lectures with a
survey to track
the content of
each class, and
to critically
appraise each
topic and
research study
presented

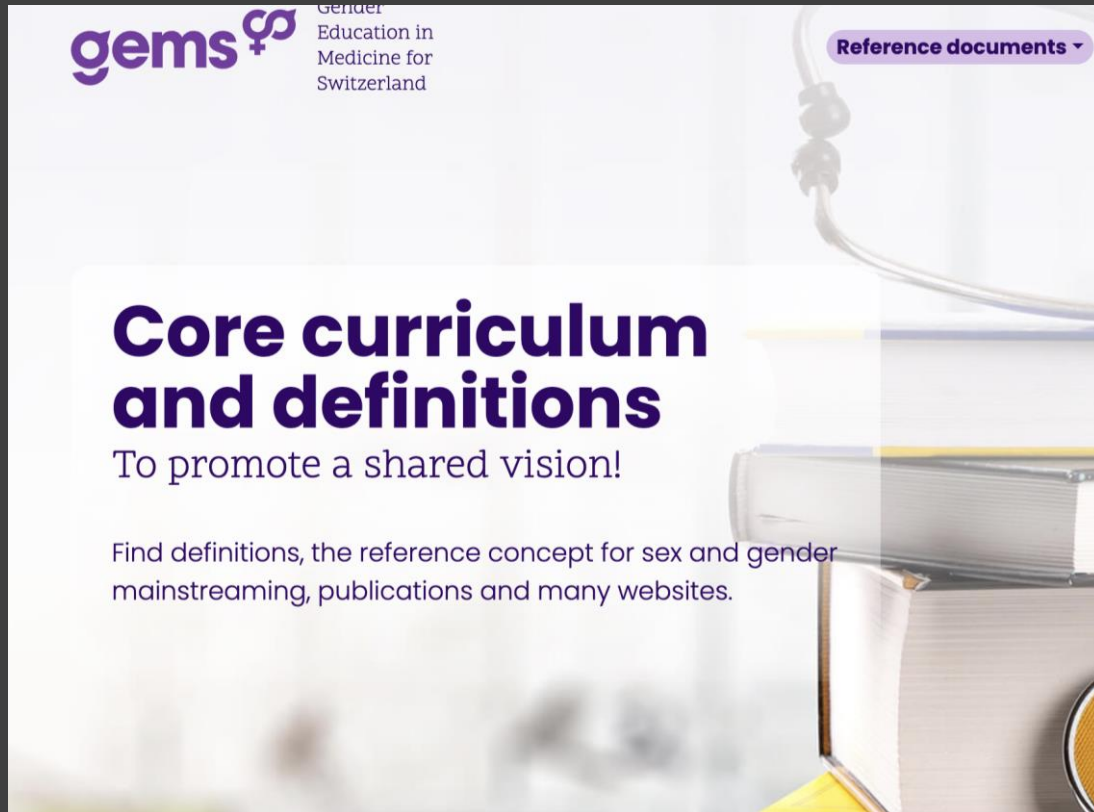
1. Is there any mention of the sex or gender of the participants in each topic or study?
2. Are the study's results analyzed by sex or gender?
3. Does the discussion underscore gaps in sex-specific knowledge?
4. Does the discussion mention sex or gender considerations in the presentation or treatment of the condition?

Less than **25%**
of all sessions
raised the topic
of sex or gender
influences on
physiology and
pathophysiology
or the
experience of the
patient in the
health care
environment.

The results
informed
recommendation
s for improving
the inclusion of
data on sex- and
gender-based
content.

Thande et al. The Influence of Sex and Gender on Health: How Much Is Being Taught in Medical School Curricula? *J Womens Health (Larchmt)* 2019 Dec;28(12):1748-1754.

In Switzerland, universities are working together to integrate sex and gender in the Swiss Medical Curriculum



Core curriculum

Reference document for Sex and Gender integration
in the Swiss medical curriculum

Working group of the project Sex and
Gender integration in the Swiss Medical
Curriculum

October 2022

<https://www.gems-platform.ch/en/reference-documents>

Mandatory training for students and faculty

Advancing next gen science

Training Modules

Three online sex and gender training modules that many academics credit with building the capacity of the health research enterprise have now been completed by almost 30,000 users. **95% of course completers** report an intent to improve their behaviour with respect to sex and gender in health research.

Module 1
**SEX AND GENDER
IN BIOMEDICAL
RESEARCH**



Module 2
**SEX AND GENDER
IN PRIMARY
DATA COLLECTION
WITH HUMANS**



Module 3
**SEX AND GENDER
IN THE ANALYSIS
OF SECONDARY
DATA FROM HUMAN
PARTICIPANTS**



“Everyone in our Faculty of Medicine’s graduate school is now required to do one of the IGH sex and gender training modules as part of their professional skills course. This wasn’t something that the Faculty of Medicine paid much attention to before.”

—IAN GRAHAM, PROFESSOR, UNIVERSITY OF OTTAWA

RESEARCH PROJECT AWARDS AND RECOGNITION









Best
integration
of sex or
gender



The Canadian Society of Obstetrics and Gynecology Canada recommends to

**EXPLORE BIASES,
PAY ATTENTION TO
LANGUAGE**

GUIDELINES FOR INCLUSIVE LANGUAGE FOR SEX AND GENDER DIVERSITY

CURRENT TERMS	INCLUSIVE ALTERNATIVES
 Mother/Father Wife/Husband Boyfriend/Girlfriend Vagina/Penis Breastfeeding	 Parent Partner Significant other Genitals Nursing or chest feeding
 “Do you have a husband here or other family I can call?”	 “Do you have a loved one here or a significant other who I can call?”
 “Are you and your boyfriend using protection? Will your husband be here for the baby’s ultrasound?”	 “Do you regularly practice safe sex? Will your birthing partner be coming to the ultrasound?”

As recommended by the Canadian Society of Obstetrics and Gynecology Canada



HOW TO THINK THROUGH A SEX AND GENDER LENS

6 COGNITIVE STEPS

to integrate sex and
gender into clinical
practice

1 Identify patient sex and gender.

2 Recognize sex differences in clinical manifestation of disease.

E.g., Females more likely to have coronary microvascular disease and to present without substernal chest pain

3 Recognize potential limitations in diagnostic testing.

E.g., Variable prognosis of exercise treadmill test in males versus females.

4 Use sex-specific thresholds for biomarkers/laboratory value references.

E.g., Troponin, sex-specific EKG criteria for ST-elevation MI

5 When available, dose medications based upon sex-specific evidence.

E.g., Sex-based dosing of sedative medications or anticoagulants for treatment of myocardial infarction.

6 Mitigate gender and racial bias.

MITIGATING GENDER BIAS: A SYSTEMATIC APPROACH TO DIAGNOSING & TREATING HEART ATTACKS

Huded et al. (2018) JACC

HISTORIC CONTROL GROUP
490 men 233 women

INTERVENTION GROUP
378 men 171 women

Usual care for heart attacks allows
diagnostic bias among physicians



Men vs Women
77% vs 69% guideline therapy
104 vs 112 min door to balloon time

30-day mortality 6.1% higher in women

New 4-step protocol

1. ER Criteria do not require cardiology consult
2. Guideline based drug therapy despite diagnostic uncertainty
3. Immediate transfer to the catheterization lab
4. Initial radial approach for vascular access



Men vs Women
84% vs 80% guideline therapy
89 vs 91 min door to balloon time

30-day mortality reduced to 3.2%
higher in women

CLASSIFYING LUNG FUNCTION ACCORDING TO GENDER IDENTITY CAN BE IMPRECISE

TRANSGENDER WOMAN

SPIROMETRY WITH FEMALE SEX DESIGNATION

FEV₁ considered **within normal range** (91.5% of predicted).

Overestimates patient's lung function.



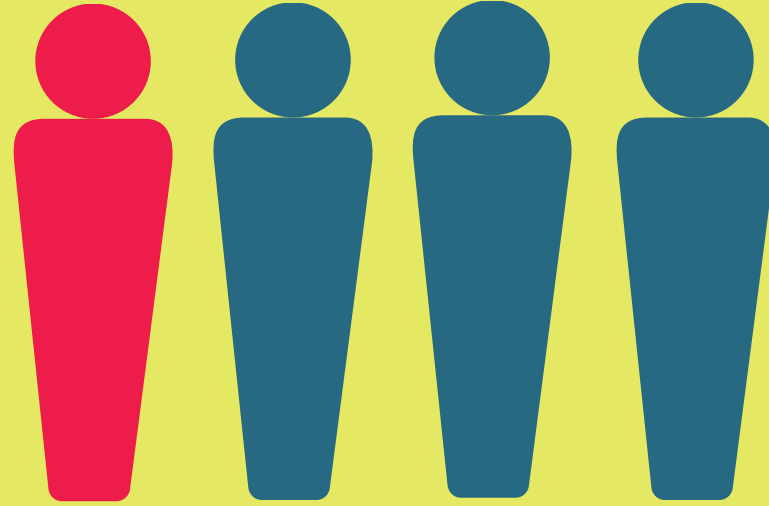
SPIROMETRY WITH MALE SEX DESIGNATION

FEV₁ considered **low** (78% of predicted).

Better estimation of patient's true pulmonary function.

Females have lower predicted flow rates and volumes in spirometry. Clinicians must balance appropriate classification of disease severity yet maintain respect in honoring a patient's reassigned gender.

APPLYING A SEX AND GENDER SCIENCE APPROACH MIGHT
HELP US TO INTERVENE AND UNDERSTAND WHY...



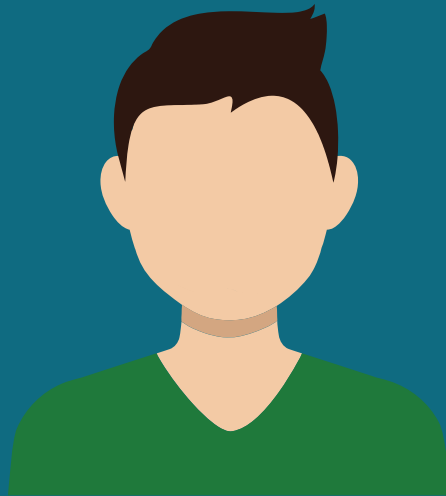
**MEN ACCOUNT FOR
THREE OUT OF FOUR
DEATHS BY SUICIDE.**

EVERYONE HAS A ROLE TO PLAY IN CHANGING CULTURE

STUDENT
OR POST-DOC



FACULTY OR
PRINCIPAL
INVESTIGATOR



HEALTHCARE
PROFESSIONAL



MEDICAL SCHOOL
DEAN



Classes & student
poster competitions

Thesis
defenses

Teaching &
conferences

Patient care

Ensure sex and gender content
in courses and exams

Culture starts shifting when we change the "norm"



ACTIONS YOU CAN TAKE NOW

1

If you are a **student**, pay attention and point out if sex and gender are not addressed in lectures, assignments or clinical cases

2

If you are a **researcher**, call out your peers during research presentations if data on sex and gender are not reported and if incorrect terminology is used

3

If you are an **educator**, include sex and gender in your courses and ask if the course curriculum includes a focus on sex and gender science

4

If you are a **clinician**, systematically work through the 6 cognitive steps to account for sex and gender in clinical care to prevent bias.



ACTIONS YOU CAN TAKE NOW

5

If you **review** for funders or journals, evaluate the appropriate consideration of sex and gender in research design, methods, analysis

6

If you are a **member of a professional society**, ask if the clinical practice guidelines committees pay explicit attention to sex and gender in their recommendations

7

Ask questions during a thesis defense or at conferences if data are not disaggregated by sex or take gender into account

8

Start a working group or student network in your area for introducing new methods in sex and gender science!

I INVITE YOU TO BE BOLD
AND PUSH BOUNDARIES

TO BE THE LEADERS
OTHERS FOLLOW



ONE DAY THE WORLD
WILL THANK YOU!