Universitätsmedizin Essen
Universitätsklinikum

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Examples for sex and gender sensitive dimensions in health research projects

Prof. Dr. rer. nat. Anke Hinney

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Attention increases

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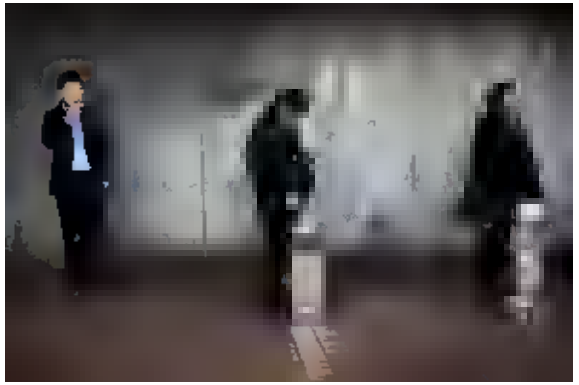
Neglecting sex and gender in research is a public-health risk

Women are more likely to die after a severe heart attack than are men.

Credit: Simon Dawson/Reuters



Smoking is more common among men than women globally.

Credit: Behrouz Mehri/AFP/Getty

Haupt et al. Nature. 2024 May;629(8012):527-530.

„Closing the Woman's Health Gap"
McKinsey Health Institute 2024

Investments to eliminate inequalities in women's healthcare could increase global economic growth by US$1 trillion annually by 2040 and reduce women's sick leave by two-thirds, which is equivalent to the creation of 137 million new full-time jobs. This is the conclusion of the report.

https://www.weforum.org/publications/closing-the-women-s-health-gap-a-1-trillion-opportunity-to-improve-lives-and-economies/

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On the way to find the right medicine for every person

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The 4 Cs of Studying Sex to Strengthen Science

Consider

Design studies that take sex into account, or explain why it isn't incorporated

Collect

Tabulate sex-based data

Characterize

Analyze sex-based data

Communicate

Report and publish sex-based data

https://orwh.od.nih.gov/sex-as-biological-variable

NIH National Institutes of Health
Office of Research on Women's Health

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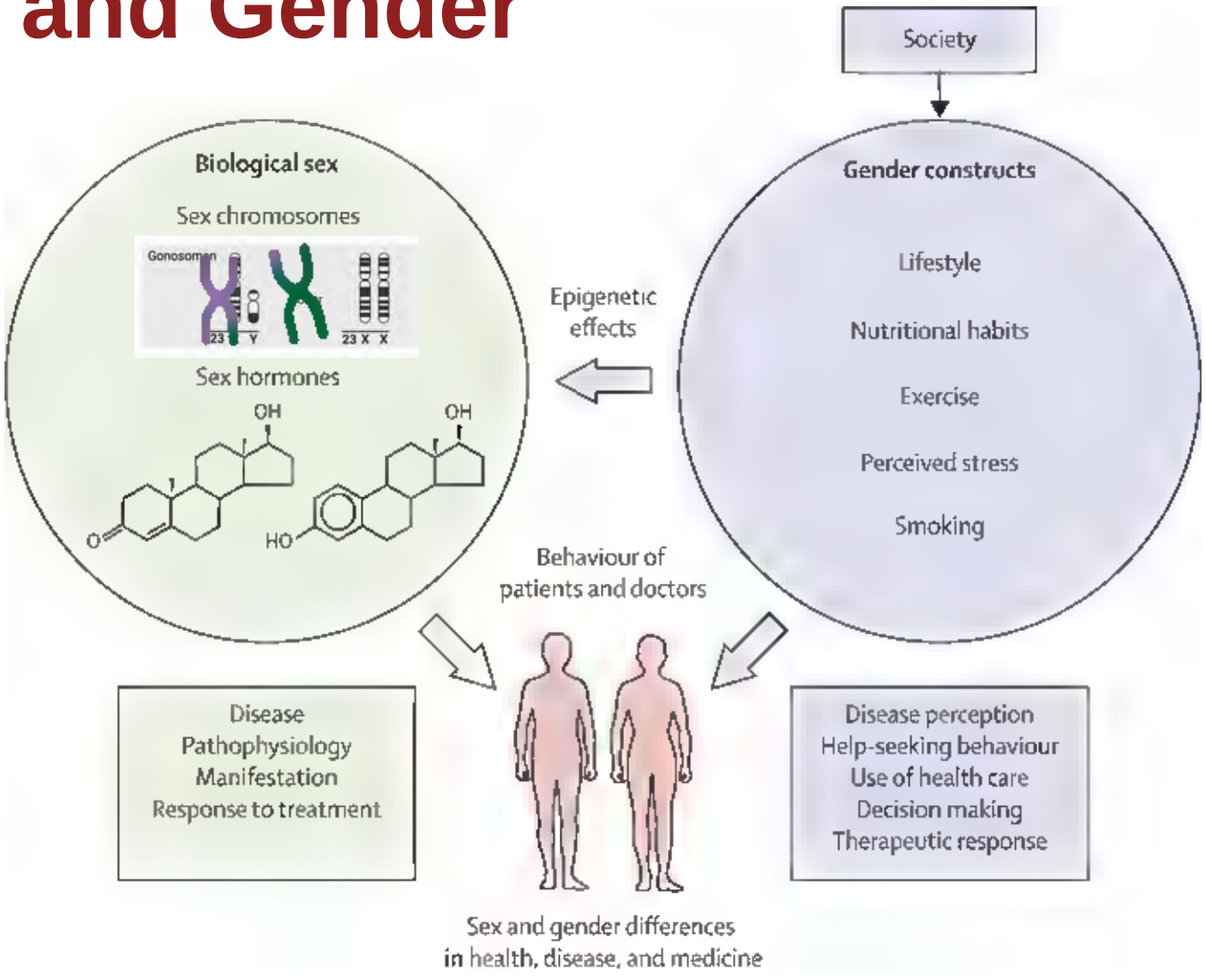
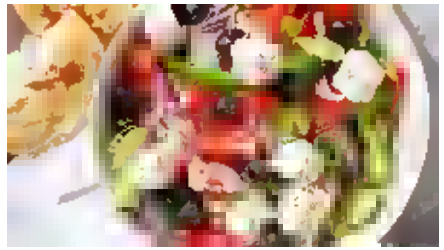
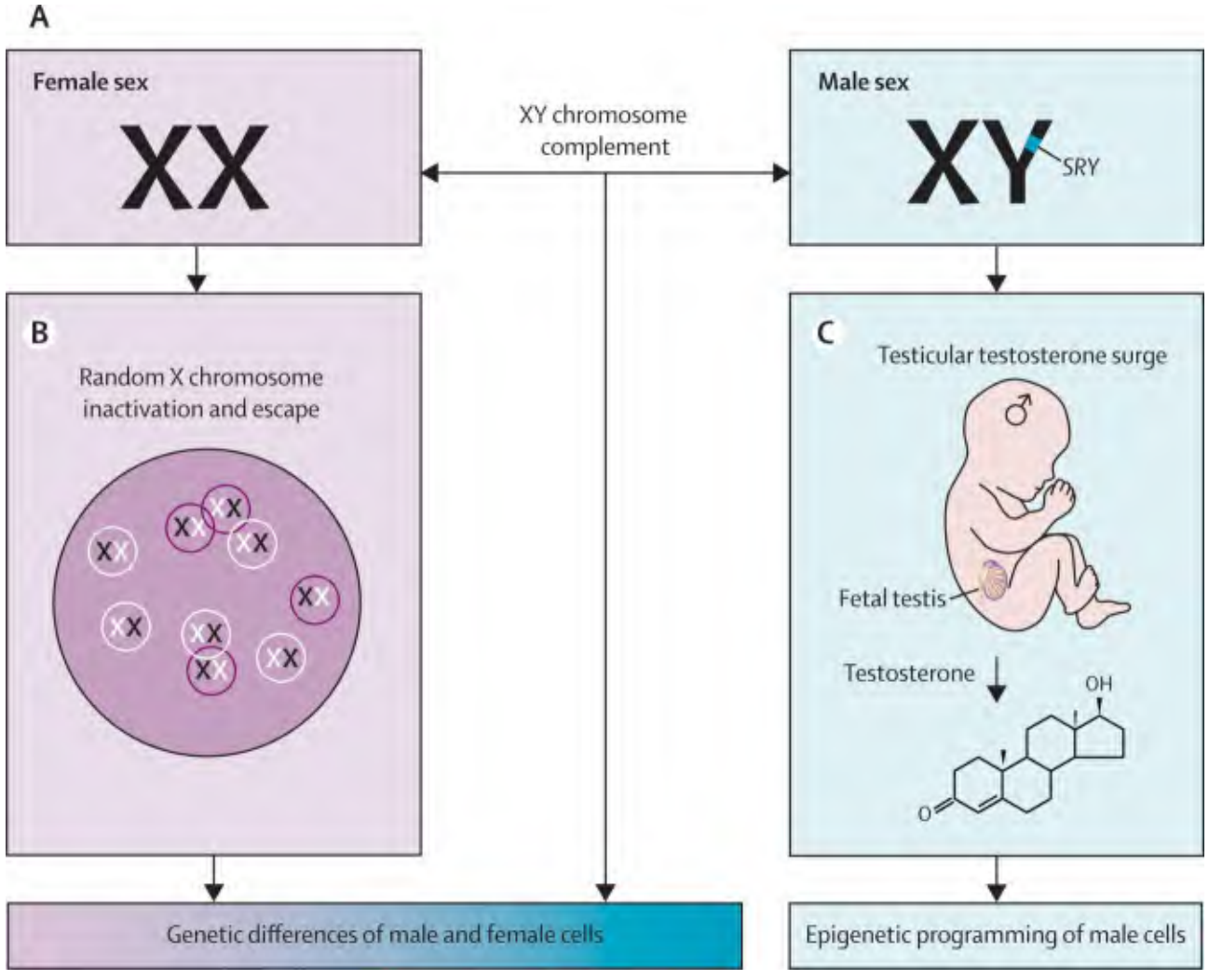
Sex and Gender





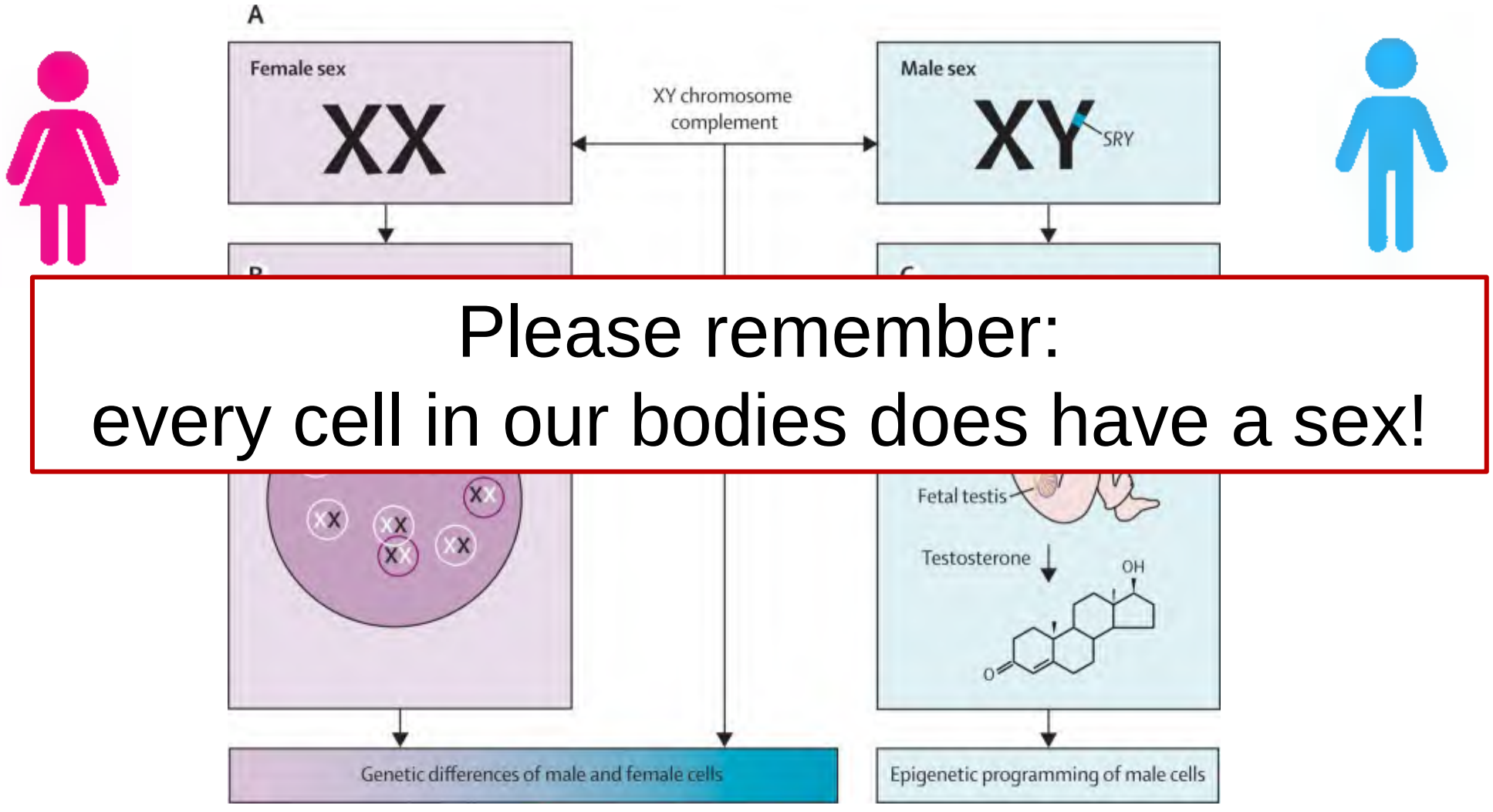
Muvais-Jarvis et al. 2020 The Lancet

Genetic differences



Mauvais-Jarvis et al. 2020 The Lancet

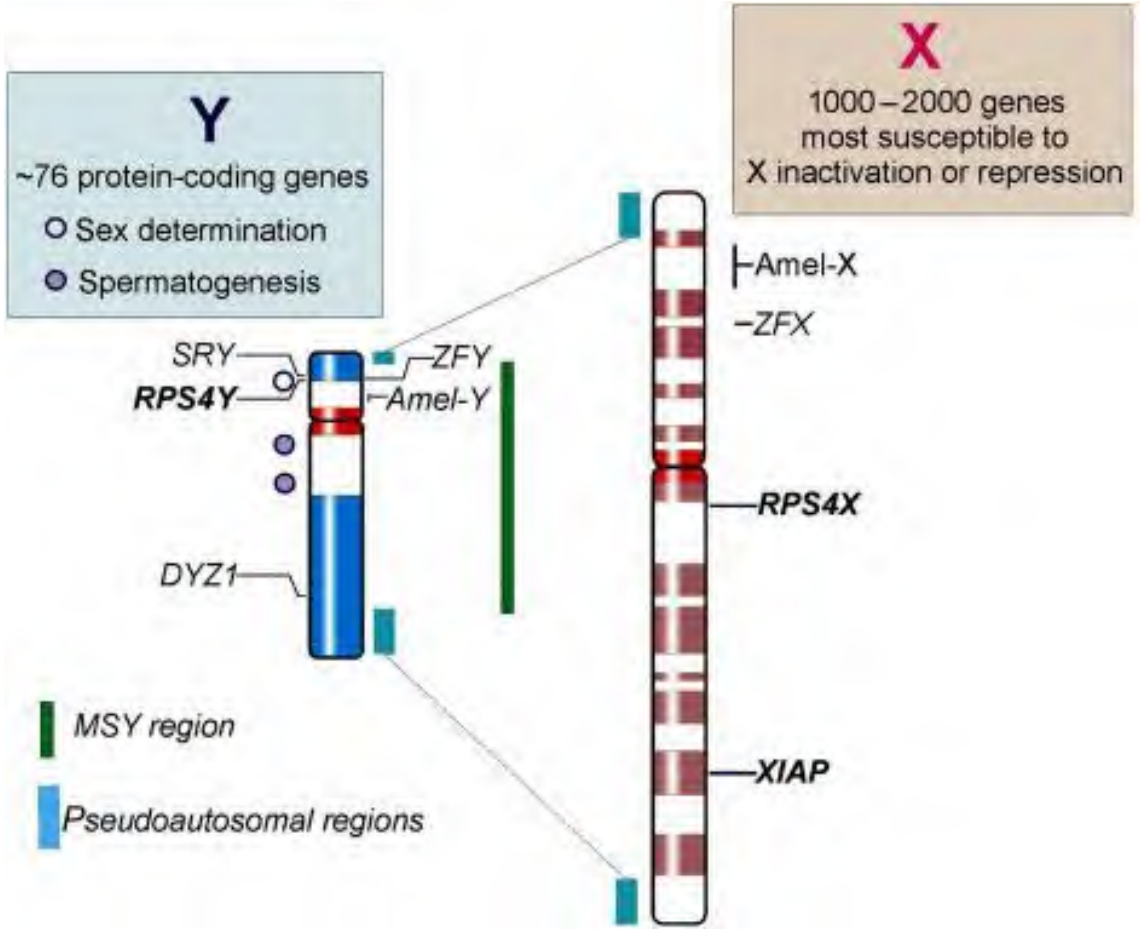
Genetic differences



Please remember:
every cell in our bodies does have a sex!

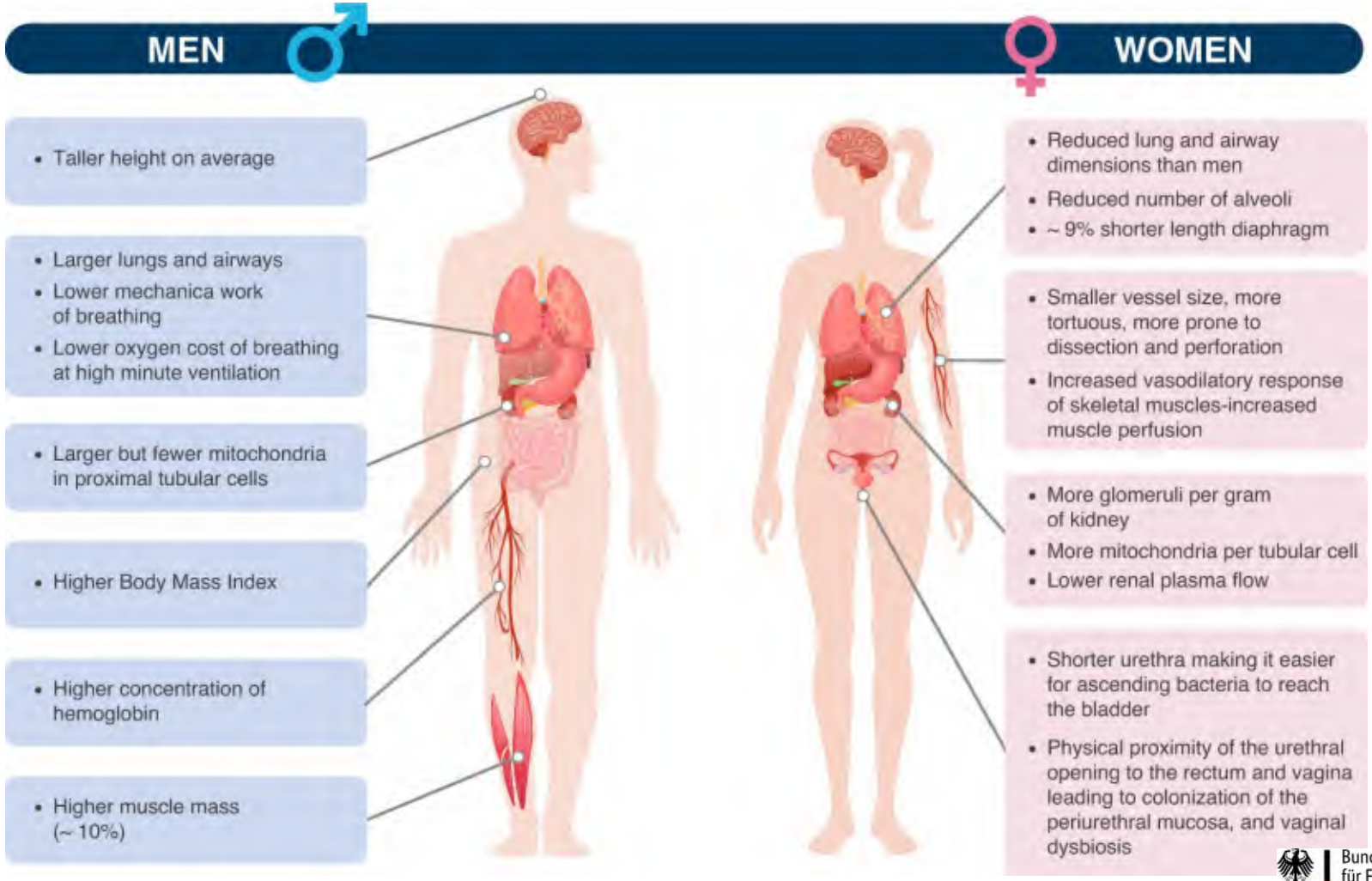
Mauvais-Jarvis et al. 2020 The Lancet

Sex Chromosomes



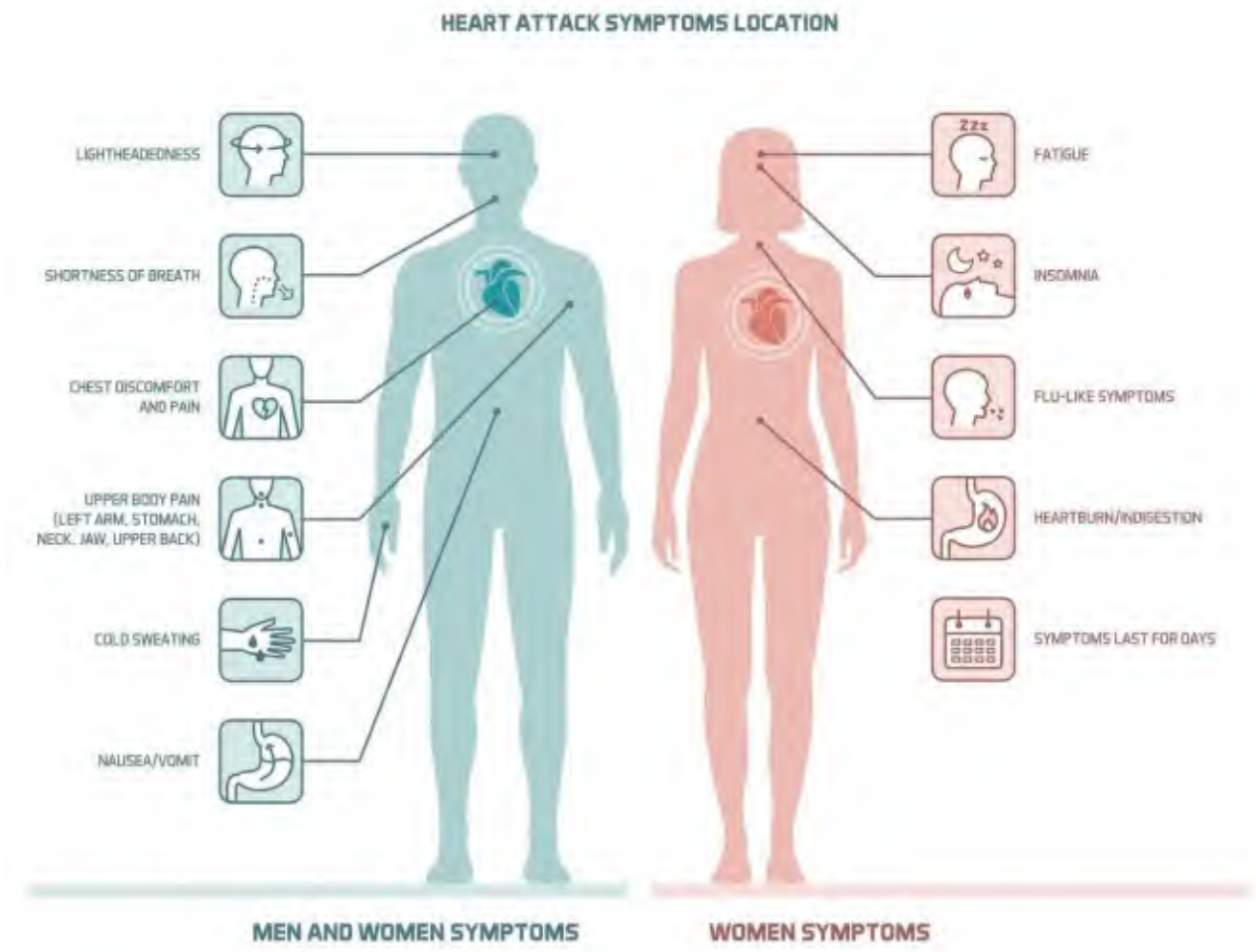
Bradbury 2023 in Principles of Gender-Specific Medicine

Physiological differences



Merdji et al. 2023 Intensive Care Medicine

Additional differences



https://www.shutterstock.com/de/image-vector/heart-attack-symptoms-on-men-women-631913825?trackingId=5c64bc7c-d44f-421b-a9d0-46bd59a34b4e&listId=searchResults

Symptoms

- **Heart attack**

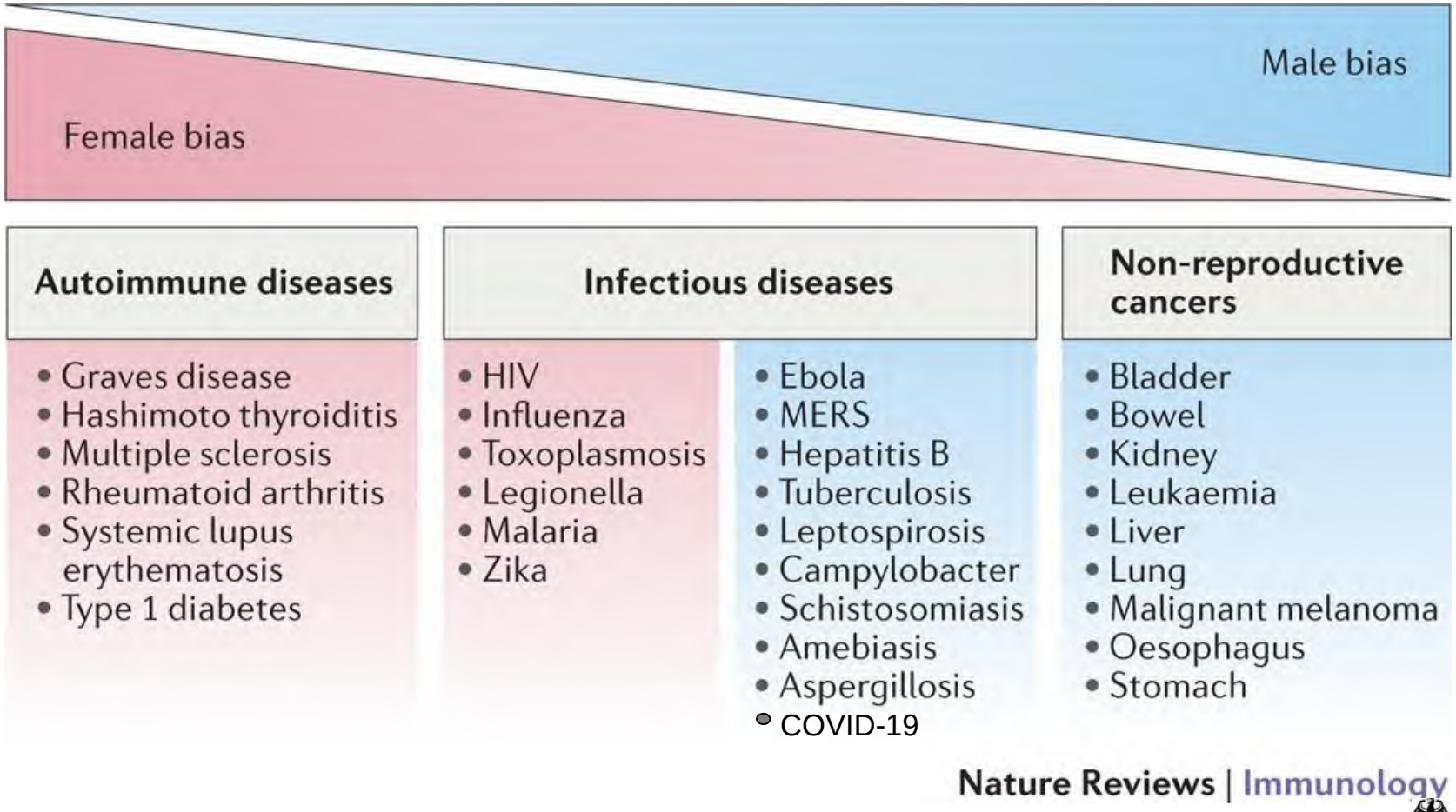
Frequency

- **Osteoporosis**
- **Depression, Eating disorders**
- **Breast cancer**

Can lead to delayed and inprecise diagnosis

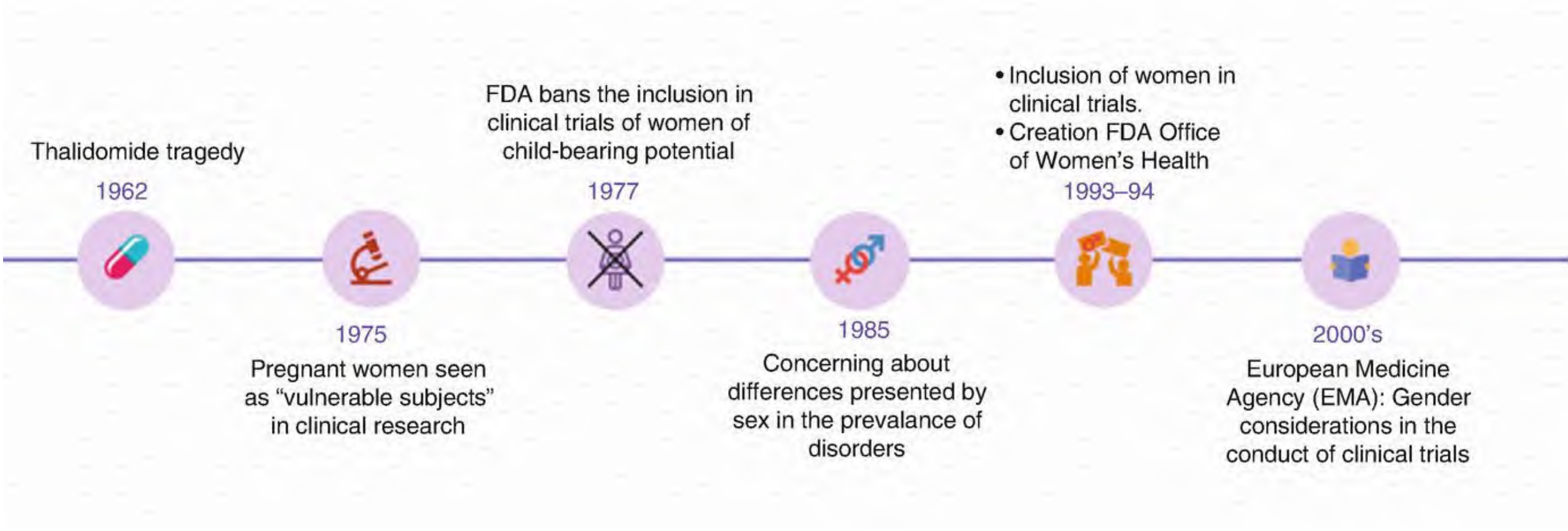
- Rajcsanyi, …, Hinney A. Redesigning medicine: integrating sex and gender for better health outcomes. Naunyn Schmiedebergs Arch Pharmacol. 2026 Feb;399:3321-3333.

Differences in frequency



Klein et al. 2016 Nature Reviews Immunology

History of females in clinical studies



Recio-Barbero & Pérez-Fernandez 2019 in Psychopathology in Women, Springer

Sex differences in drug processing

FEMALES	Physiological Differences	MALES
Body composition		
Slower processing of most drugs More accumulation of lipophilic drugs	↑ Fat mass	↓ Faster processing of most drugs Less accumulation of lipophilic drugs
Different concentrations of hydrophilic drugs (also dependent on stages of menstrual cycle)	↓ Lean mass ↑ Free water	↑ Different concentrations of hydrophilic drugs ↓
Higher resting heart rate Longer QT intervals Higher risk of arrhythmias	↑ Variation in heart rate	↓ Lower resting heart rate Shorter QT intervals Lower risk of arrhythmias
Slower absorption of drugs	↓ Gastric motility	↑ Faster absorption of drugs
Different expression of cytochrome P450 (more CYP3A4 in women)	↓ Stomach pH	↓ Different expression of cytochrome P450 (more CYP2D6 and CYP2E1 in men)
Oestrogen and progesterone compete with drugs for degradation by CYP450	↓ Liver enzymes	↑
Slower excretion of drugs	↓ Kidney excretion	↑ Faster excretion of drugs

Madla et al. 2021 Advanced Drug Delivery Reviews

Overmedication in women

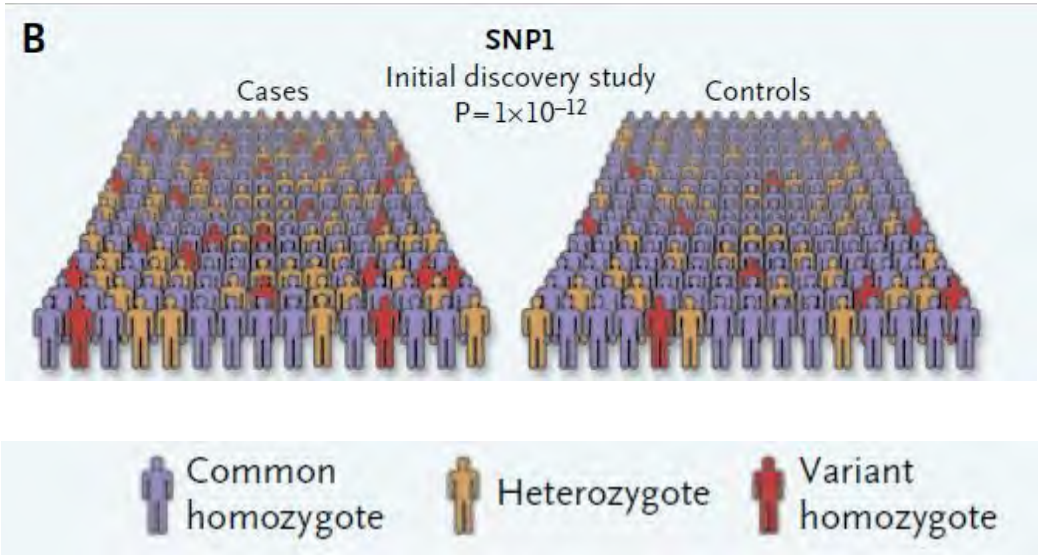
- **Males and females received same dose of zolpidem** (either 10 mg or 12.5 mg, depending on application)
- **Women had higher next-day effects** due to slower drug elimination rate

→ FDA recommended that the dose of zolpidem to be **reduced by half for women**

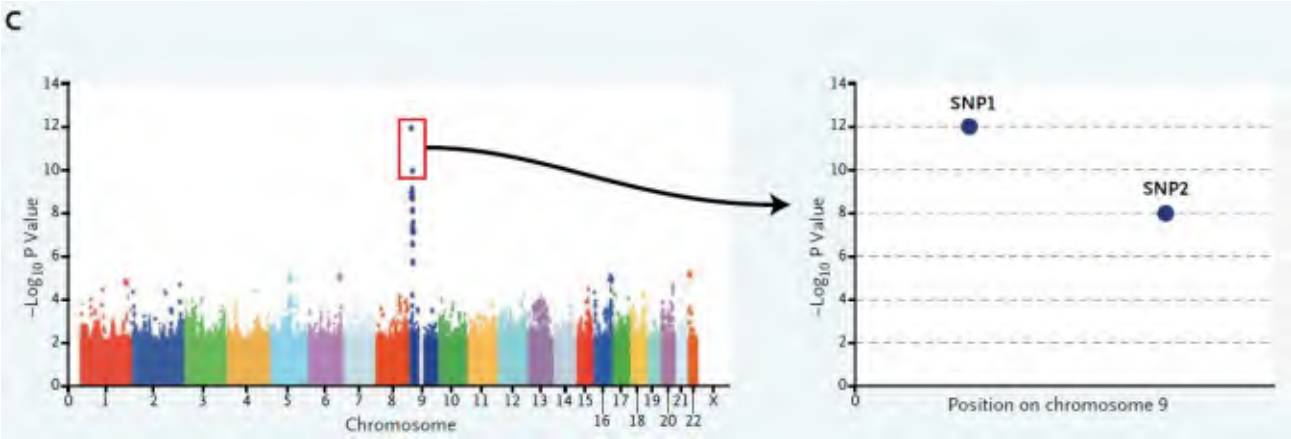
Bush 2016 The SBHSQ Report; Madla et al. 2021 Advanced Drug Delivery Reviews

Example - Genetics

Genome wide association studies

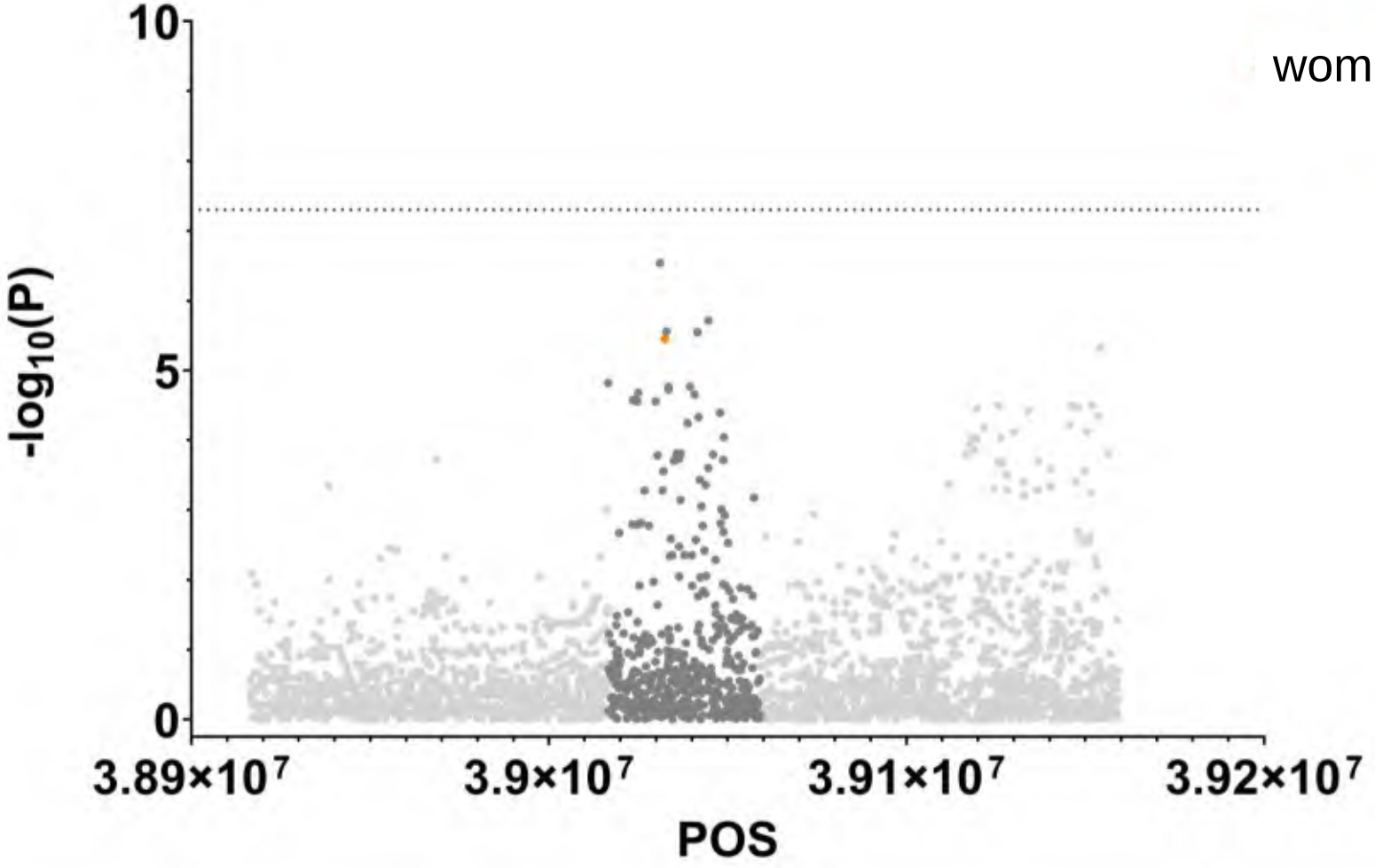


Hardly any of these studies are analysed sex-specifically



Manolio *N Engl J Med*. 2010;363:166-76. Review

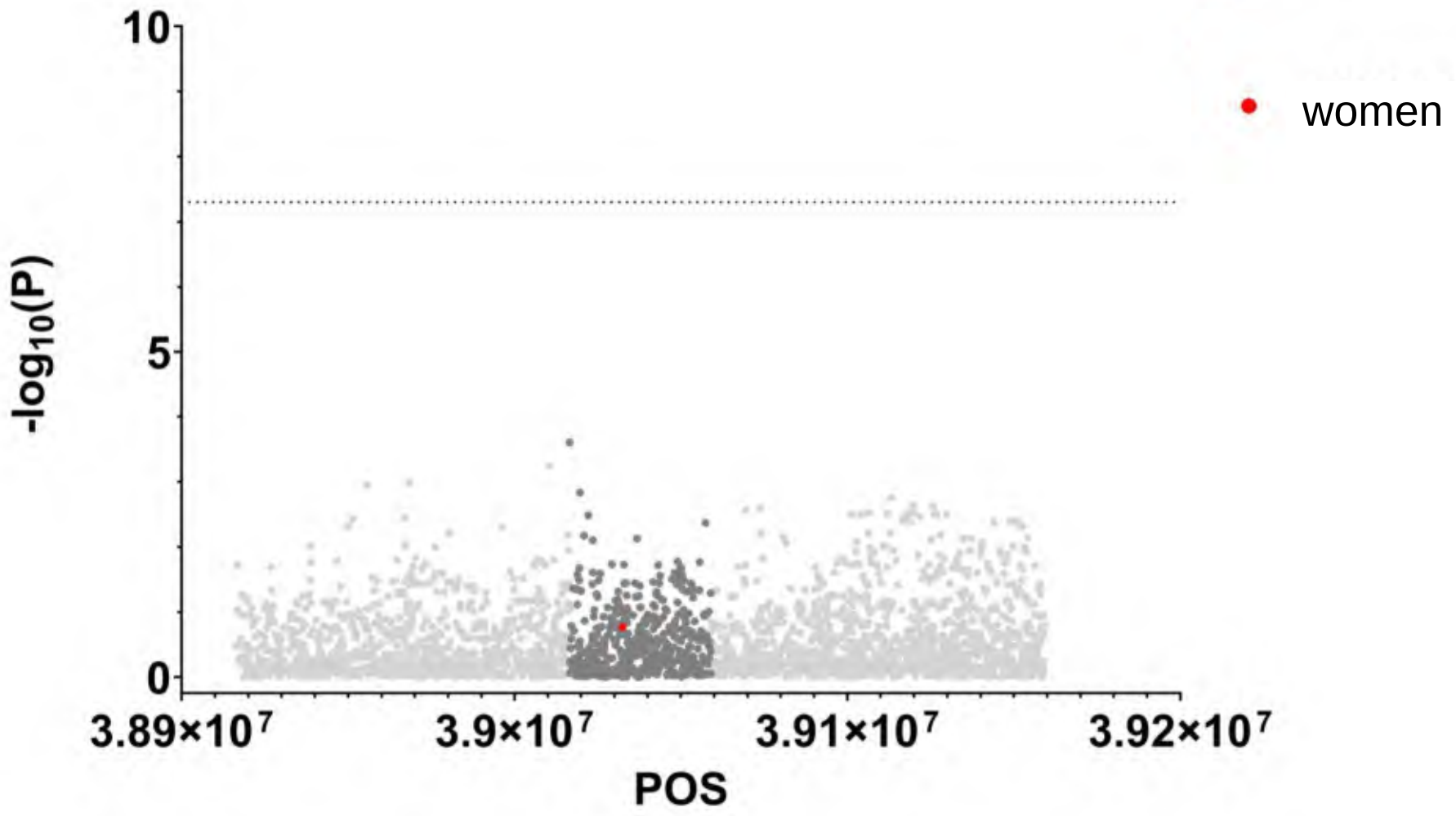
Example: important to analyse both sexes separately



women and men

Rajcsanyi et al. submitted

Example: important to analyse both sexes separately



Rajcsanyi et al. submitted

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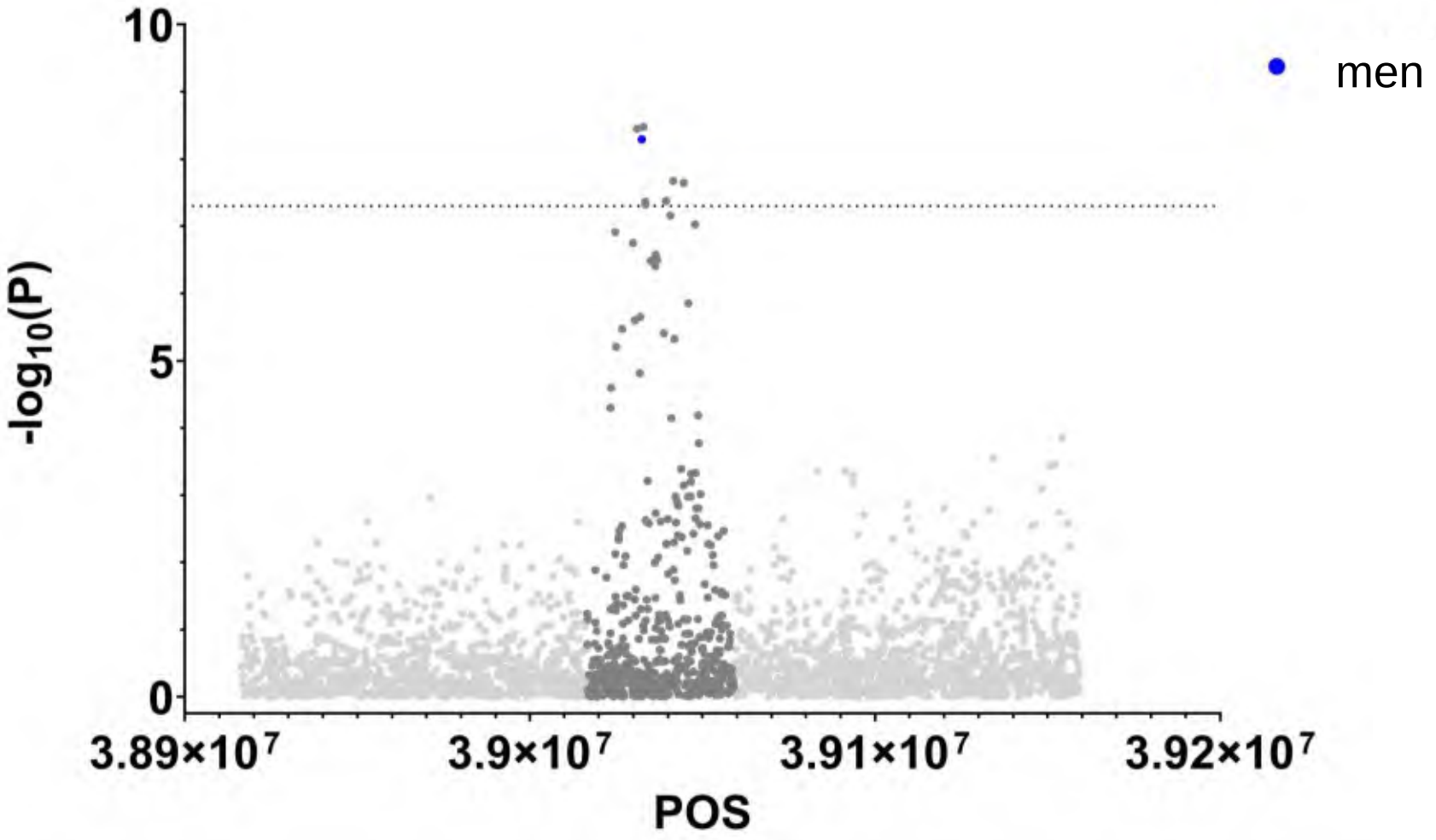
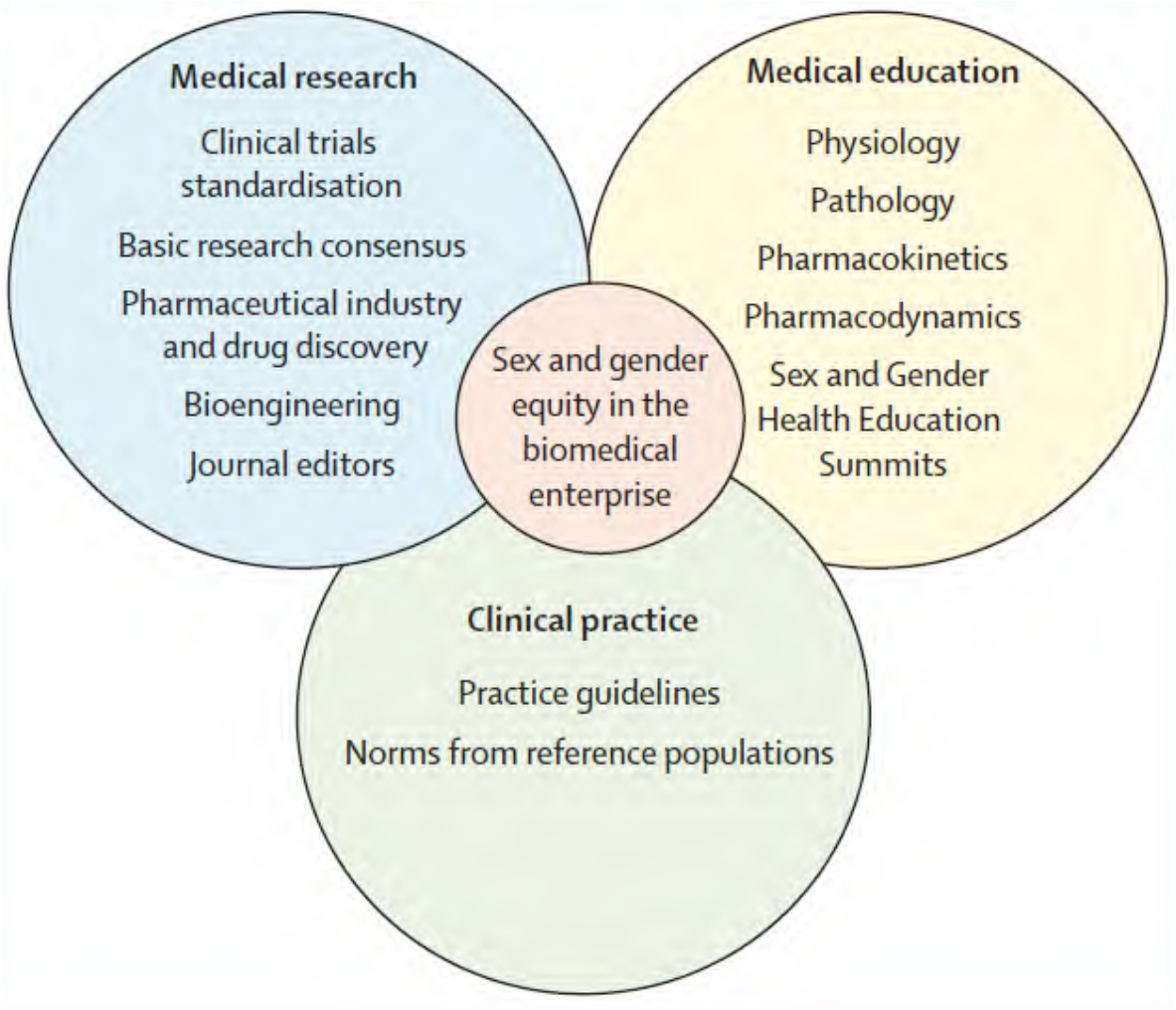


Rajcsanyi et al. submitted

Future



Mauvais-Jarvis et al. 2020 The Lancet

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Thank you

SPIRIT 2.0 – Summer School zur Geschlechterwendigkeit bei Psychischen Erkrankungen

5. bis 9. Oktober 2026 in Essen
https://www.uni-due.de/igsm/index.php

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