



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



Computational Modeling of Hormone Homeostasis (CMOHH)

Integrated hormone dynamics for safer therapies, healthier lives

Hormones shape every aspect of physiology, yet their regulation varies between sexes and across life stages such as puberty, pregnancy, midlife, and menopause. These differences explain why medicines can be more or less effective for women and men.

The CMOHH program accelerates innovation through advanced computational models that **predict sex-specific outcomes** before clinical trials begin. These models inform dosing, anticipate toxicity, and guide the design of **safer, more effective therapies** for everyone.

CMOHH: A Nationwide Effort to Harness Hormone-Driven Biology

- Developing a physics-informed computational model that simulates how vaginal tissue grows, remodels, and responds to mechanical stress across the lifespan (Virginia Tech; led by Rafaella De Vita, PhD. OT2OD042813)
- Modeling cartilage cells to understand how differences in male and female metabolism produce specific proteins and unintended off target drug effects (Montana State University -Bozeman; led by Ronald June, PhD. OT2OD042823)
- Building an *in silico* platform of female reproductive endocrinology to predict metabolic therapeutic response across female life stages (Michigan State University; led by Teresa Woodruff, PhD. OT2OD042764)
- Creating a digital twin that integrates the hypothalamus, placenta, and gastrointestinal tract, improving understanding of hormone regulation during pregnancy (Morgan State University; led by Pilhwa Lee, PhD. OT2OD042825)
- Modeling how the microbiome influences estrogen metabolism and how estrogen is processed and recycled across interconnected gut, liver, and vaginal systems (University of Virginia; led by Jason Papin, PhD. OT2OD042817)
- Simulating hormone-driven skeletal responses to osteoporosis therapies and endocrine treatments in both males and females (University of California, San Francisco; led by Edward Hsiao, MD, PhD. OT2OD042820)

Powering Precision, Prevention, and Shared Discovery

- **Precision dosing & safety:** anticipate sex-specific efficacy and toxicity signals before first-in-human studies
- **Whole-life health:** model hormone dynamics across life stages to inform health for women at all ages
- **Data and model sharing:** accelerate insights into chronic disease and sex differences by sharing computational models, workflow and data

Learn more

- See the NIH press announcement: [NIH launches \\$21 million initiative to improve understanding of sex-specific hormonal biology.](#)
- Read the **ORWH initiative page:** [Computational Modeling of Hormone Homeostasis.](#)

At A Glance

- An ORWH-led, \$21M nationwide research effort creating human-based, data-driven computational models to reveal how hormone biology shapes health and disease risk across life stages for women and men.
- Six awards powered by advanced methods - digital twins, multi-scale and Super Intelligence (SI)-enhanced models - generating scientific evidence grounded in human biology for new therapeutics and better health.