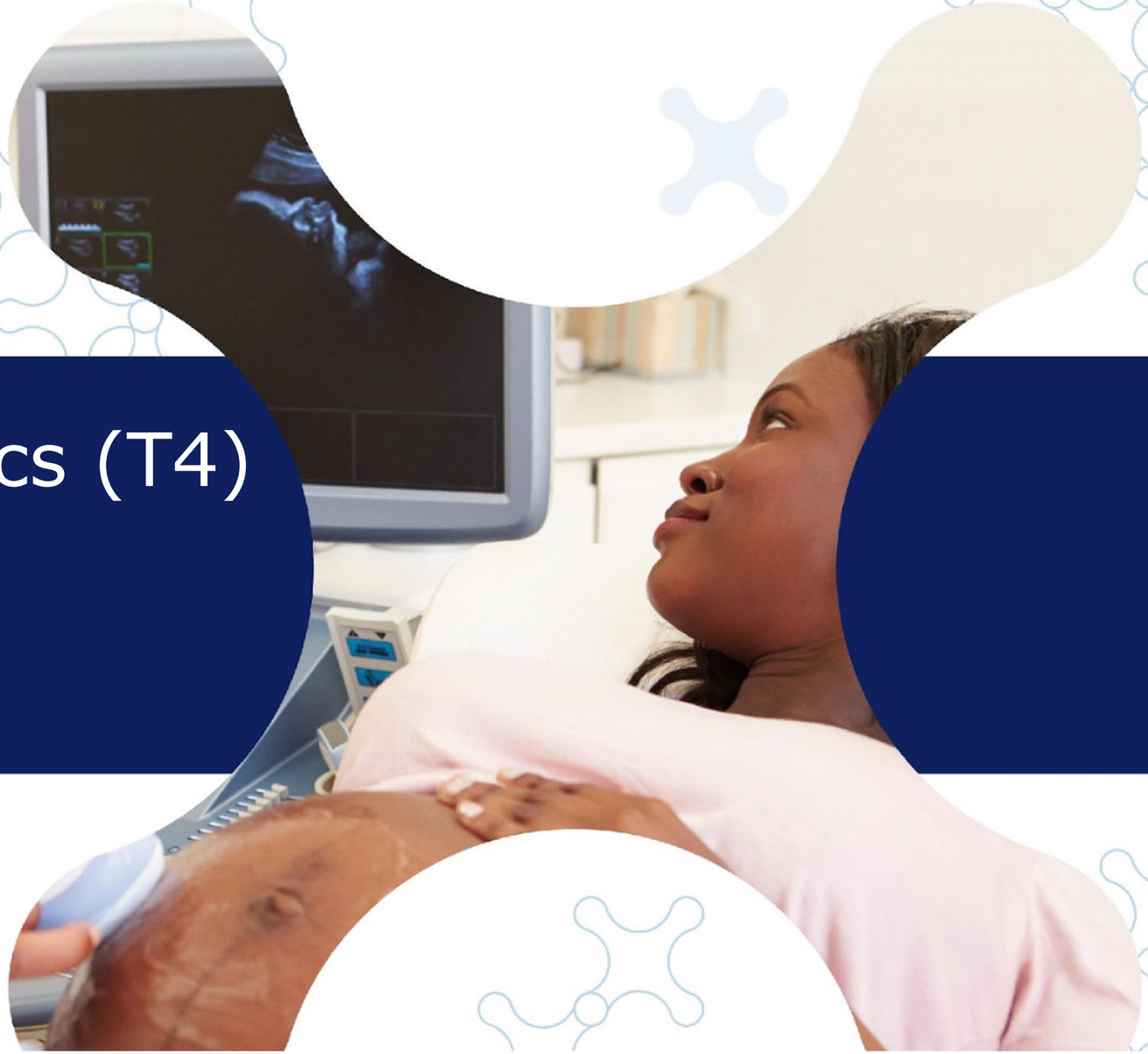
Big Data & Bioinformatics (T4)

Lance Kam, Columbia University



Our Team Spans Disciplines & Schools

Itsik Pe'er, CU

Computer Science, Computational Methods in Germline Human Genetics

Elham Azizi, CU

Biomedical Engineering, Machine Learning, Genomics, Tumor Cell Composition

Timothy Downing, UCI

Biomedical Engineering, Tissue Engineering, Regenerative Biology, Mechanobiology

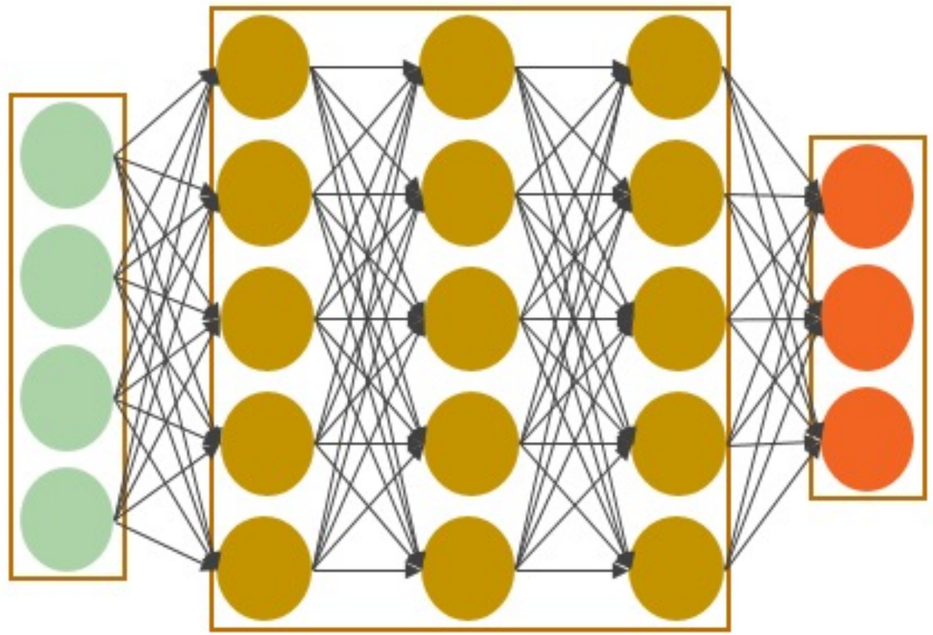
Lance Kam, CU

Biomedical Engineering, Immune Engineering, Microfabrication

Spencer Lake, WUSTL

Mechanical Engineering, Materials Science, Soft Tissue Mechanics

Big Data & Bioinformatics

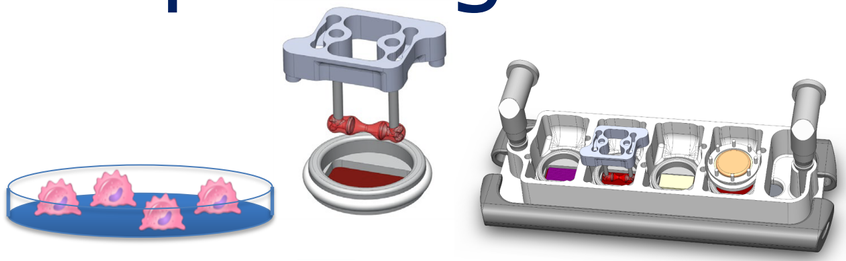


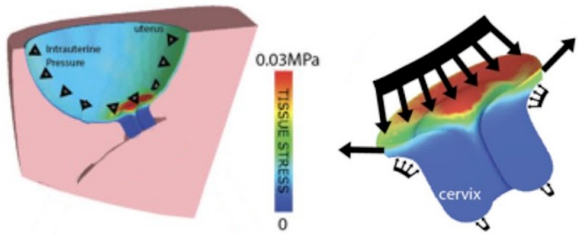
Capture human diversity

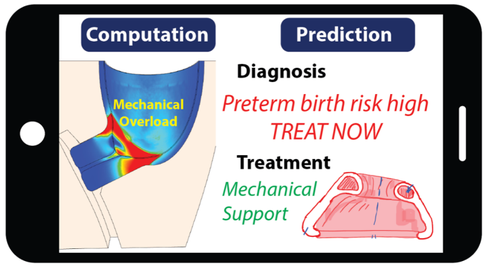
Causal analysis

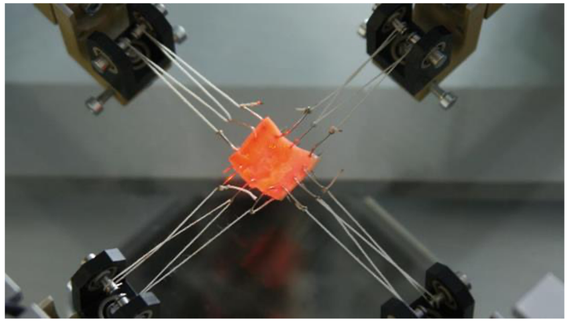
Simulation and prediction

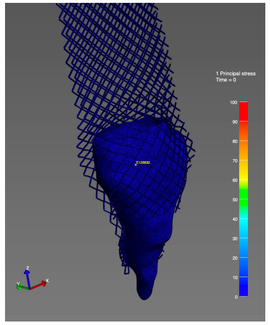
Capturing human diversity

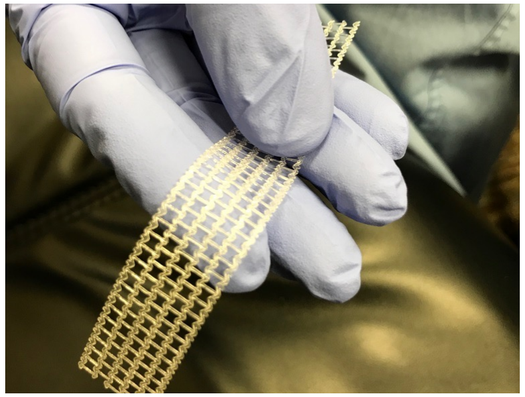












Capturing human diversity

10,037 nulliparous women

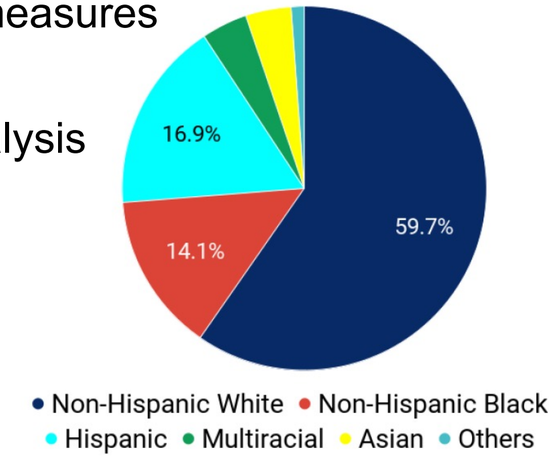
- material & paternal demographics
- nutritional, behavioral, and psychosocial assessments
- blood pressure, weight, measurements
- clinical and sonographic measures
- sleep, stress, anxiety
- biospecimens for later analysis

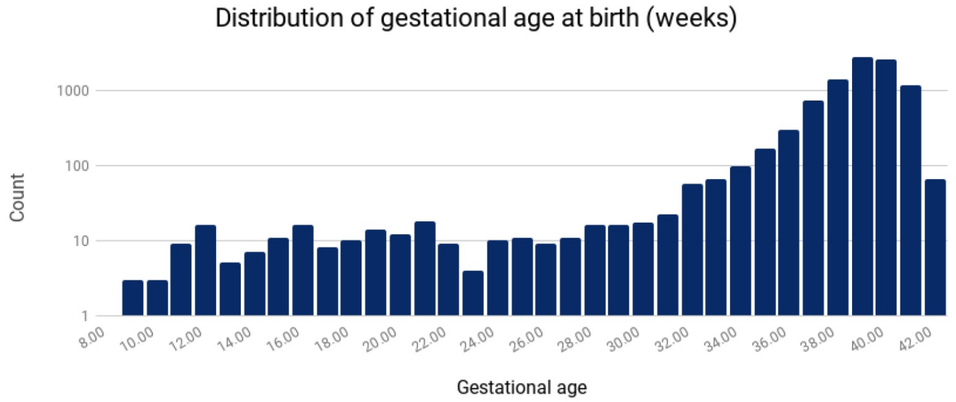
nuMOM2b

Nulliparous Pregnancy Outcomes Study
Monitoring Mothers-to-be

Pregnancy outcomes

- preterm birth
- preeclampsia
- fetal growth restriction
- additional maternal / fetus-newborn outcomes

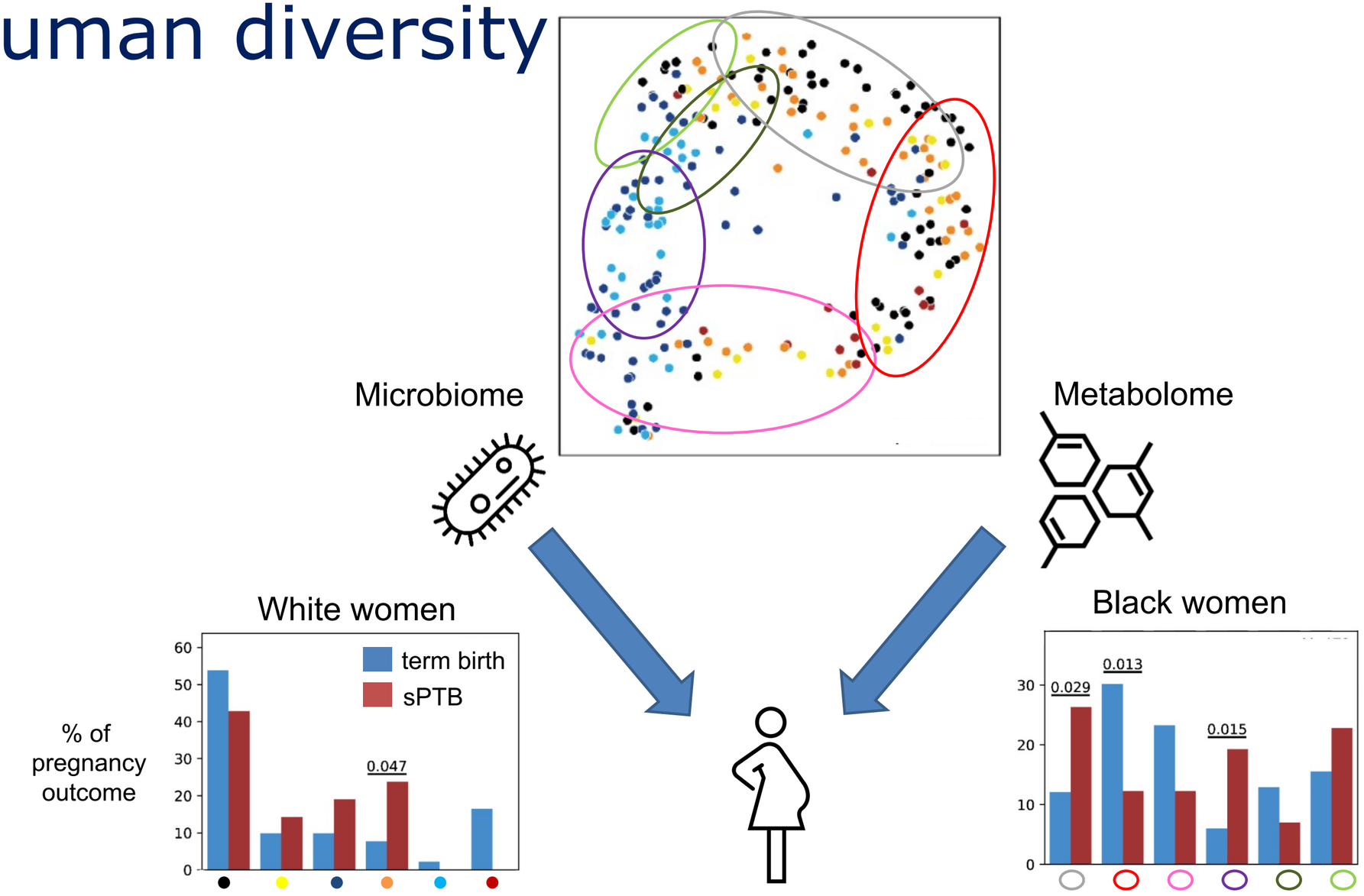




- Physical activity correlates with adverse pregnancy outcomes
- Identification of genetic variants associated with preterm birth and pregnancy loss
- Quantitative measure of continental ancestry through SNP analysis

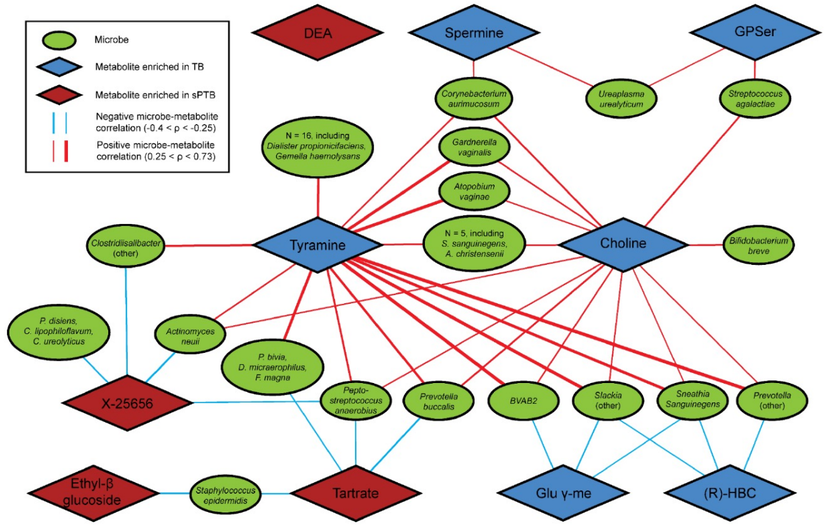
Haas, D.M. *et al.* (2015) *Am. J. Obstet. Gynecol.* **212**:539.e1

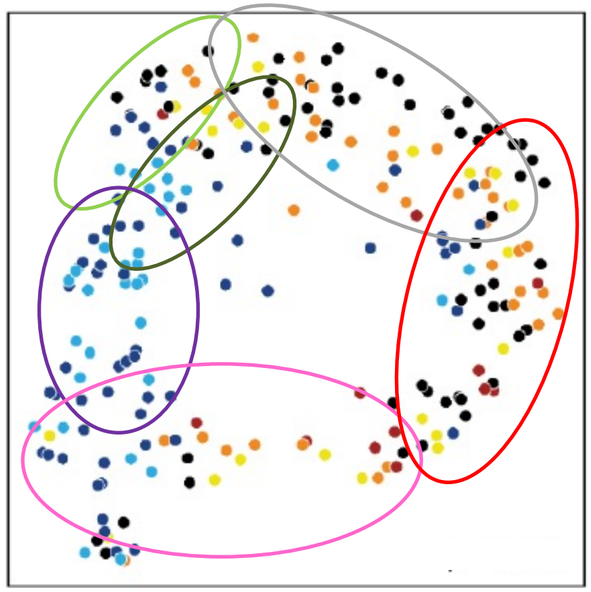
Capturing human diversity



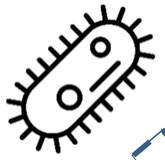
Kindschuh, W.F. *et al.* (2021) *bioRxiv.* 2021.06.14.448190

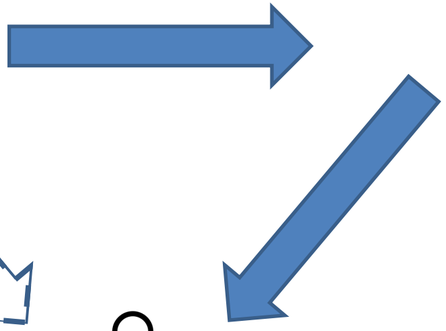
Causal network analysis

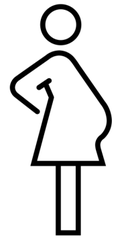




Metabolome

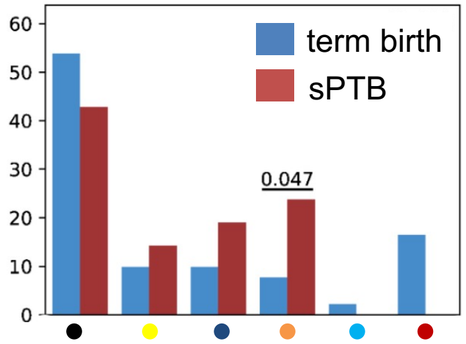




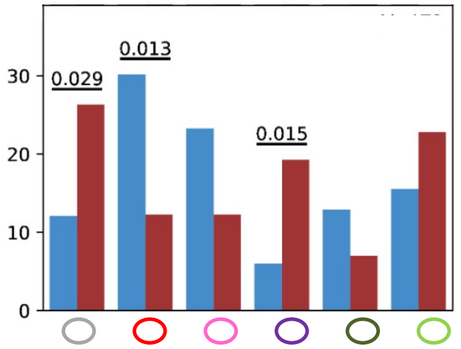


White women

% of pregnancy outcome



Black women



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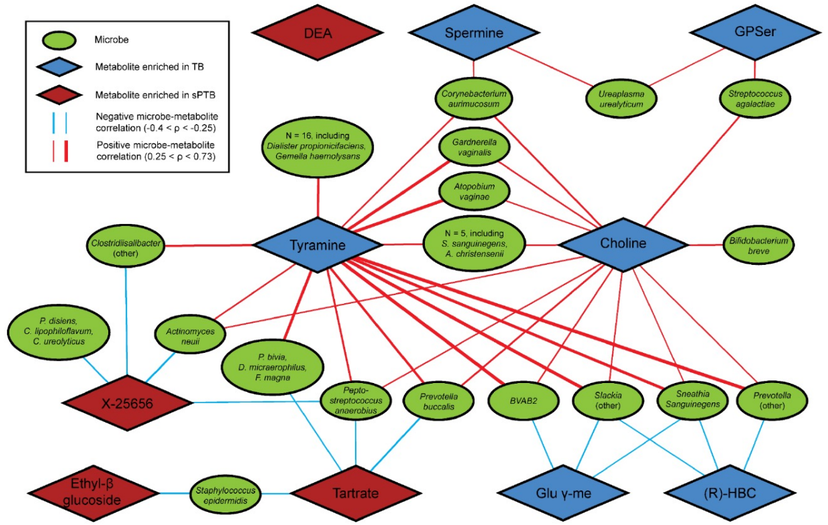
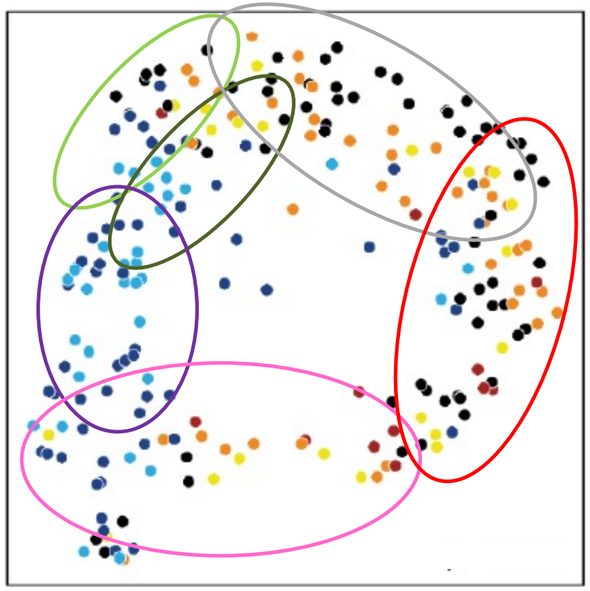
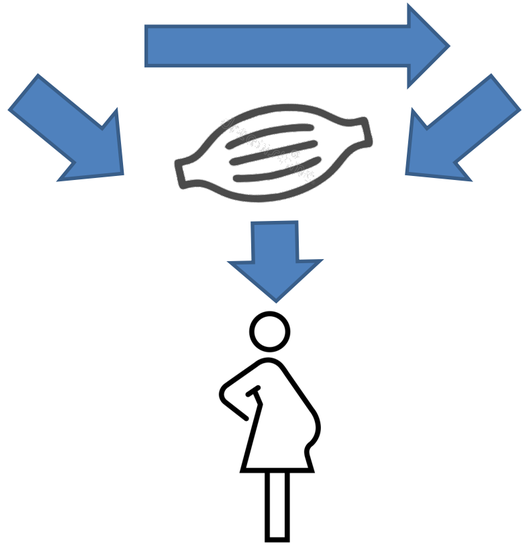
Causal network analysis



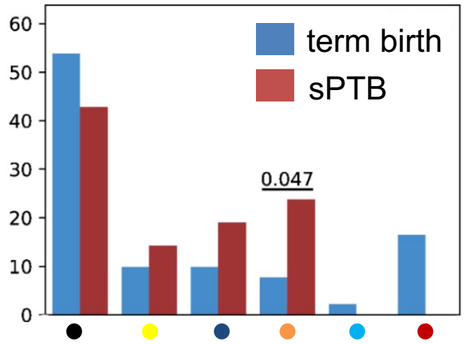


Metabolome

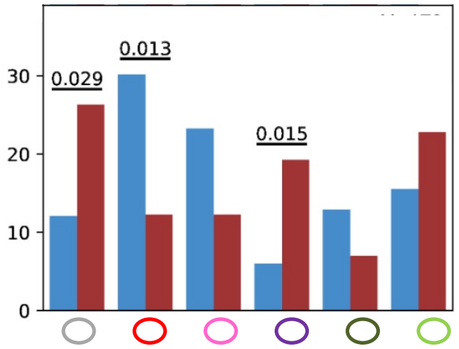


White women

% of pregnancy outcome



Black women



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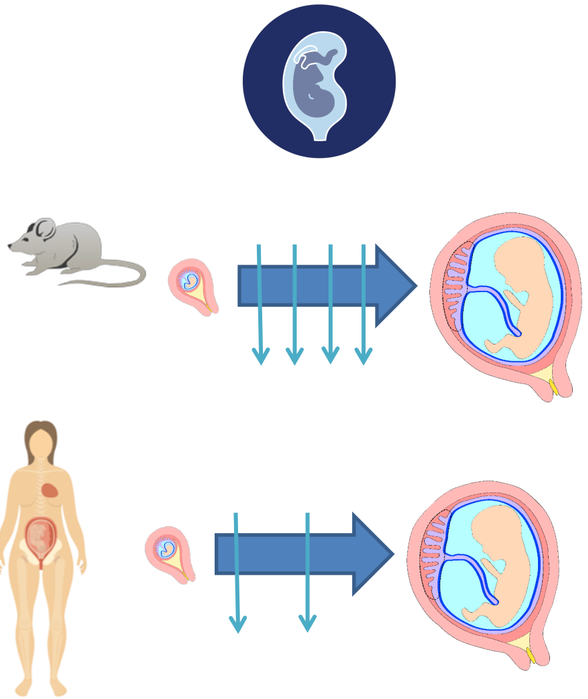
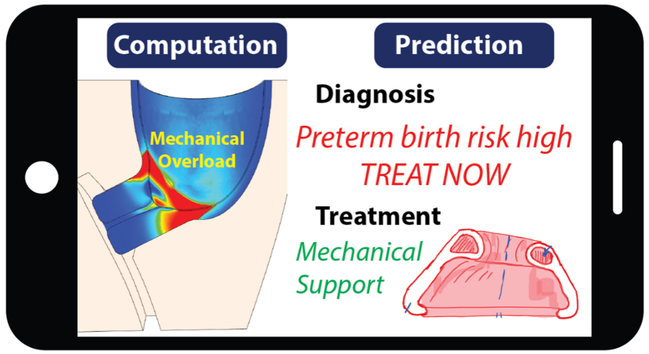
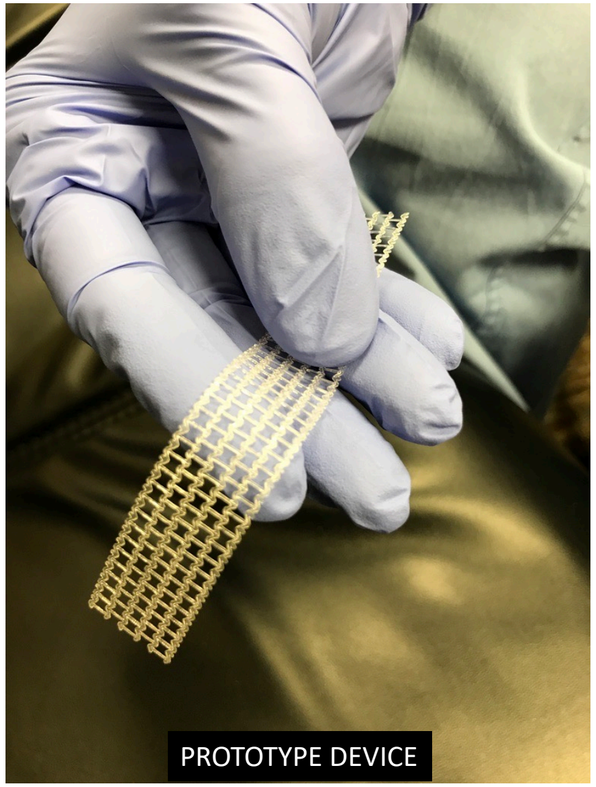
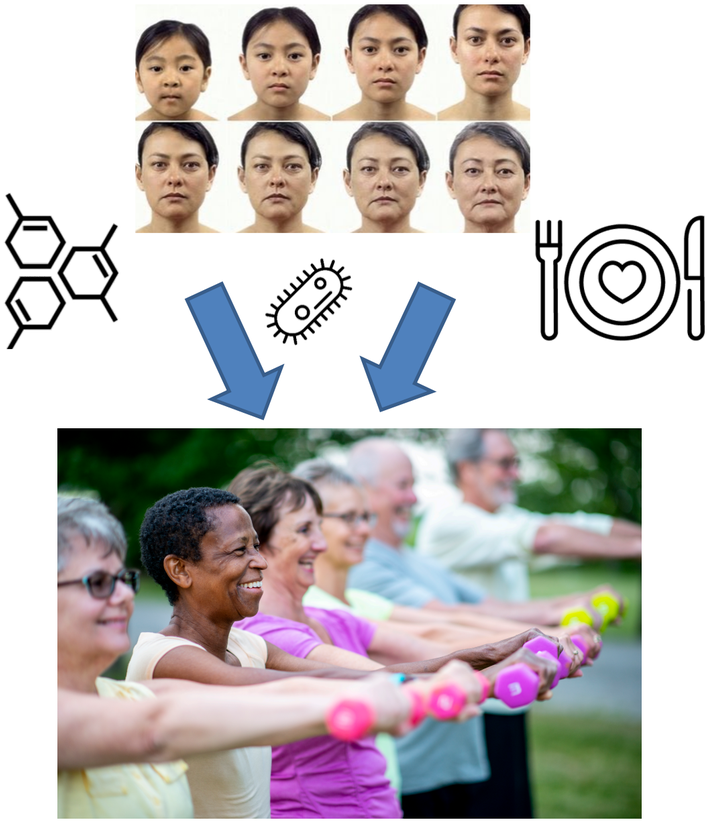
Simulation and prediction









Integration and milestones (T4)

T1
Multiscale Biomechanical Computation & Imaging

T2
Mechano-organs

T3
Clinically Deployable Devices

T4
Big Data and Bio-informatics

R1
Experimental Cellular & Tissue Mechanics

R2
Tissue & Organ Mechano-biology

R3
Multiscale Theoretical Mechanics

R4
Mechanomics

Education & outreach modules

- Data & Diversity
- Data science
- Intellectual property

YEARS 1–2	YEARS 3–5	YEARS 5–10
• Module development • System definition • Initial guidance of ex vivo models • Data systems	• Guidance and evaluation of ex vivo systems • Simulation and prediction • Impact analysis • Identify biomechanics-based data	Deploy systems across all testbeds • Preterm birth prediction • Pelvic support design • Monitor health and customize biomechanics-based solutions

Enabling Technology Testbeds Q&A