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Investigating the Influence of Prenatal Metals Exposures on Childhood Mitochondrial Biomarkers

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Investigating the Influence of Prenatal Metals Exposures on Childhood Exposures on Mitochondrial Biomarkers

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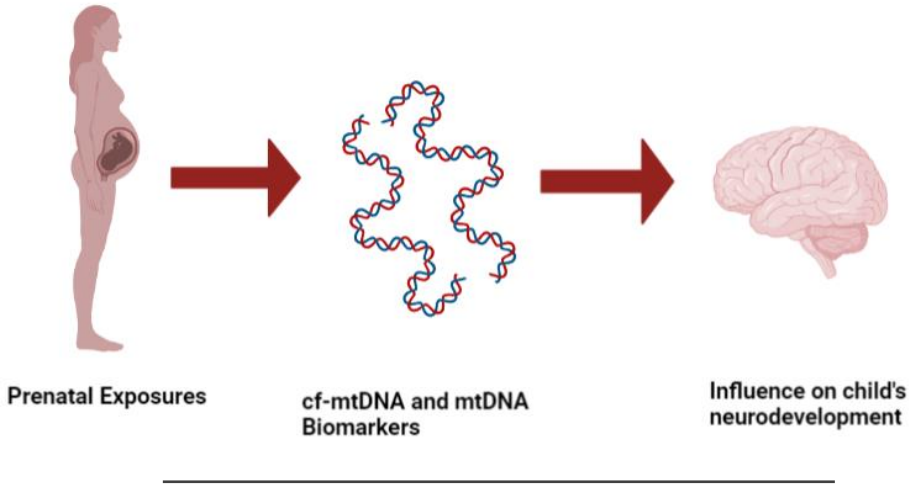
PrIMER
Program to Inspire Minority & Underserved Undergraduates in Environmental Health Science Research

Columbia University MAILMAN SCHOOL OF PUBLIC HEALTH

MOLLOY UNIVERSITY

Background

- *Mitochondrial DNA* (mtDNA) can indicate biological conditions because changes depending on stress conditions.
- **The mitochondrial DNA Copy Number (mtDNAcn)** is a *measure of mitochondrial genomes* content per cell and can reflect mitochondrial function.
- **Cell-free mtDNA Copy Number (cf-mtDNA)** refer to *measure of mitochondrial genomes* reflected in the plasma or serum compartment and can indicate inflammation.
- Both biomarkers are indicative of mitochondrial damage which may lead to chronic adverse health conditions.



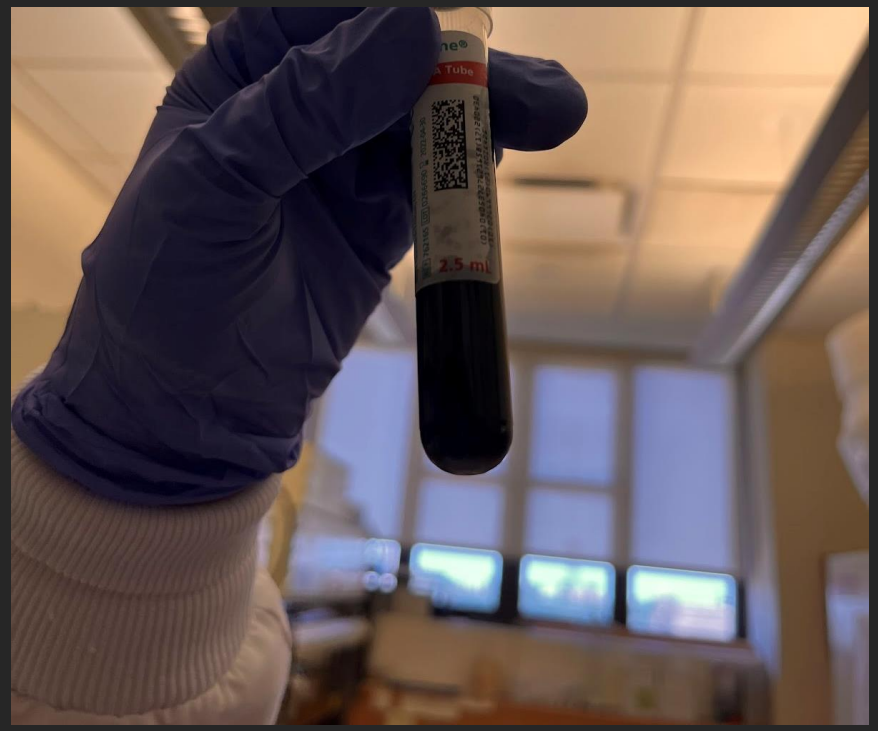
Project 1

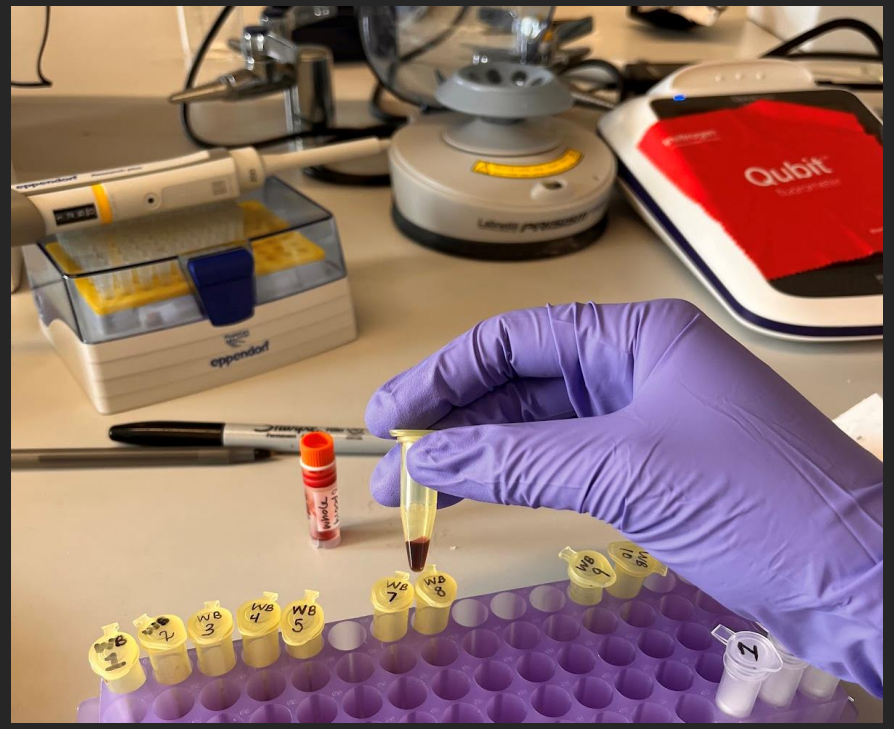
Objective: To determine the association between prenatal exposure to metals on two biomarkers of mtDNA in child blood: mtDNAcn & cf-mtDNAcn

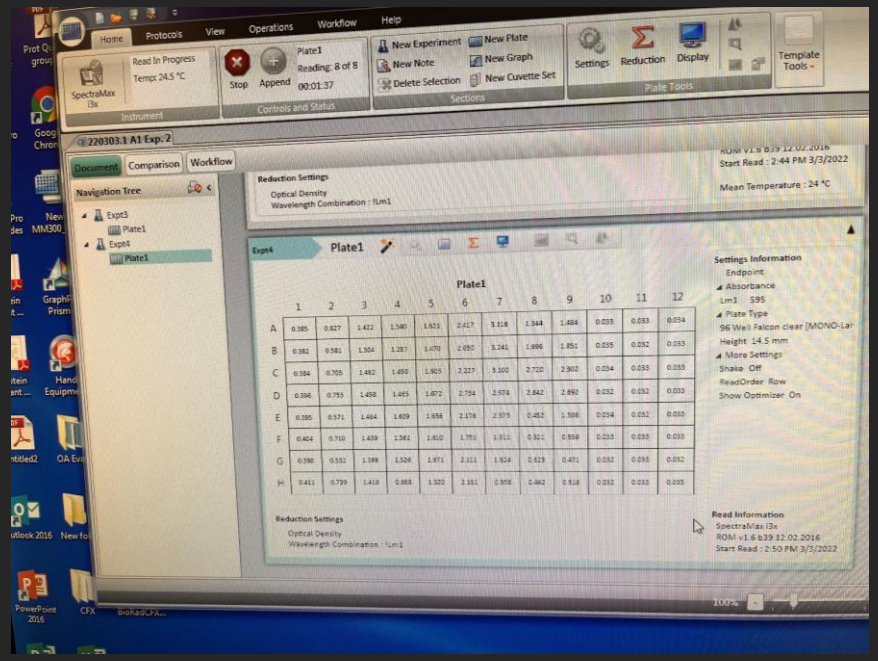
Goal: to investigate the associations between maternal blood metals (Pb, Cd, Mn, Hg, Arsenic) measurements and mtDNA & cf-mtDNA biomarkers

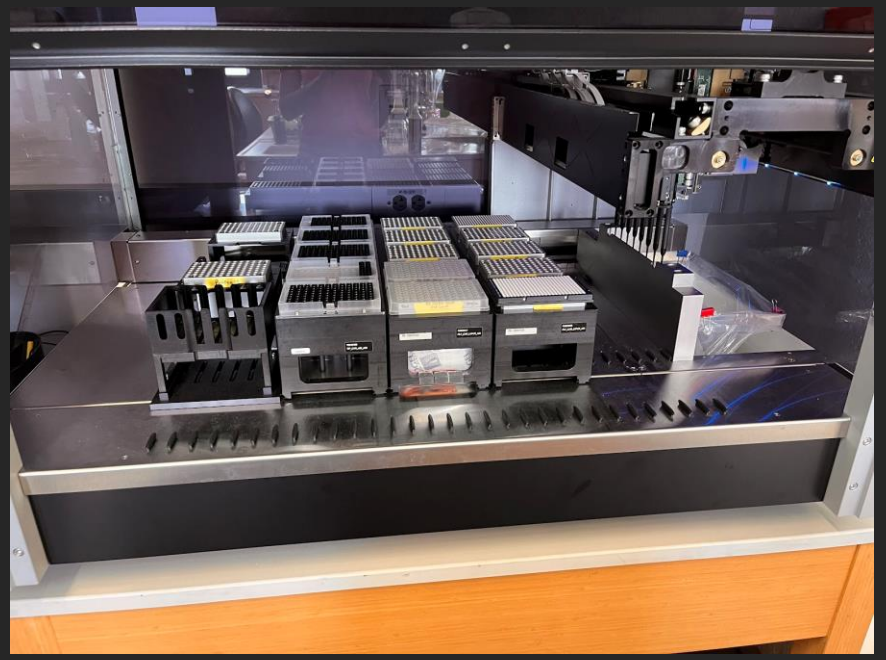
Project 1 Methods

- Isolate & Clean DNA
- Dilute samples & make standards (Qubit)
- Normalize samples & re-picogreen them (2ng/ul)
- Use Pipetting Robot for 384 well plate
- Perform mtDNA copy # assay
- Perform Gel Electrophoresis









R analysis

Compare	Find the CQ values
Examine	Examine Standard curve
Compare	Triplicate standards vs average samples
Calculate	Calculate regression lines and primer efficiencies
Calculate	Calculate mtDNAcn
Merge	Merge all data and continue analysis

mtDNA Probe

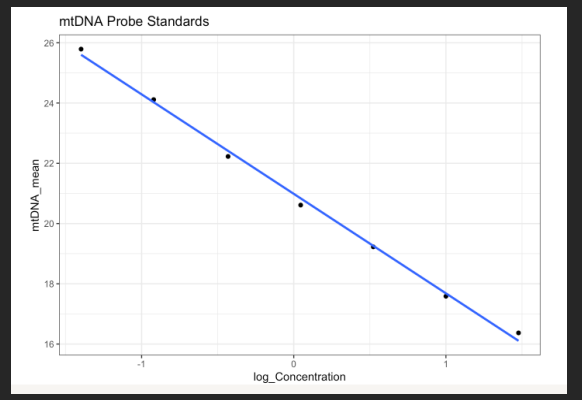
r.squared
0.9970738

```
kable(triplicates_stds %>%
  do(glance(lm(nDNA_mean~log_Concentration, data = .))) %>% select(r.squared), caption = "nDNA Probe")
```

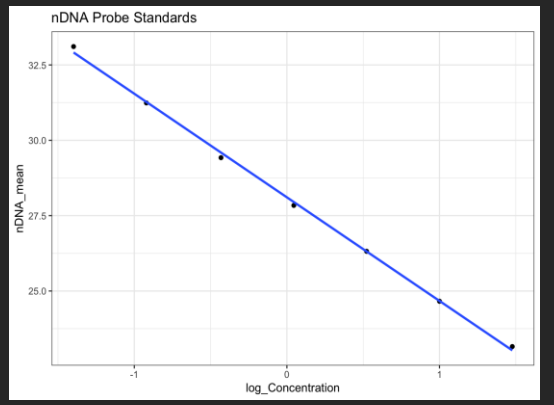
nDNA Probe

r.squared
0.9987257

Need values to be close to 1



MtDNA primer 100.8267

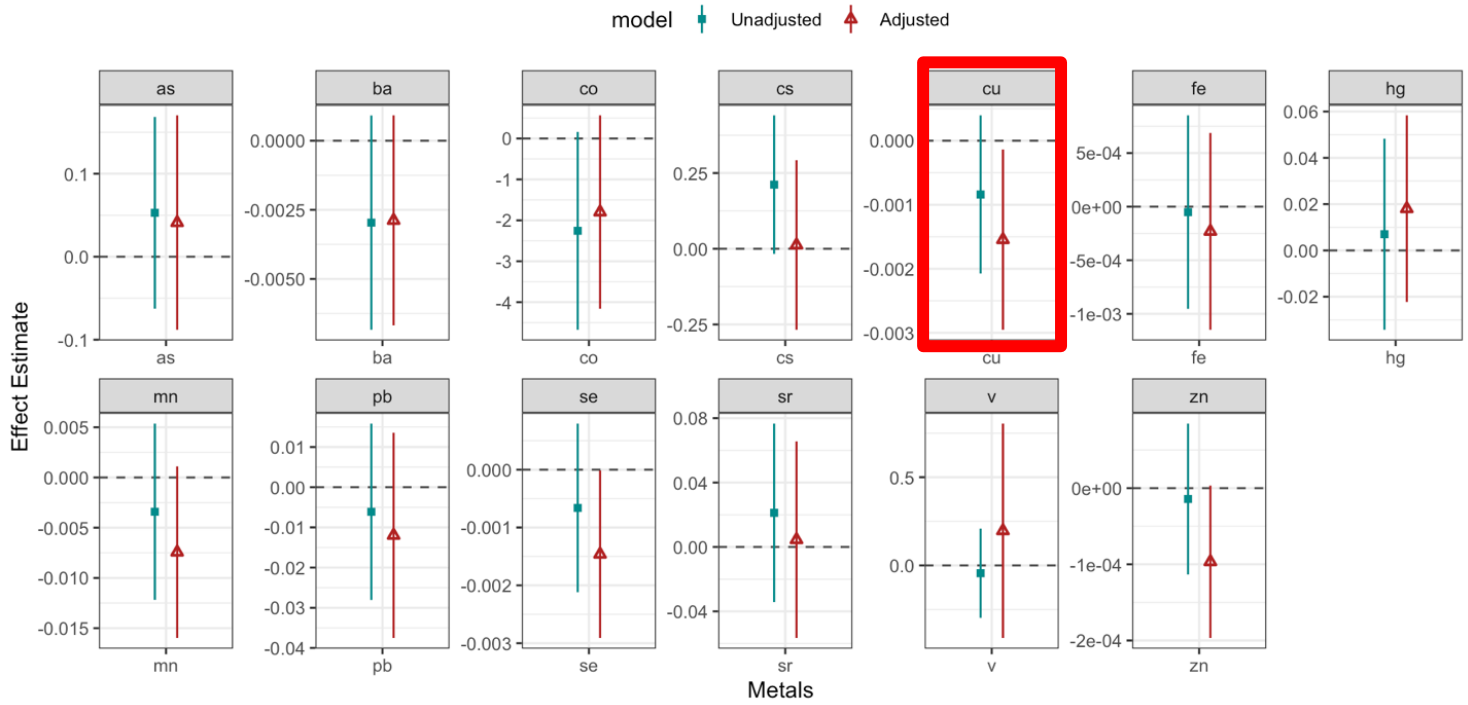


nDNA primer 95.40516

Results

Figure 1: Forest plots for Cellular mtDNAcn and Metals as change in mtDNA per 1ug/L increase in metals

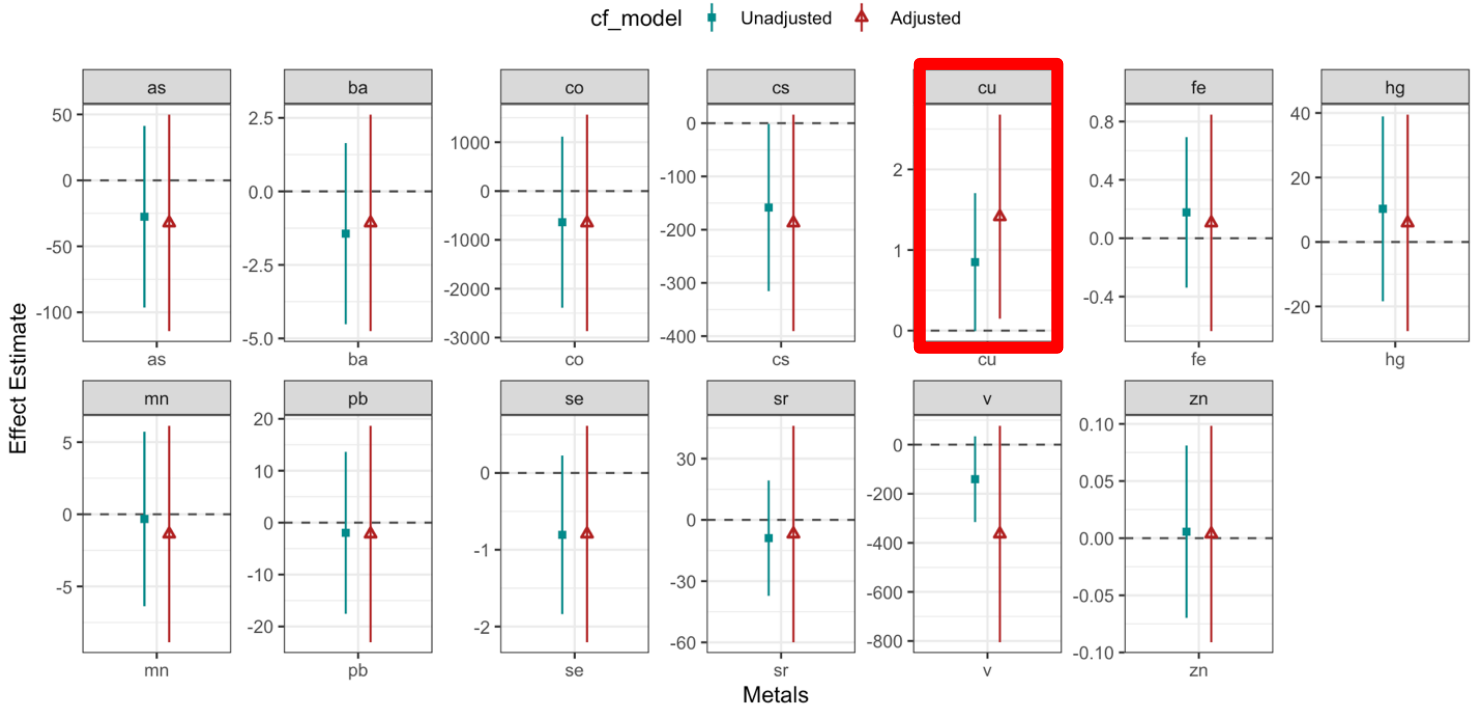
Effect estimate between cellular mtDNAcn and copper: -0.0015 (-0.003, -0.0001), p=0.03



Results

Figure 2: Forest plots for Cell-Free mtDNAcn and Metals as change in mtDNA per 1ug/L increase in metals

Effect estimate between cell-free mtDNAcn and copper: 1.41 (0.15, 2.68), p=0.03



Conclusions

Copper levels were significantly negatively associated with a reduction in cellular mtDNAcn and positively associated with cf-mtDNA.

Copper is an essential metal for child development, suggesting a complex relationship between prenatal copper and mitochondrial health.

No associations between mtDNA biomarkers and other metals were observed.

Acknowledgements

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PrIMER Trainees

My parents and sisters

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