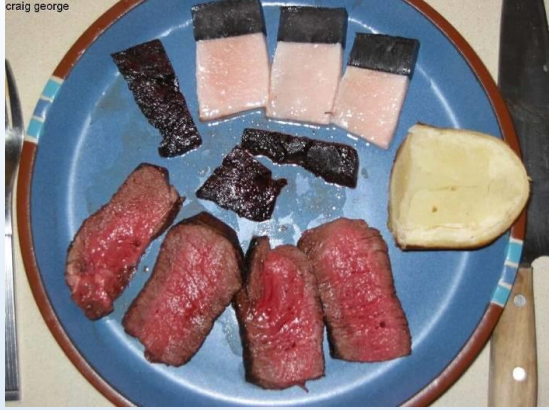


Mercury & Food Web

Todd O'Hara on behalf of

RAMP, WTL and METAL

UAF DEPARTMENT OF VETERINARY MEDICINE

UNIVERSITY OF ALASKA FAIRBANKS

Major Programs/Labs Represented

- RAMP = Rural Alaska Monitoring Program (previous talk)
- WTL = Wildlife Toxicology Laboratory (PI, O'Hara)
- METAL = Marine Ecotoxicology and Trophic Assessment Laboratory (PI, Rea)

Overlying Theme For Our Team

HEALTHY ANIMALS

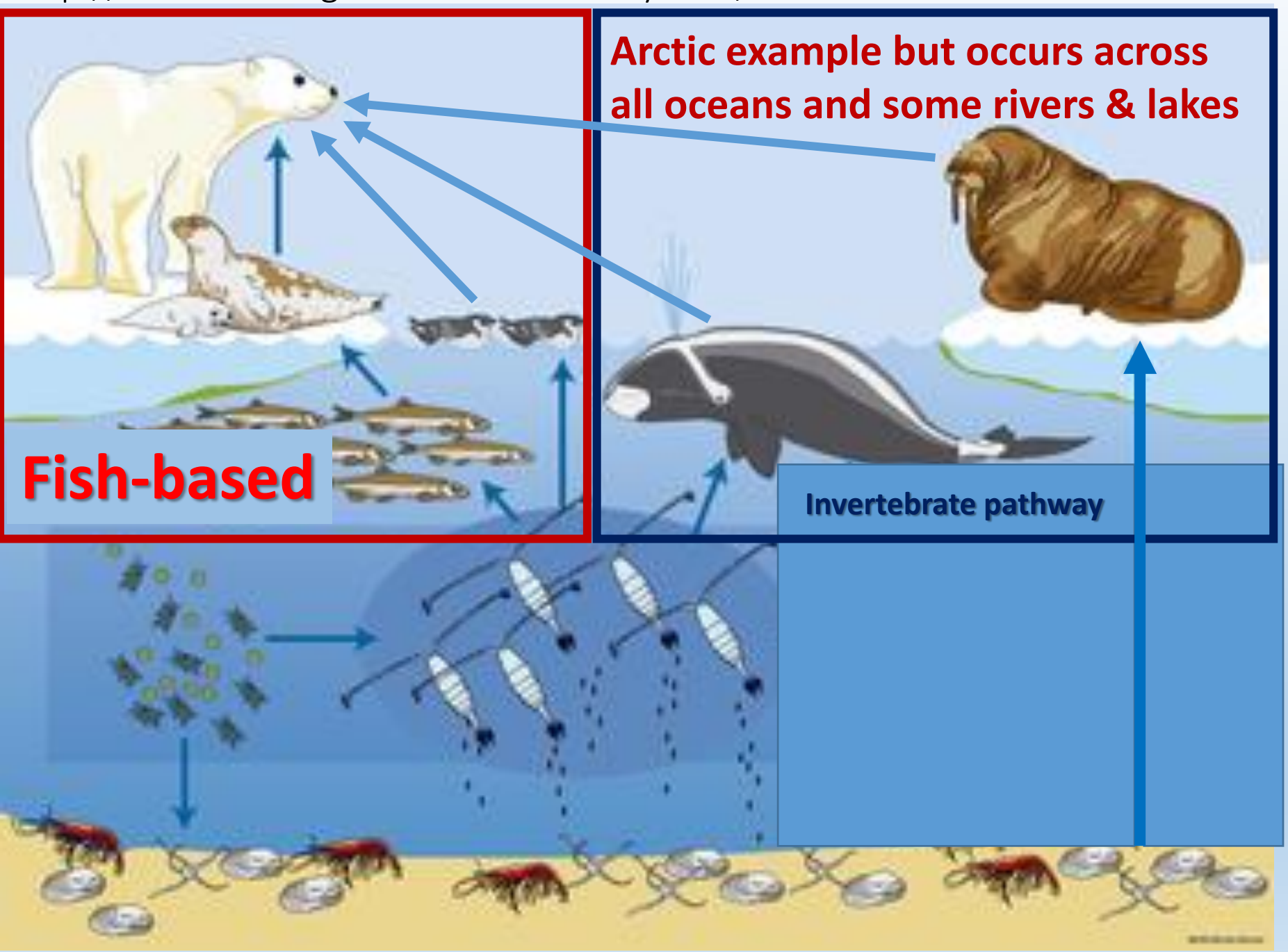
↓

HEALTHY FOODS

↓

HEALTHY PEOPLE & COMMUNITIES

http://climatechangeinthearctic.weebly.com/the-food-web.html



<u>Fish-based</u> pathway known to transport *mercury*, <u>Vitamin D</u>, etc.

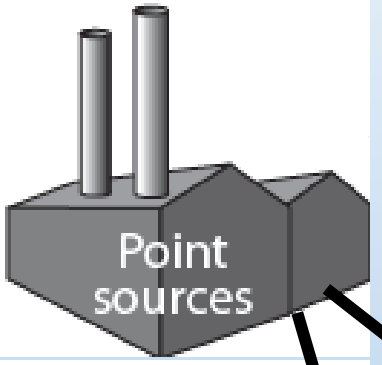
Invertebrate pathway *less mercury* but more cadmium, lots of nutrients.

Bottom line is *feeding ecology matters*!!

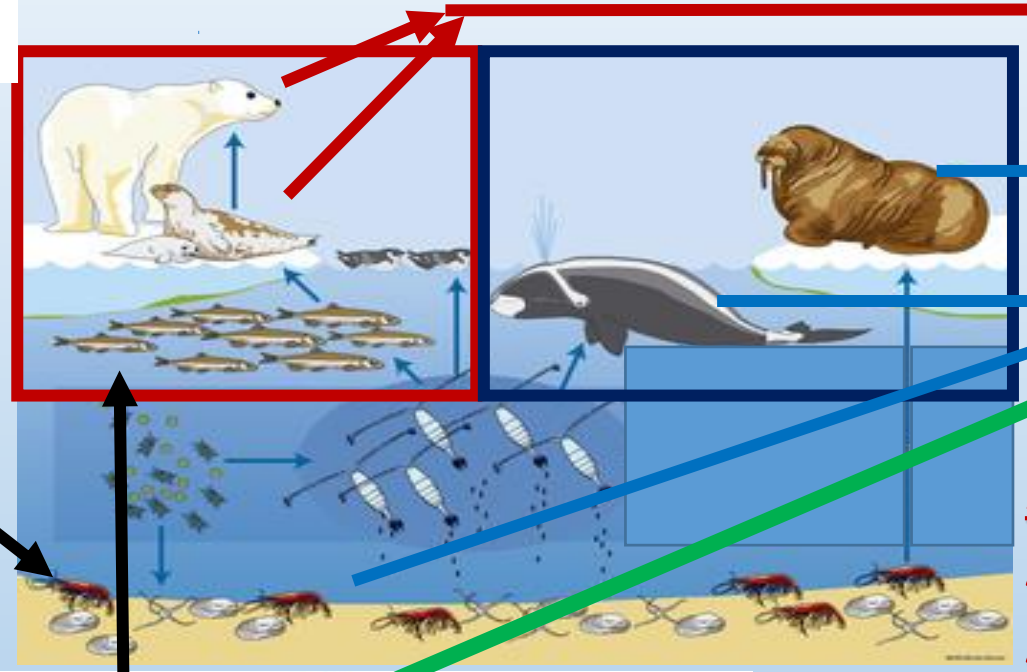
One Health: follow the contaminants (nutrient paths)

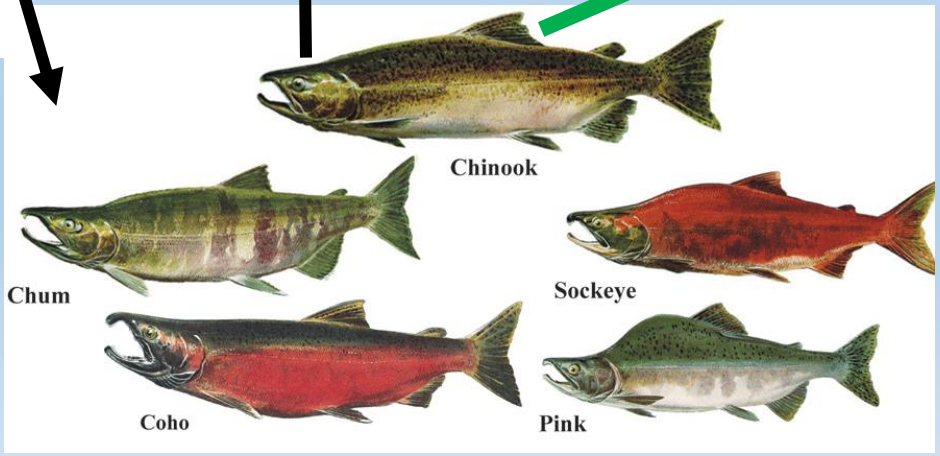
One Health Outcomes on Ecological Scale

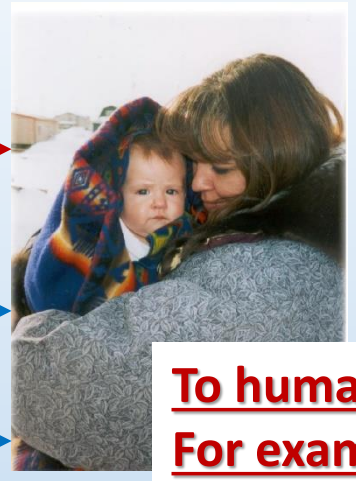
Starts with humans



Transport via
- Air
- Water
- Biota







To humans.
For example Vit. D!!!

Marine Mammals & People!

Additional source of exposure for Alaskans

Some species amplify concs.

Important nutrients

Sociocultural value

Iconic

Sentinel species (canary in the mine)

RAMP: Sample matrices

1) Mosquito monitoring

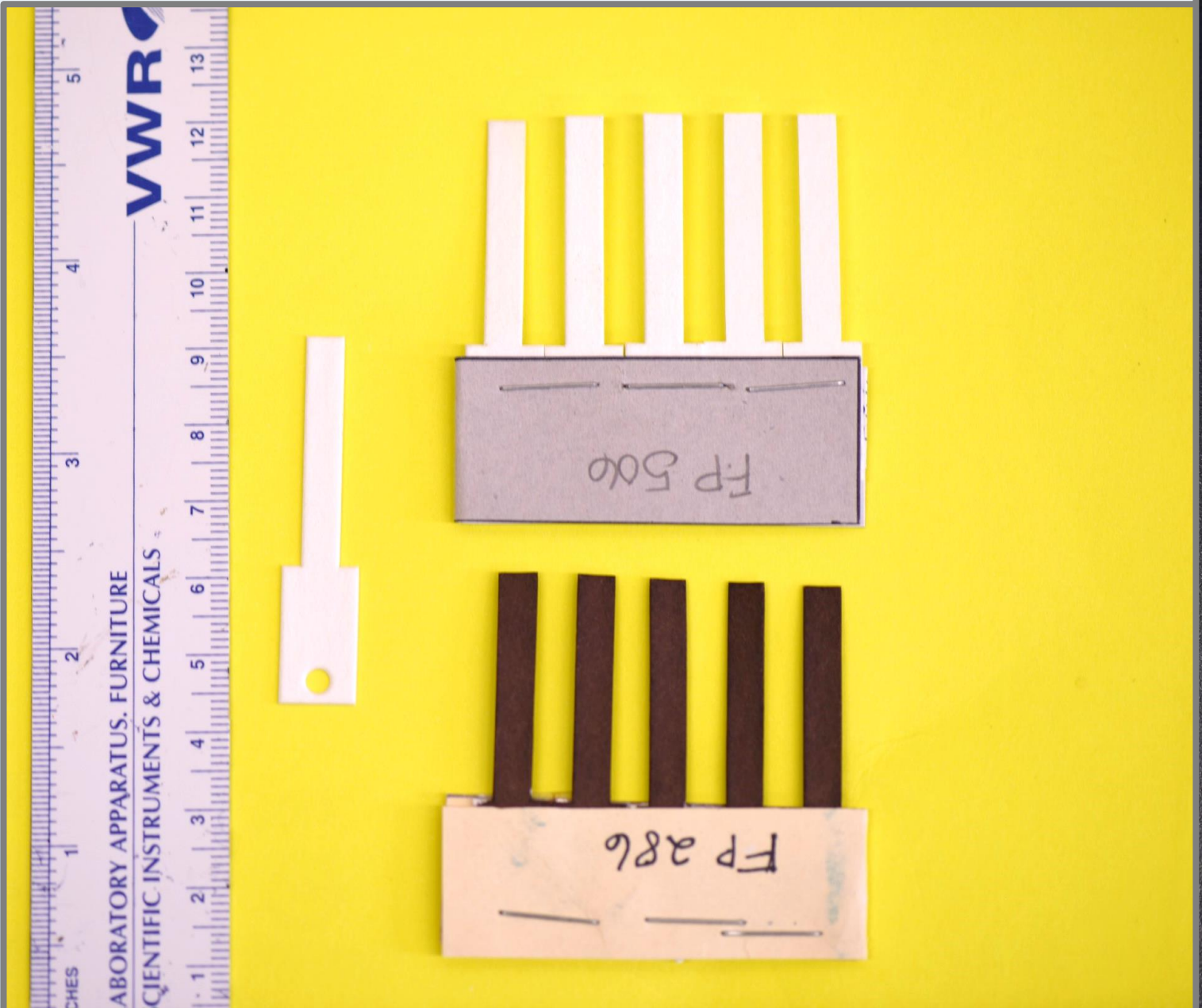
2)Blood soaked filter paper:

A) **Understanding mercury (Hg), selenium (Se), etc.**

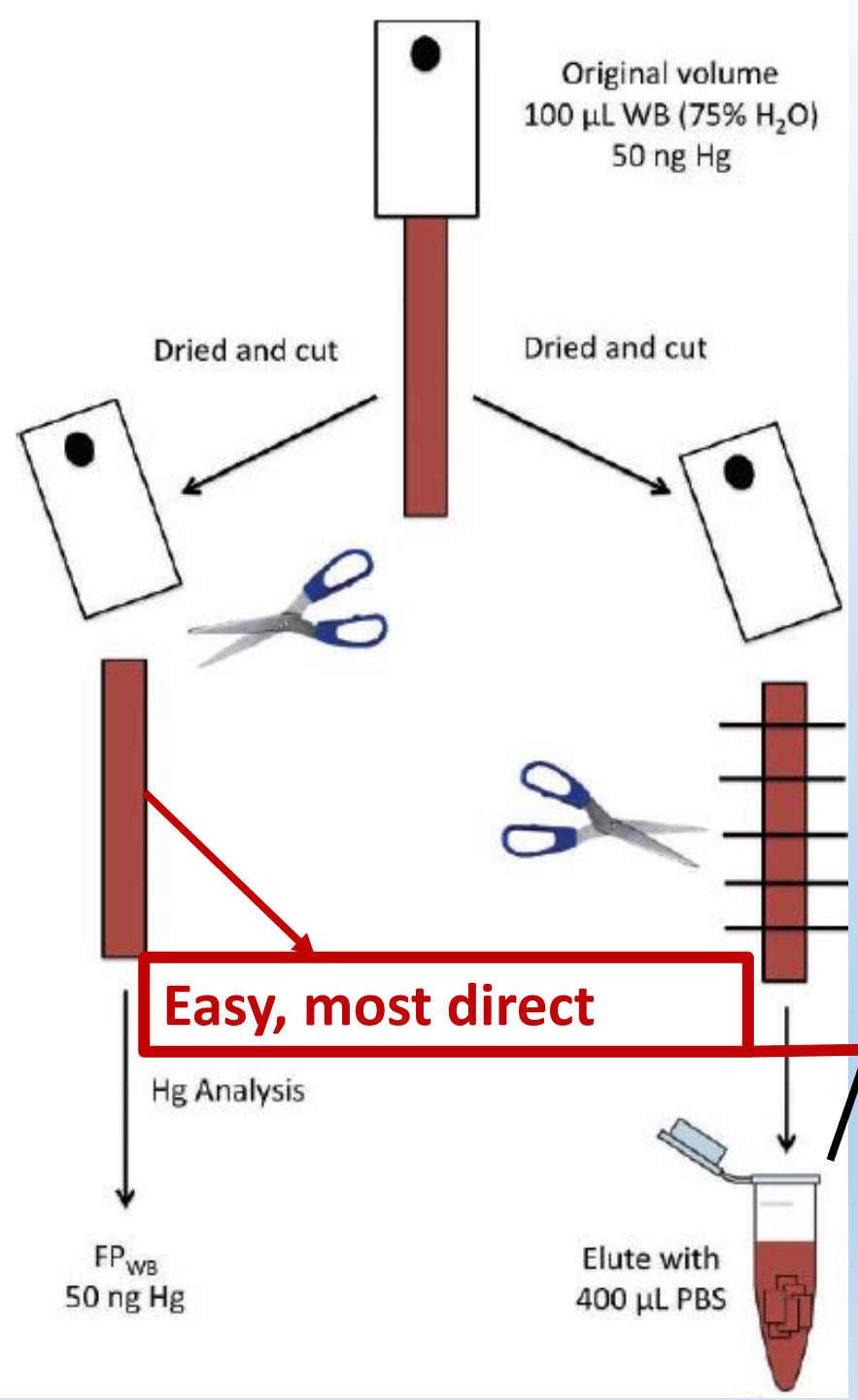
B) Serology (detect serum antibodies from host to disease agents of interest, not discussed here)

3) Feces for zoonotic parasites (intestinal tracts of trapped animals too)

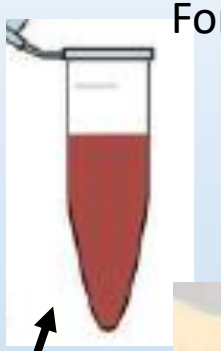
Filter paper and blood!?

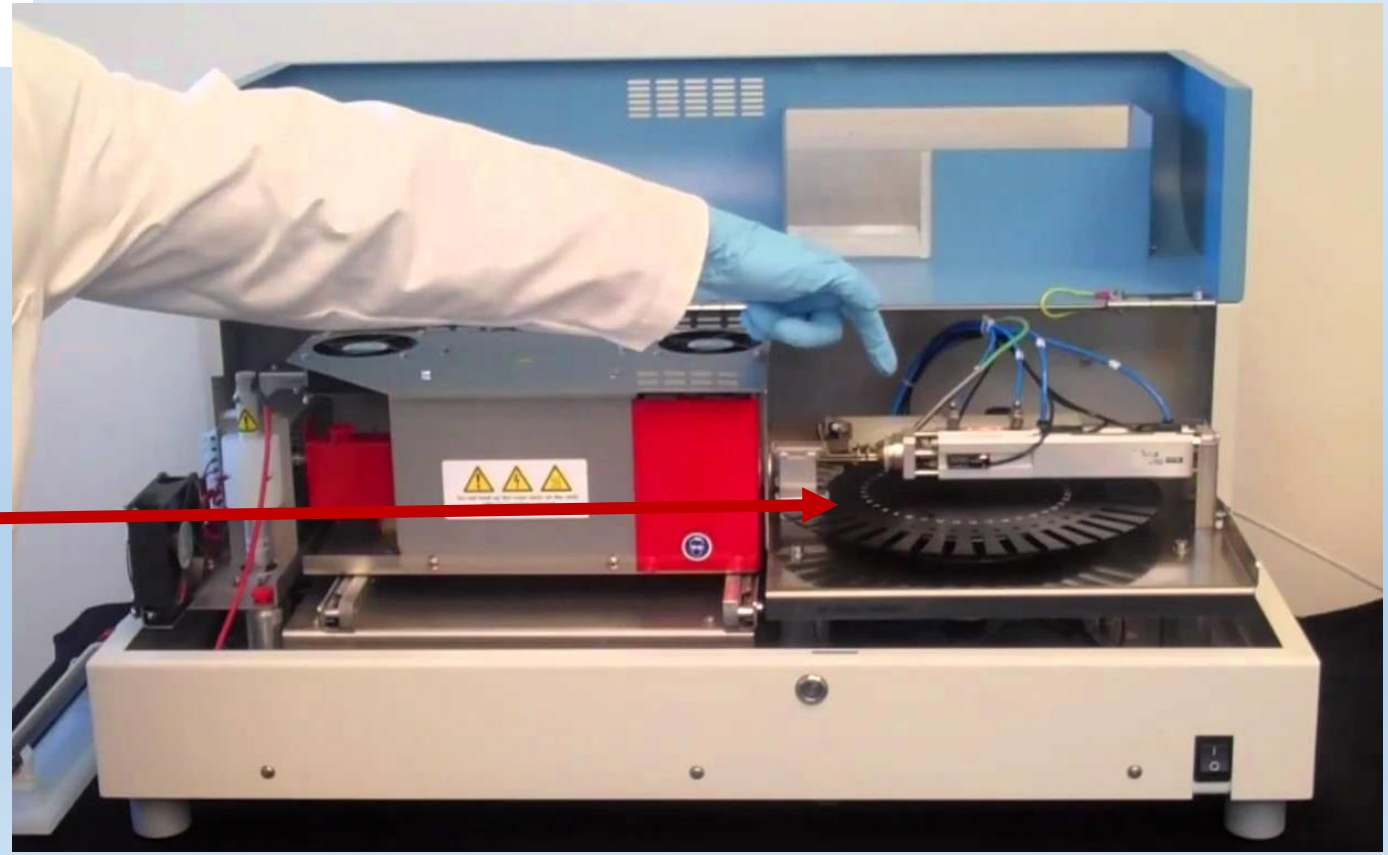


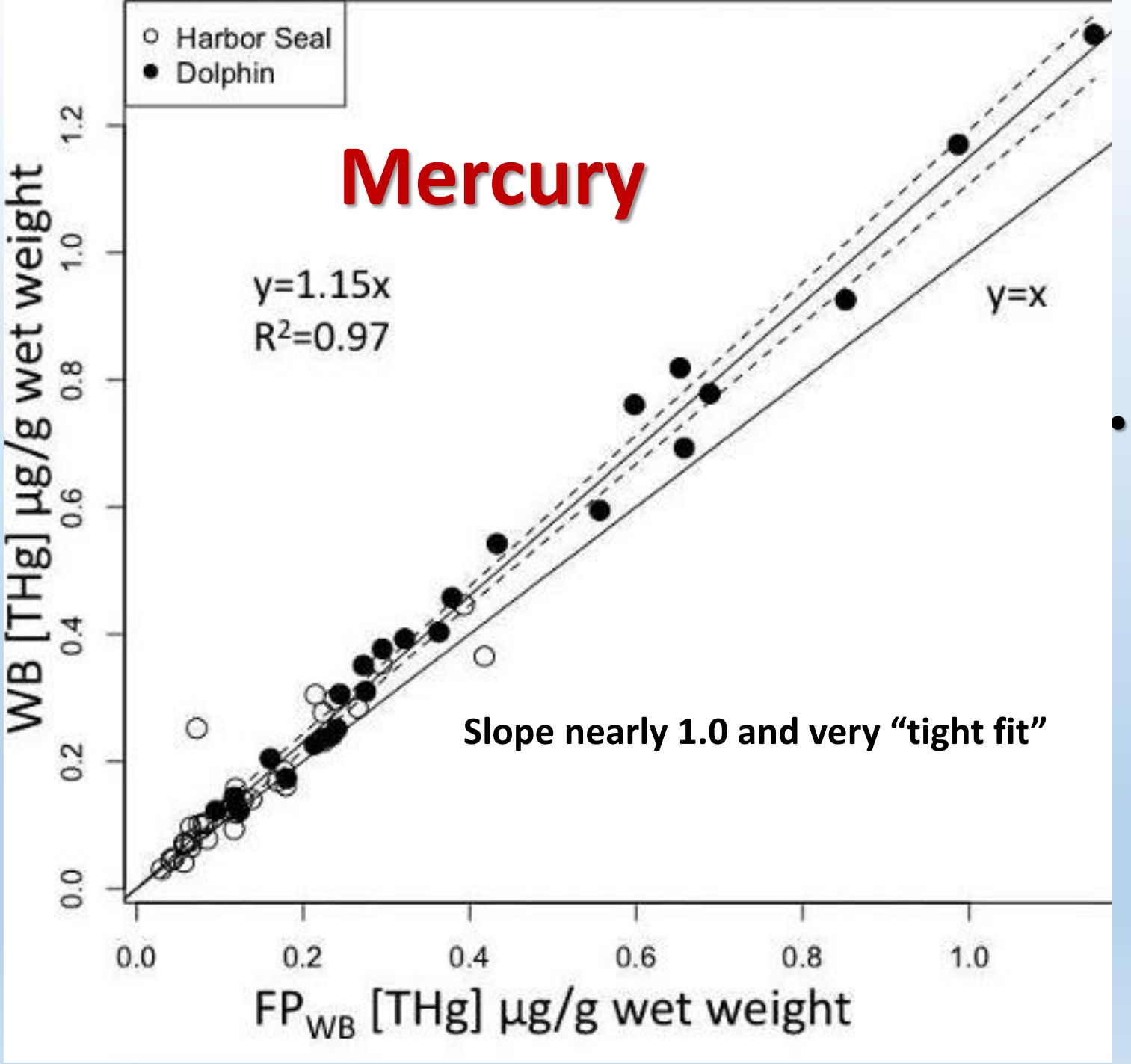
Specific Use for *Hg analyses*



For other analyses







- **Blood soaked filter paper from bottlenose dolphins and harbor seals**

Use of cellulose filter paper to quantify whole-blood mercury in two marine mammals: Validation study 2014. Hansen et al., **Journal of Wildlife Diseases 50(2): 271-278**

Analytes measured in conjunction with THg

- **Stable isotope ratios of Carbon ($\delta^{13}C$) and Nitrogen ($\delta^{15}N$)**

  Feeding ecology

  $\delta^{13}C$ – differences in foraging regions, migration…

  $\delta^{15}N$ – trophic level….

- **Selenium**

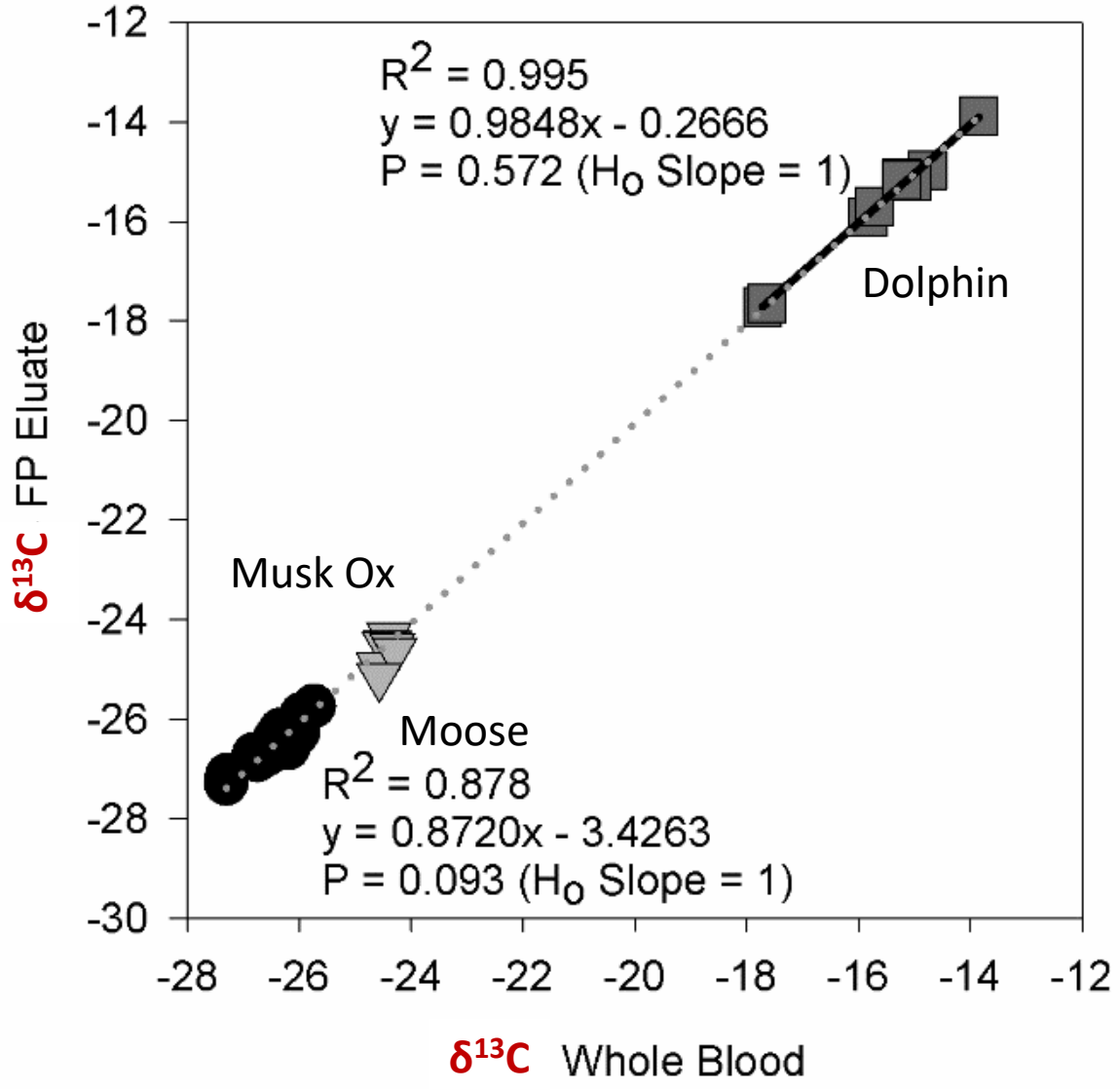
  Binds Hg

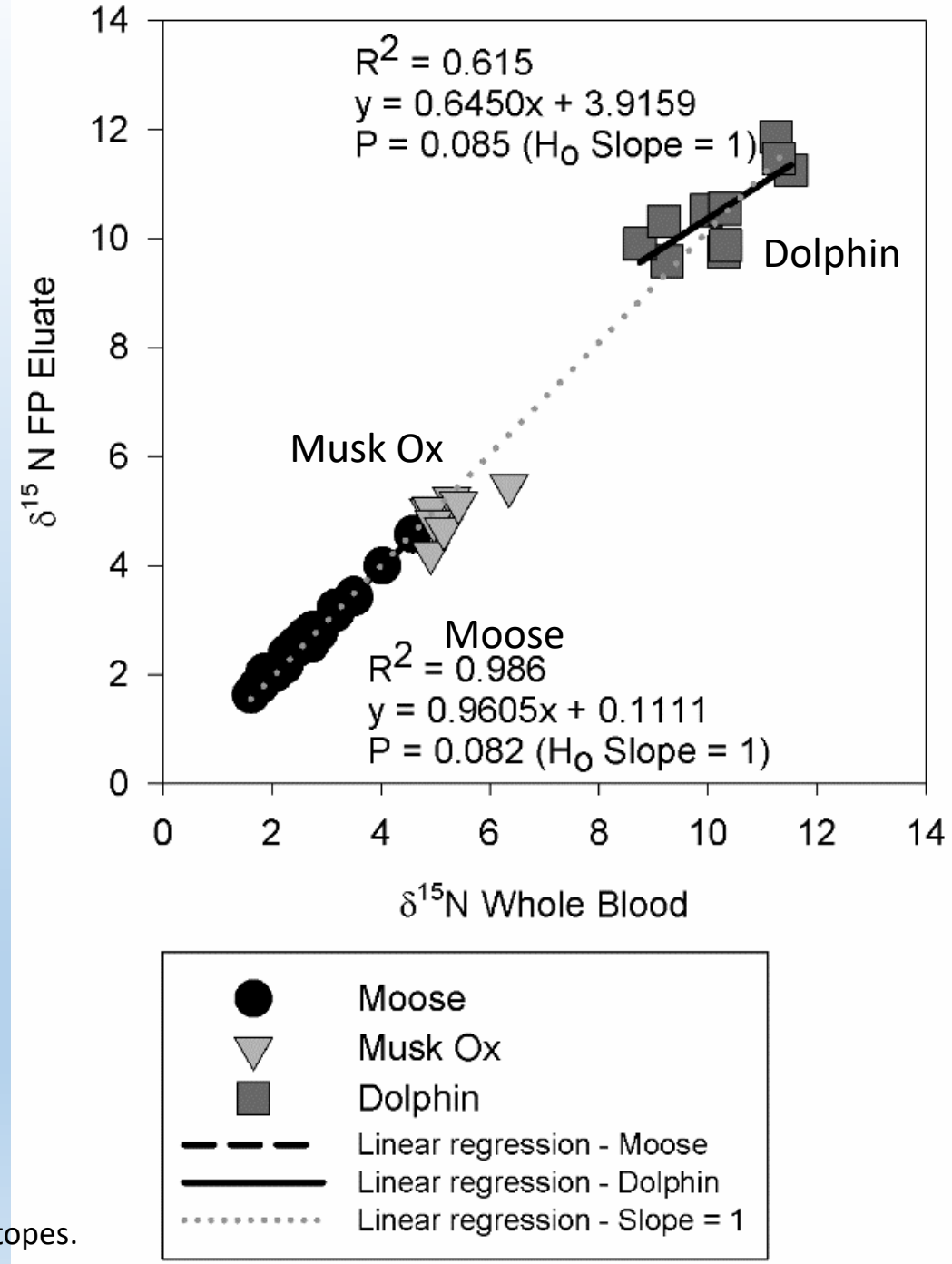
  Involved in demethylation of methylmercury

  Protective antioxidant (essential element)

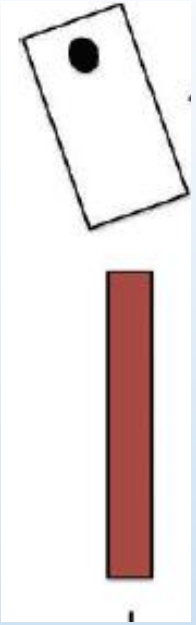
  Assess Se:Hg molar ratio

Validation of Whole Blood and FP Values for $\delta^{13}C$ and $\delta^{15}N$





O'Hara et al. 2018. Use of Blood Soaked Cellulose Filter Paper for Measuring C and N Stable Isotopes.



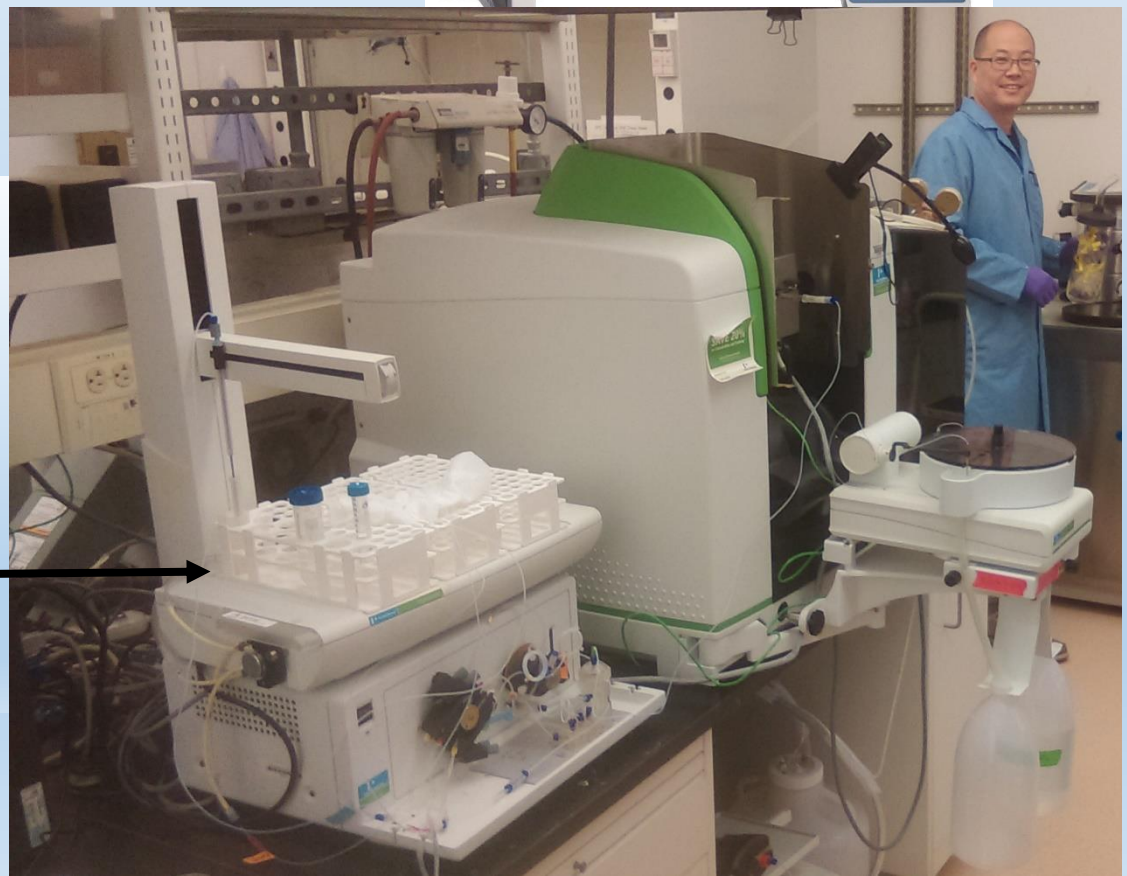
Specific Use for *Selenium*

WB samples analyzed along w/ matched FP samples.

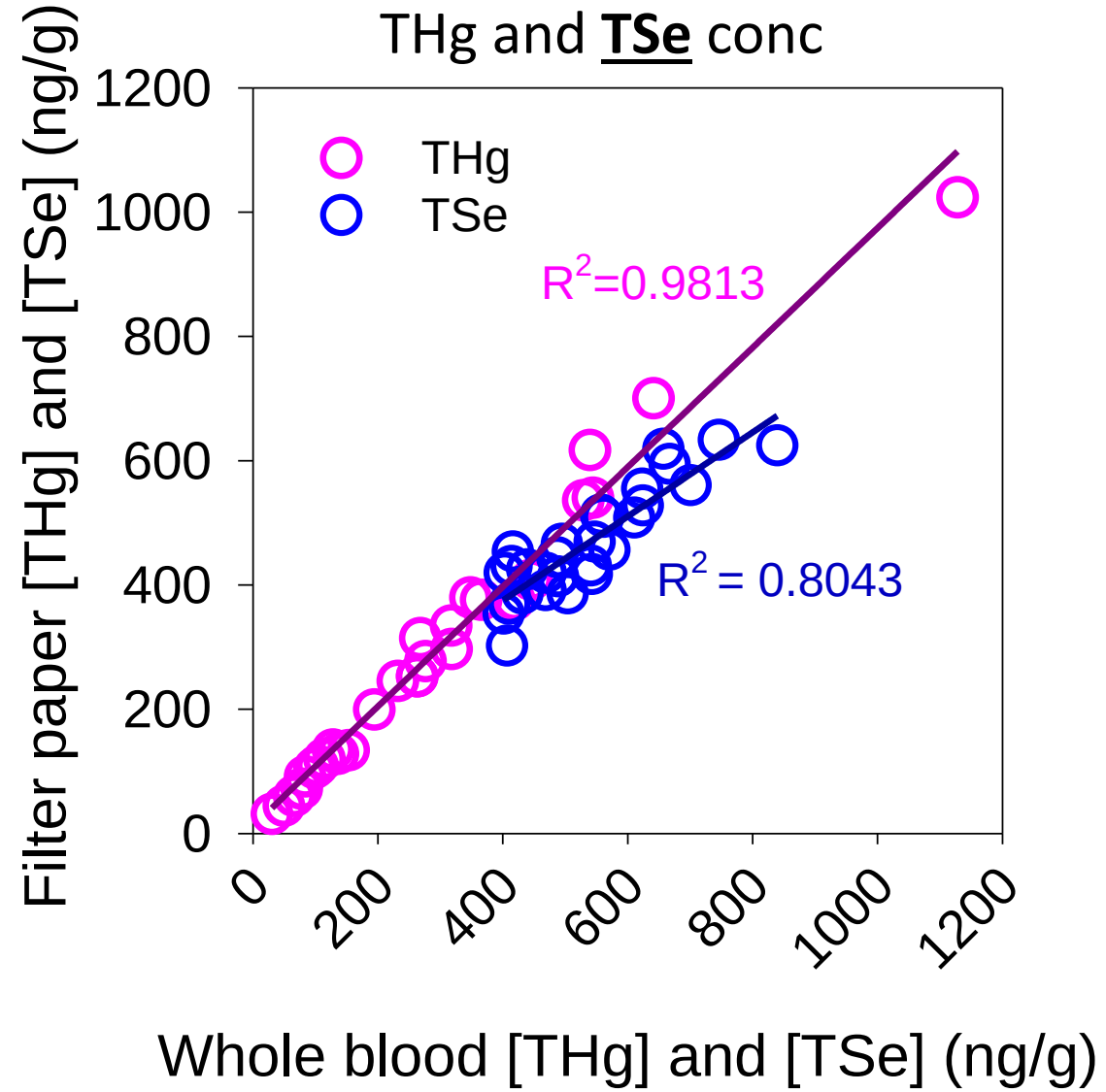
Samples digested in 4:1 nitric acid hydrogen peroxide solution at high temperatures (175°C). Microwave

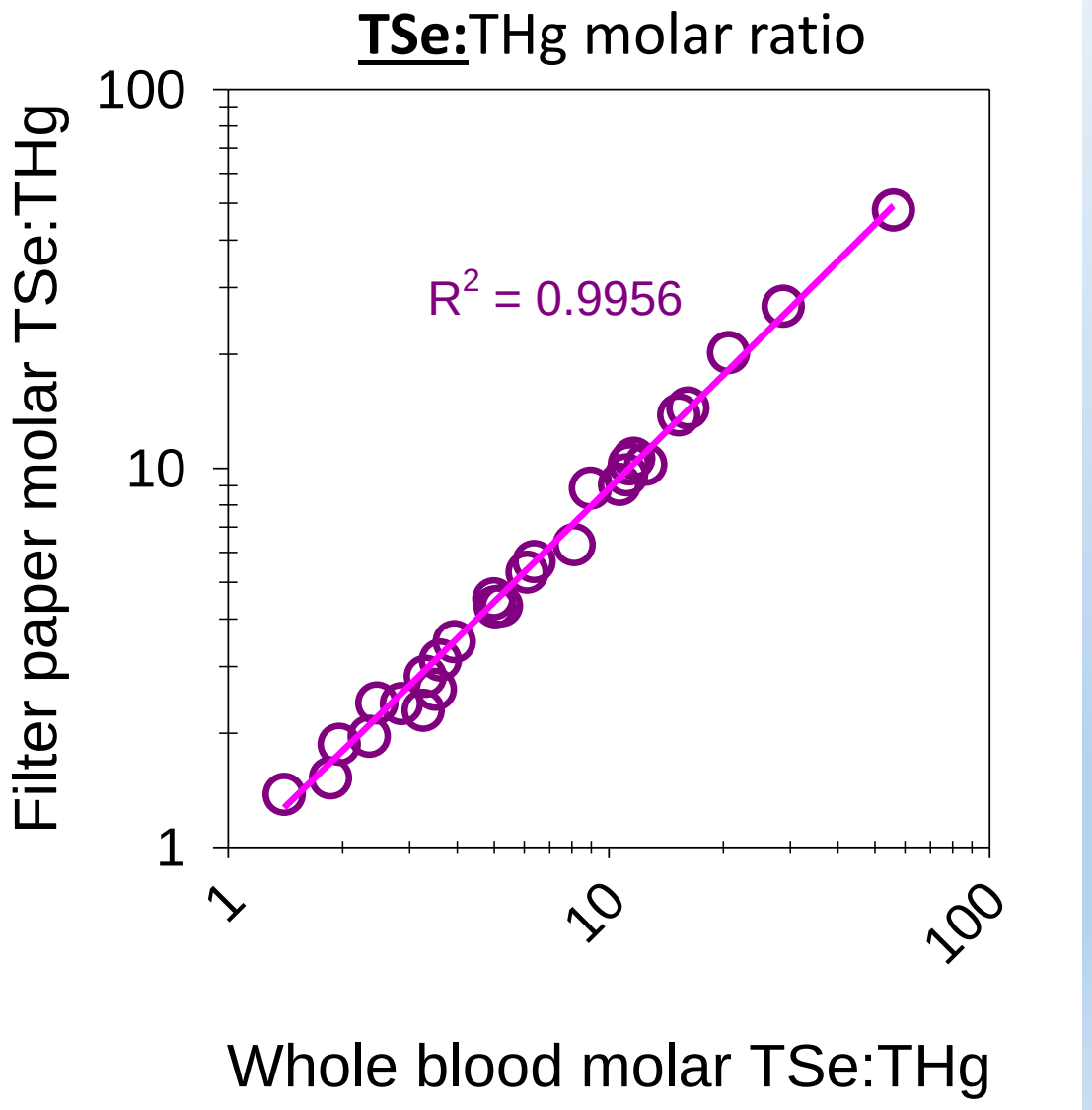
Treat with HCl at high temperature (95°C) to aid the reduction of the Se to a single ionic state.

Samples reduced in continuous flow injection mercury/hydride system (FIAS) and analyzed with an atomic absorbance spectrometer (AA). Or ICP-MS



Comparison of WB and FP [TSe] and TSe:THg molar ratio in harbor seal pups





Summary (chemistry)

Ability to reliably measure [THg], [TSe], $\delta^{13}C$ and $\delta^{15}N$ using blood soaked filter papers, broadens the scope of this sampling tool to address questions of ecotoxicology, including potential protective/adverse effects (TSe) and pathways of exposure ($\delta^{13}C$ and $\delta^{15}N$).

Prediction criteria for R^2 values (from *O'Hara et al. 2008*), Weak: R^2 0.36-0.55, Moderate: R^2 0.56-0.75, **Strong: $R^2 > 0.75$**

Acknowledgements

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- Frances Gulland, Randall Wells and George Aguiar

Thank You!!!