




UNIVERSITY OF SASKATCHEWAN

Western College of
Veterinary Medicine

DEPARTMENT OF VETERINARY BIOMEDICAL SCIENCES
USASK.CA/WCVM



**NSERC
CRSNG**

A photograph of a brown grizzly bear standing in a grassy field with purple wildflowers. The bear is looking towards the camera and has a small orange tag on its left ear. The background shows a dense forest of green trees.

Grizzly-PAW: Grizzly Population Assessment in yellowWhead: Integrated Approaches Toward Conserving Grizzly Bears On A Human-Dominated Landscape Of Western Alberta

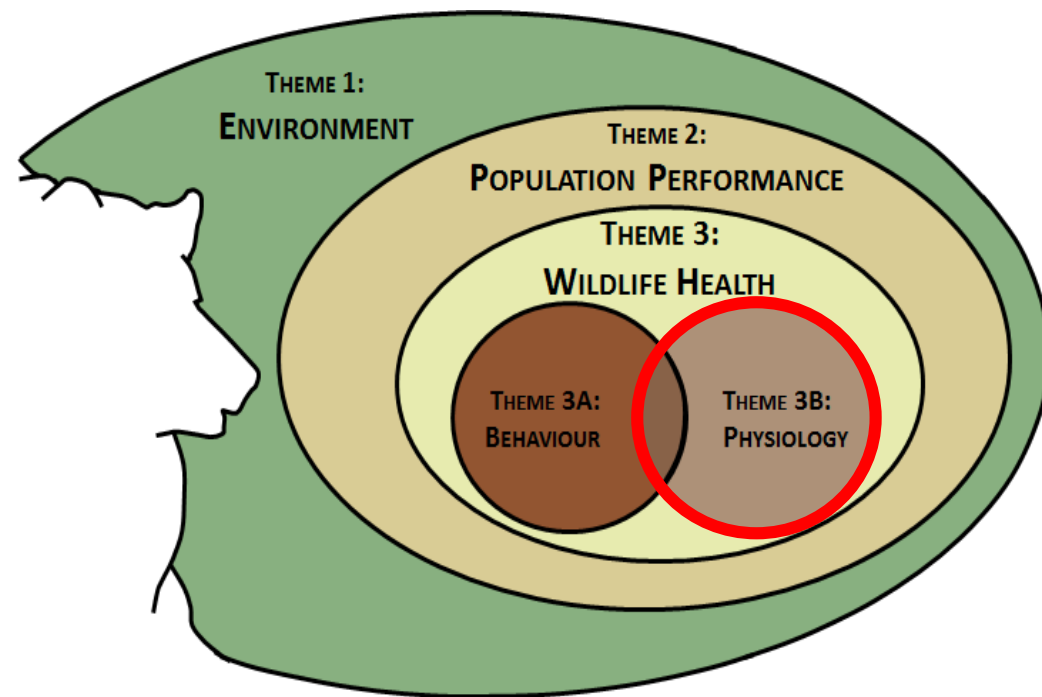
Third Annual General Meeting

Abbey Wilson and David Janz

4. Have changing landscape conditions associated with anthropogenic natural resource extraction activities resulted in changes in habitat selection by, and the health of, grizzly bears within the study area?

Q3A.1, Q3B.1, Q3B.2

We want to determine if resource extraction activities on the landscape affect the health of individual grizzly bears



Molecules to ecosystems: Emerging opportunities in conservation biology



“Conservation physiology”

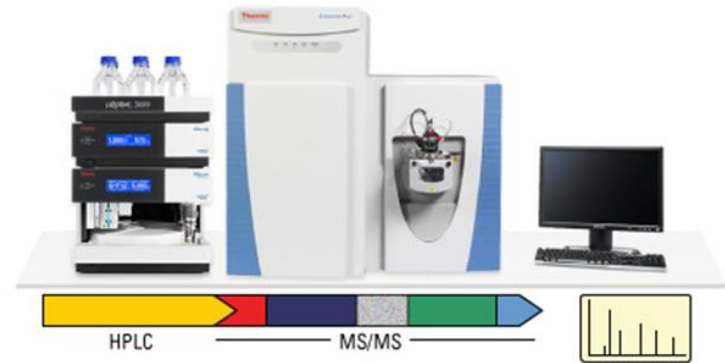
- The application of modern 21st century technologies used in human medicine (for disease diagnosis, biomarker discovery, and drug development) to free-ranging wildlife species
- Such technologies have great potential in developing a mechanistic understanding of the factors controlling distribution and abundance of wild animals in light of rapidly changing environments
- Individual animal fitness → Population dynamics

The modern biological laboratory has evolved dramatically in the past decade

“Omics” technologies
(e.g., RNASeq)



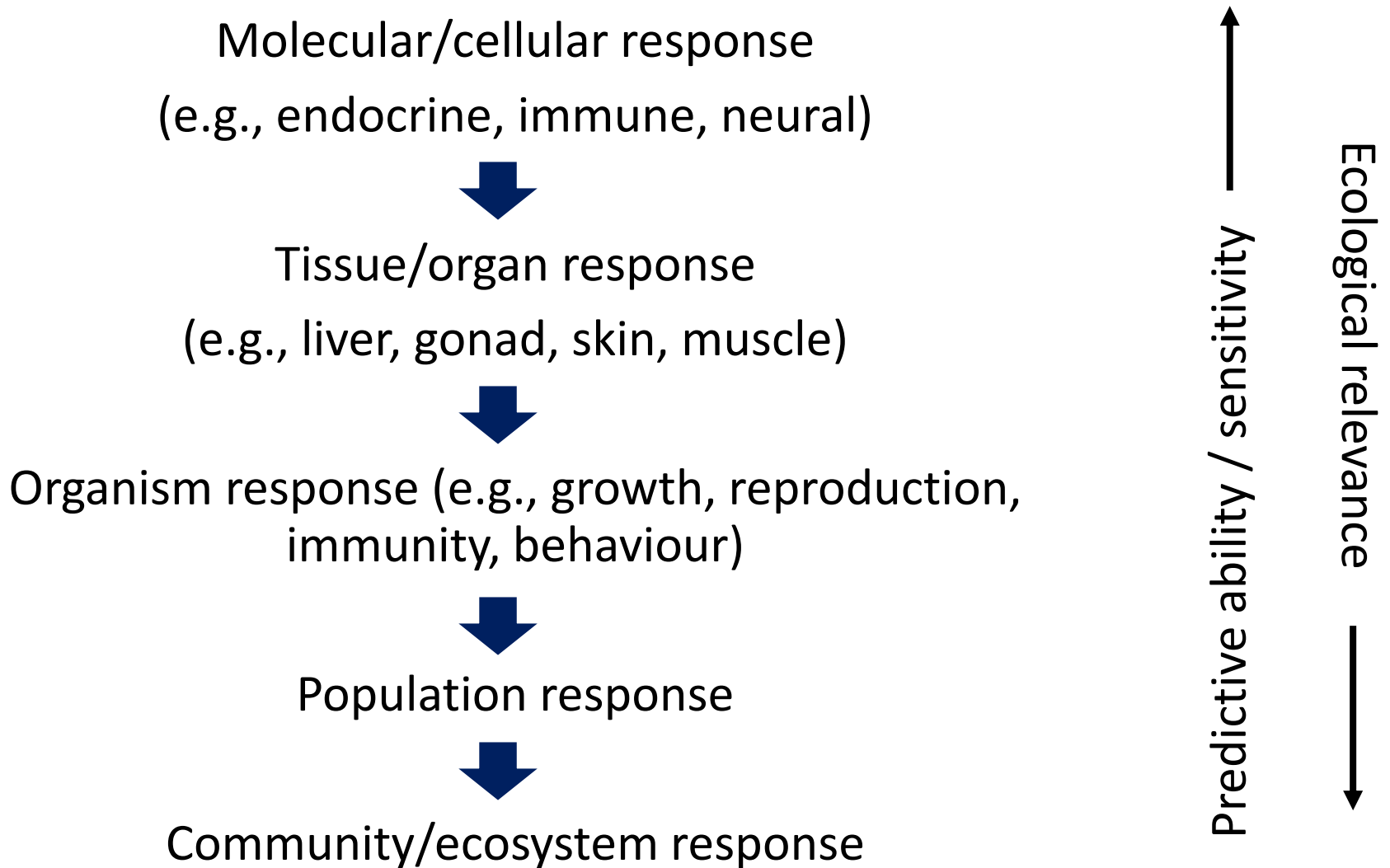
Protein quantification
(e.g., Orbitrap LC-MS/MS)



Adverse outcome pathways (AOPs)

- An approach first developed in ecological toxicology that has potential application to other integrative sciences such as conservation biology
- AOPs serve as a knowledge assembly, interpretation, and communication tool designed to support the translation of pathway-specific mechanistic data into responses relevant to assessing and managing risks of environmental stressors to ecosystem health

Adverse outcome pathways (AOPs)



'Omics

Genome (the “library”; what can happen)



Transcriptome (what appears to be happening)



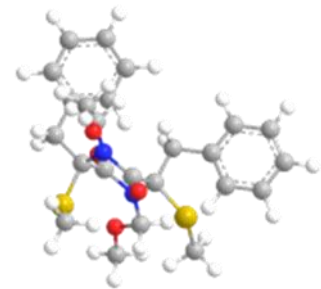
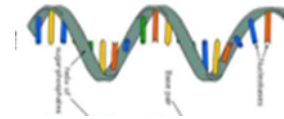
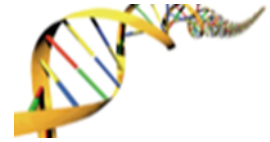
Proteome (what makes it happen)



Metabolome (what actually happens)



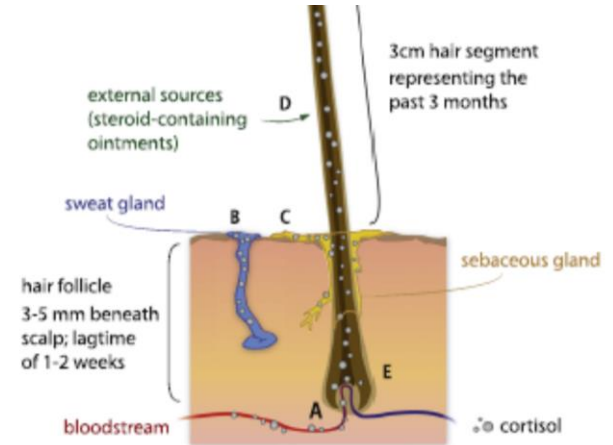
Phenotype (why we care)



Approaches we are using:

Hormone concentrations in hair

- Cortisol (stress hormone)
- Testosterone, progesterone, estradiol (reproductive hormones)



Proteomics in skin biopsies (proteins associated with stress, metabolism, reproduction)



Hair hormones: Potential applications to grizzly bear conservation and management

- Hair cortisol: create “normal ranges” of HCC for each life stage using 95% confidence intervals → individuals exhibiting HCC above range could be considered chronically stressed
- Hair reproductive hormones: predict sex, age class (juvenile vs. adult), and reproductive status (pregnant female, female with offspring, solitary female) in hair samples collected opportunistically (e.g., barbwire, tree rubs, dens)
- **Overall, use hormone concentrations in hair as tools to augment existing grizzly bear monitoring programmes**



Proteomics: Potential applications to grizzly bear conservation and management

- Protein expression profiles can potentially be used to identify individuals with altered physiology or disease:

Stress proteins → physiological stress, oxidative stress

Metabolic proteins → energy homeostasis, nutritional landscape

Reproductive proteins → pregnancy, lactation

- **Allostatic load approach:** cumulative protein expression in bears can potentially be used to develop indices of “overall biological dysregulation”, developed in human medicine to predict disease risk and longevity



Conclusions

- Similar to their use in human medicine, modern analytical techniques can be applied to wildlife species and provide sensitive biomarkers of pathology, disease, and other physiological impairments
- However, such biomarkers must be phenotypically “anchored” to apical responses at the individual animal level
- When properly validated in the lab and field, these techniques can be useful tools to help predict biological dysfunction in individual animals before population-level impacts occur
- Technology is rapidly changing, and the next decade will produce even greater technological advances that can be applied to wildlife



Conclusions

- Interdisciplinary research on Alberta grizzly bears provides an excellent opportunity to test hypotheses that attempt to relate landscape change → individual animal stress/health → population dynamics
- **Noninvasive approaches to determine individual animal health may provide useful tools to assist in the conservation of grizzly bears and other species at risk**



Thank you for attending!



Teck

