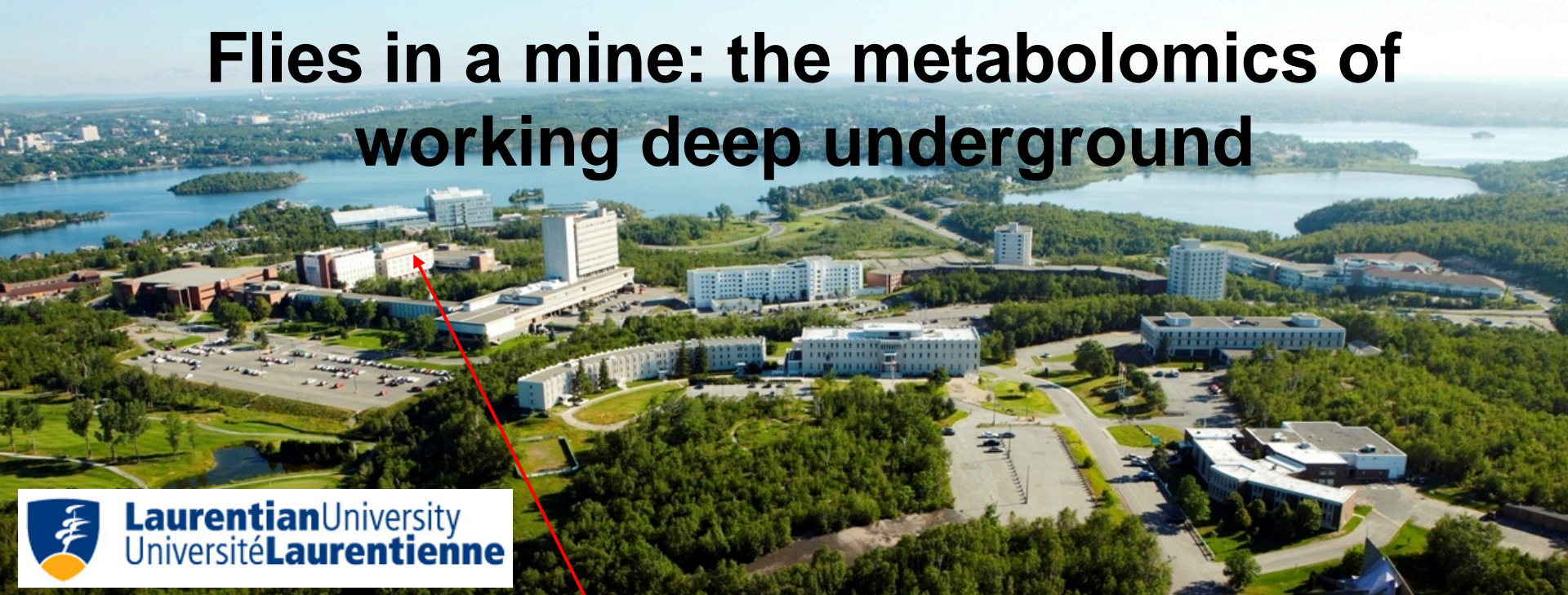
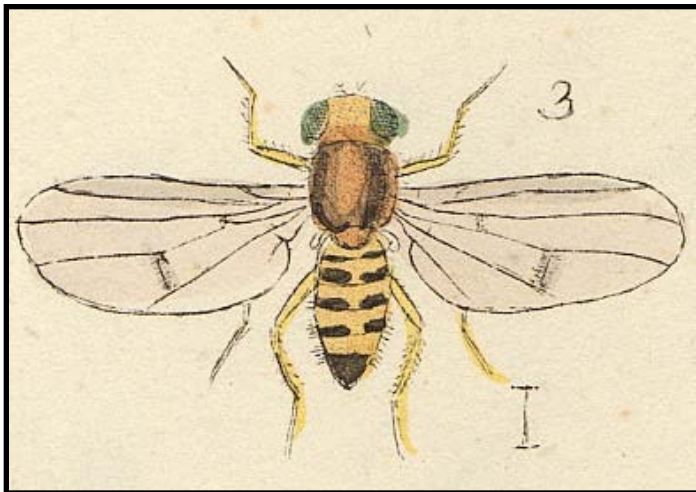


# Flies in a mine: the metabolomics of working deep underground



Flies



**Thomas Merritt, PhD**  
**Department of Chemistry and**  
**Biochemistry**  
**Laurentian University**

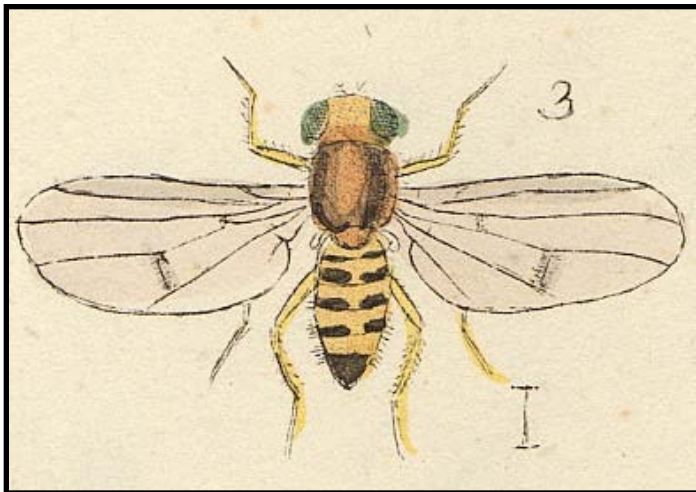


# Flies in a mine: the metabolomics of working deep underground

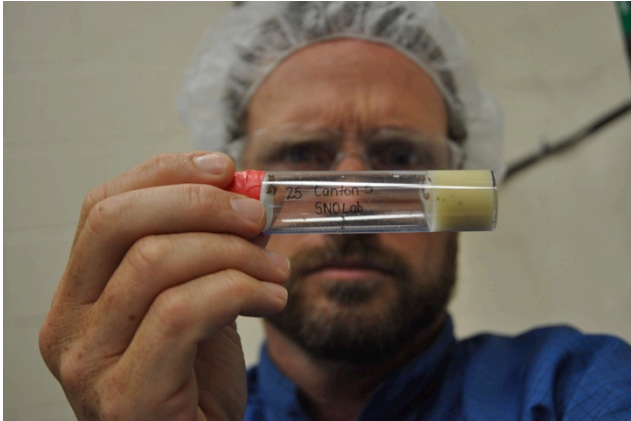


 Laurentian University  
Université Laurentienne

Flies



# Fruit Flies and SNOLAB



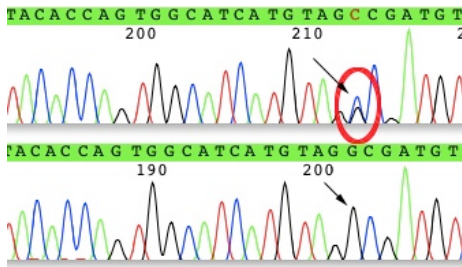
**A single day in SNOLAB substantially alters metabolism**

**10% of metabolites respond to exposure**

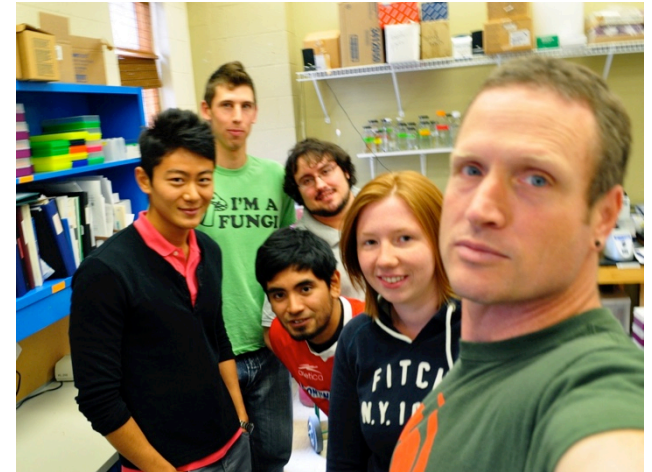


# Genetic Variation and Biological Complexity

## Genotype

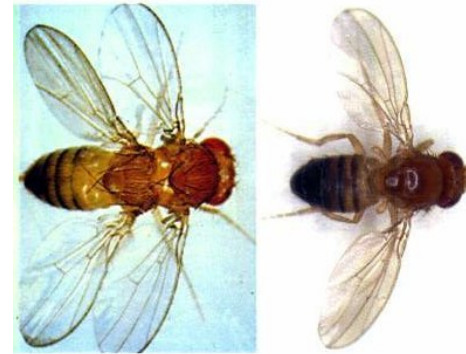


## Phenotype



**There are 6 million genetic differences between any two individuals – which drive biological differences?**

# Fruit flies as a model



*Drosophila melanogaster*



# Humans and Flies

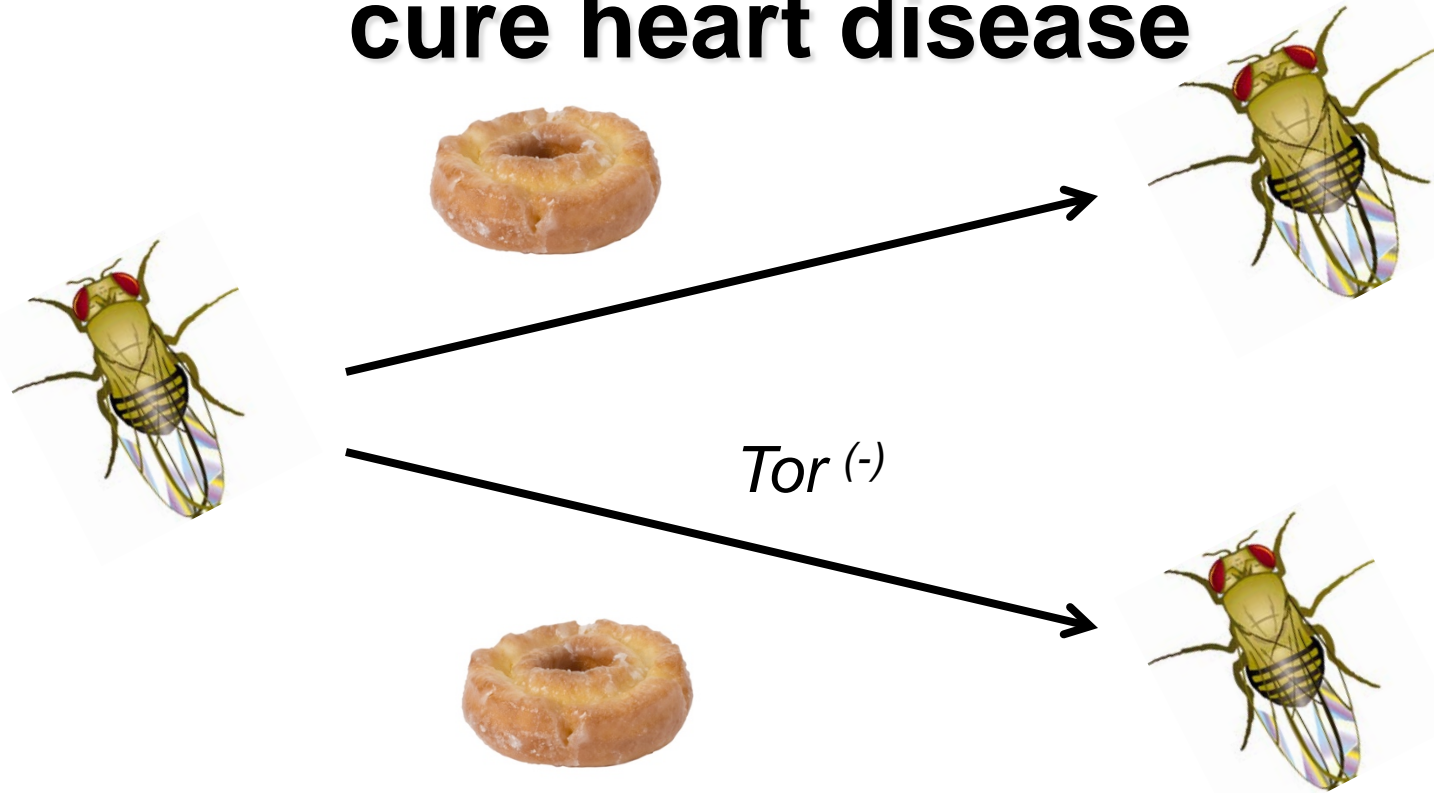


**20k vs 15k genes**

**60 to 80% of  
human disease  
genes are found in  
flies**



# ***D. Melanogaster* may cure heart disease**



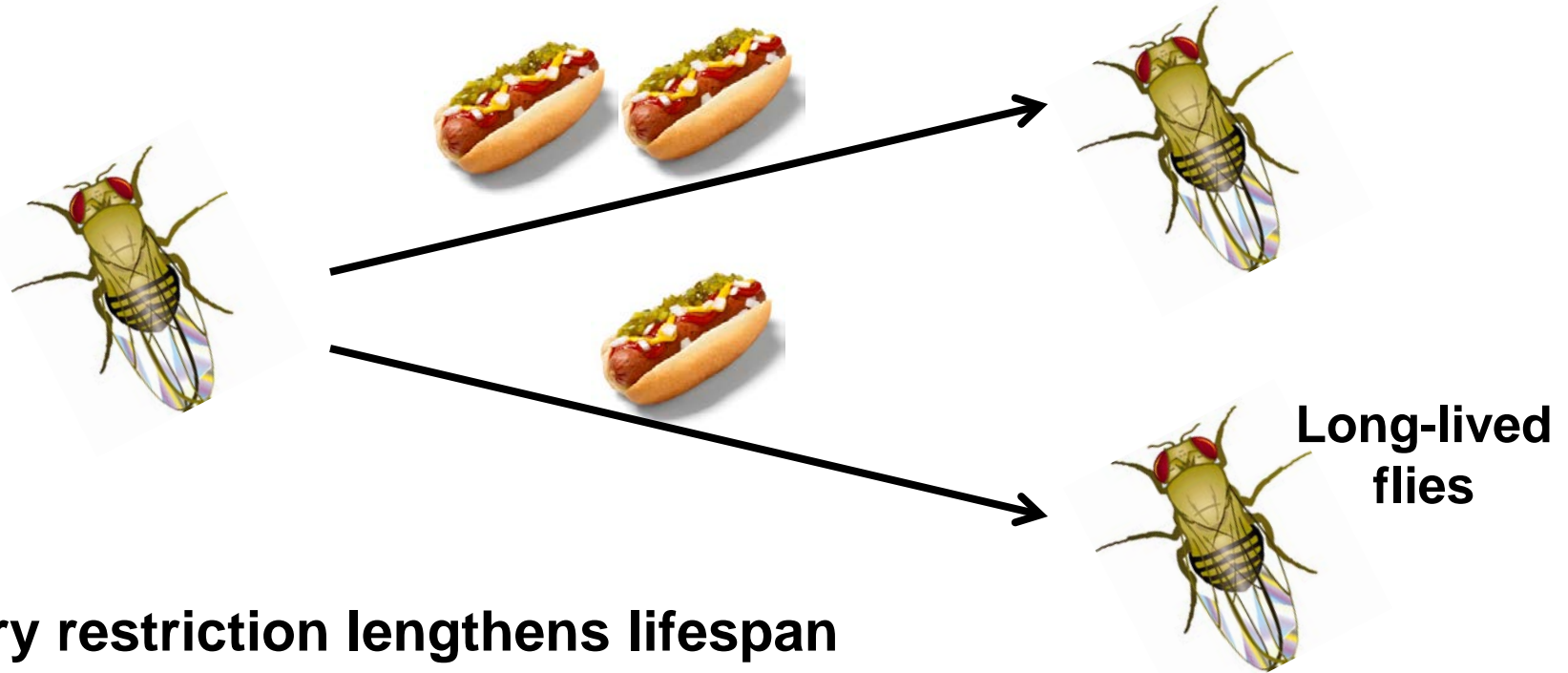
**Globally, 400 million people are obese**

**Feed flies donuts and you get fat flies with heart disease**

**Feed *Tor* (-) flies donuts and you get happy flies**



# Diet alters lifespan



**Dietary restriction lengthens lifespan**

**High protein diet shortens it**

**So does late-night eating**



# Flies in SNOLAB



**What is effect of working under pressure?**

**Quantify broad metabolic effect – the metabolome**

# Broad-Based Metabolomics

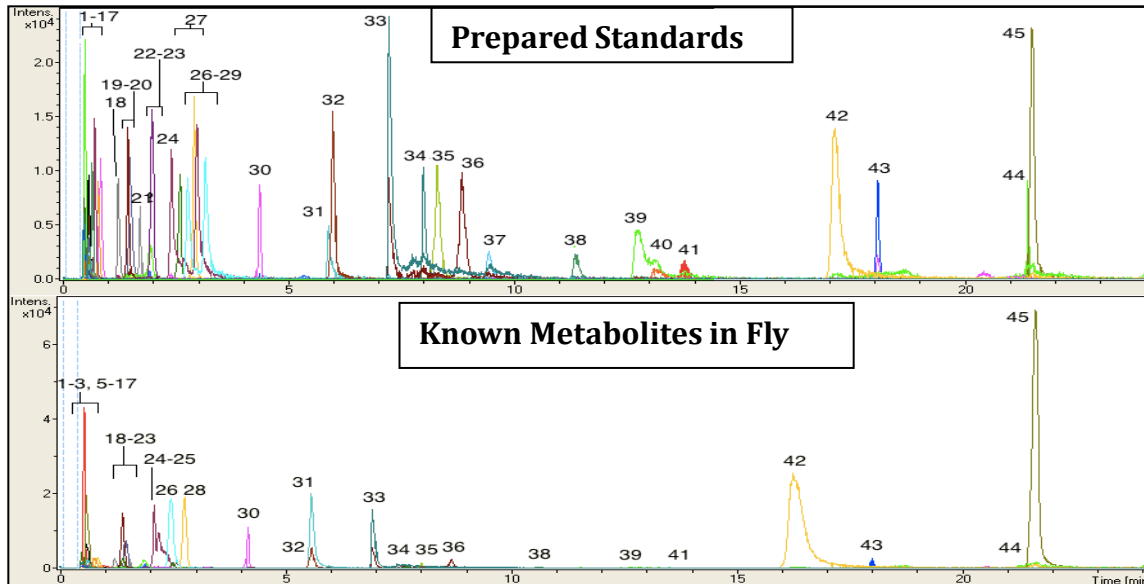


Liquid chromatography / mass spectrometry based metabolomics

LC separates complex biological sample into individual metabolites

Mass spec identifies metabolites based on extremely accurate molecular weight

No, its not that easy



45 known metabolites as standards and in fly homogenate

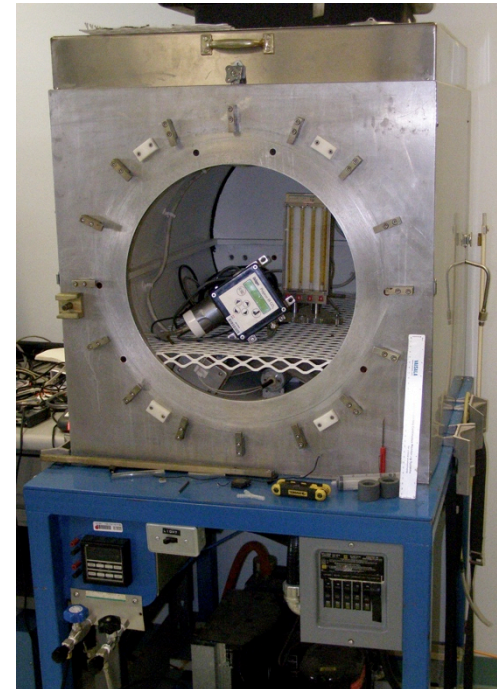
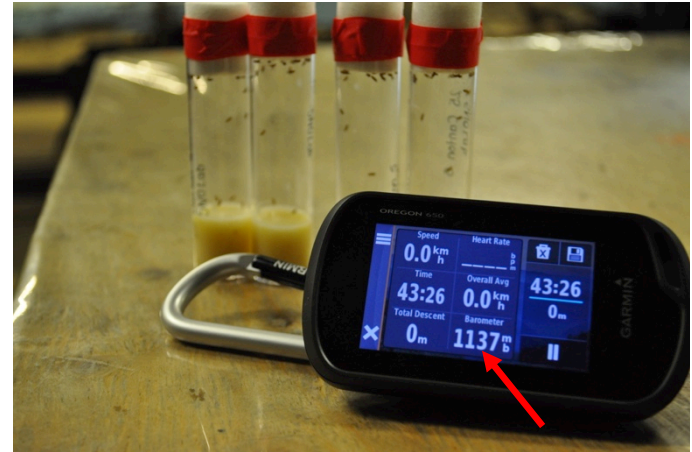
# Flies in SNOLAB



**Experiments:**  
**Pilot – 1 line of flies, 1 trip**

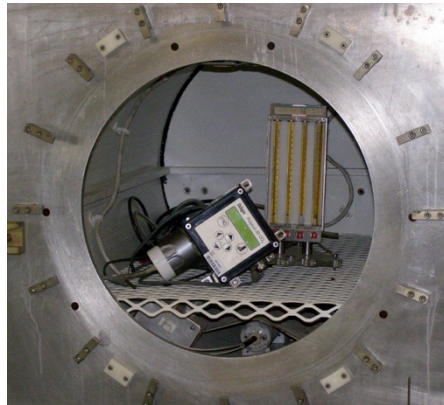
**SNOLAB Experiment**  
**3 lines, 1 trip**  
**3 lines, 5 trips**

**Laboratory Experiment**  
**3 lines, 1 exposure**  
**3 lines, 5 exposures**





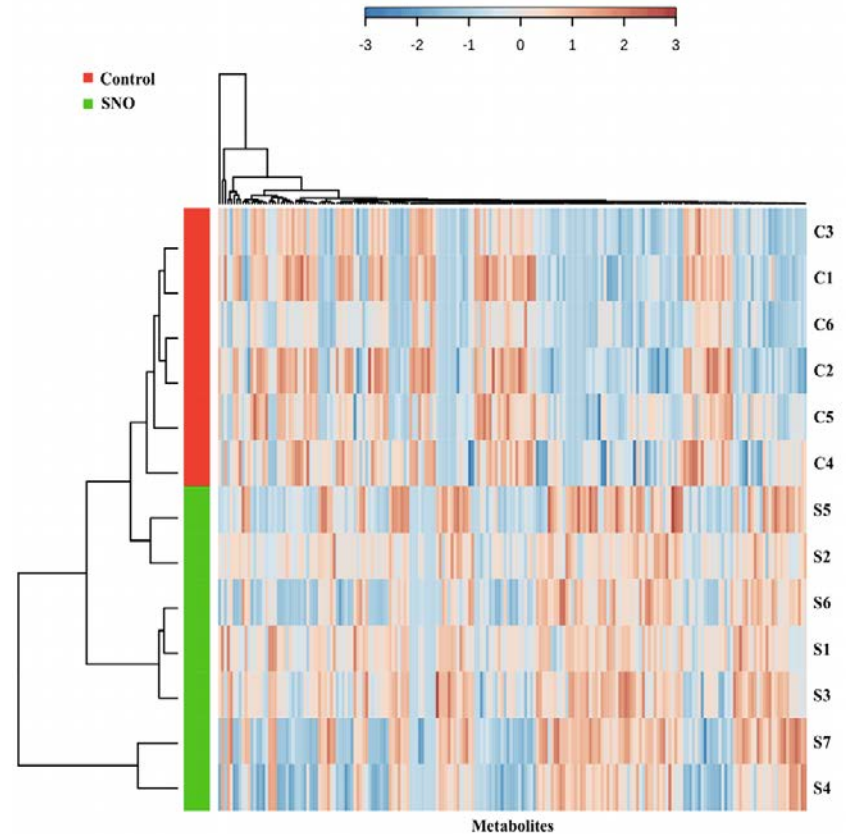
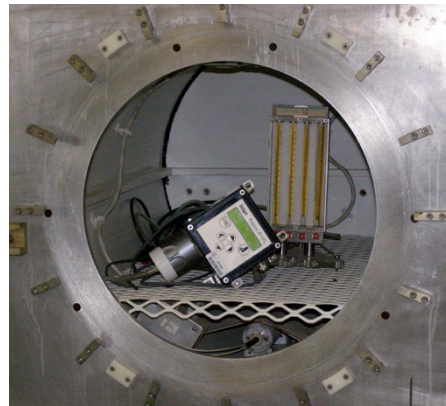
# Flies in SNOLAB



**Results**

**Liquid chromatography / mass spectrometry**

# Flies in SNOLAB



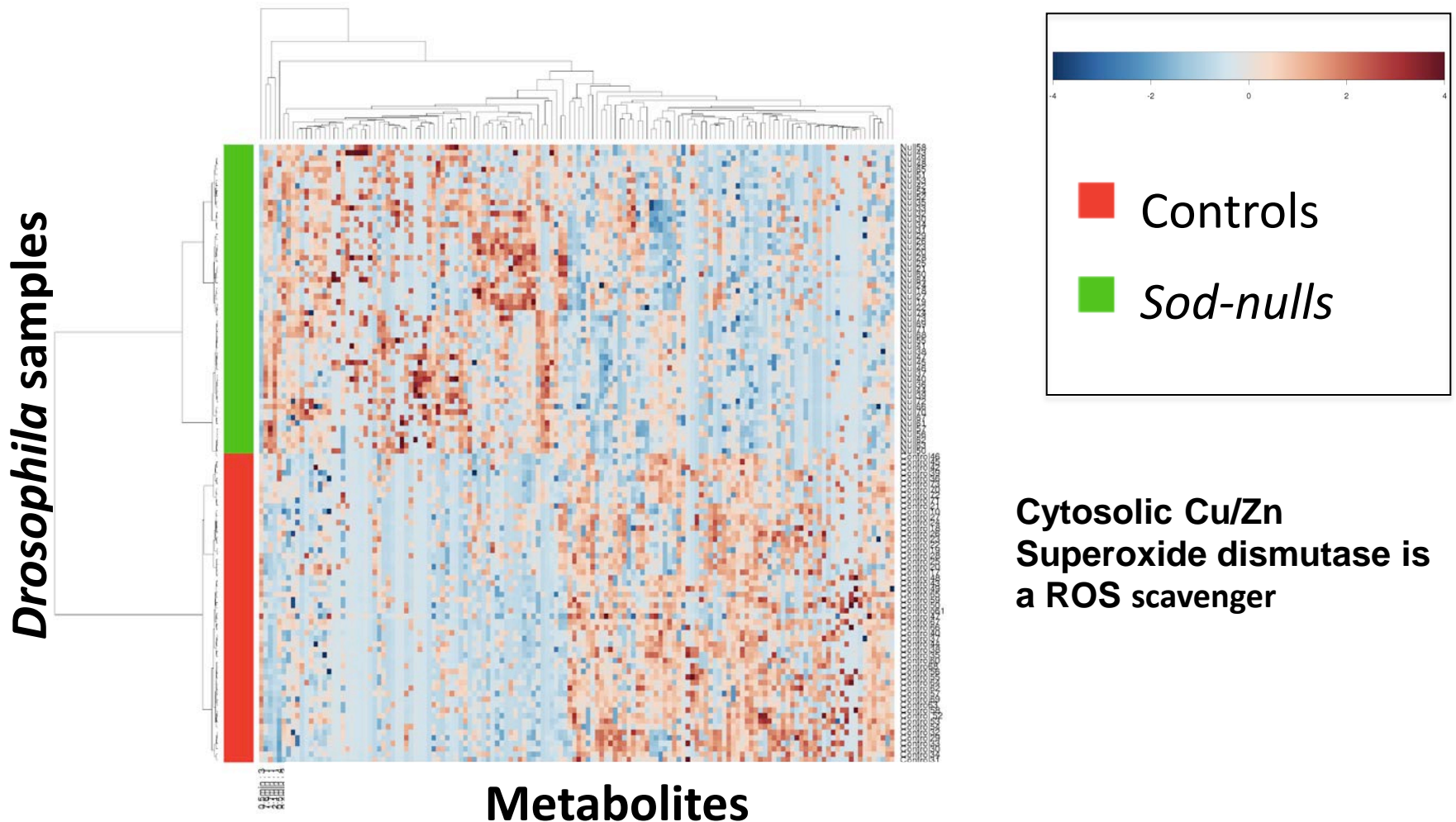
## Results

**10% of metabolome changes: 237 of 1514 metabolites**

**23 metabolites are only found in control or treatment**

**We can identify 6**

# metabolomic effect of *Sod*<sup>(-)</sup>

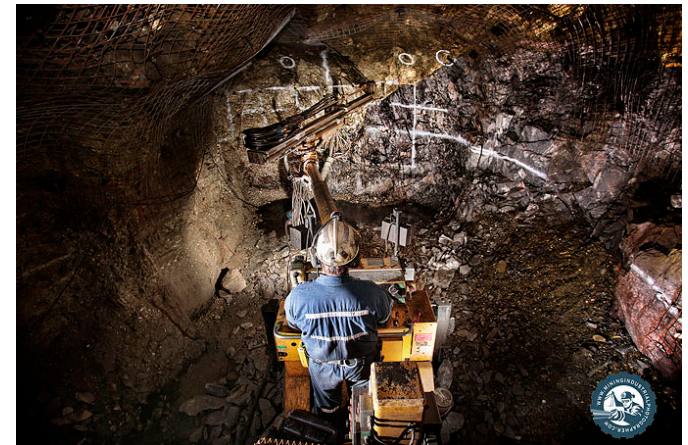
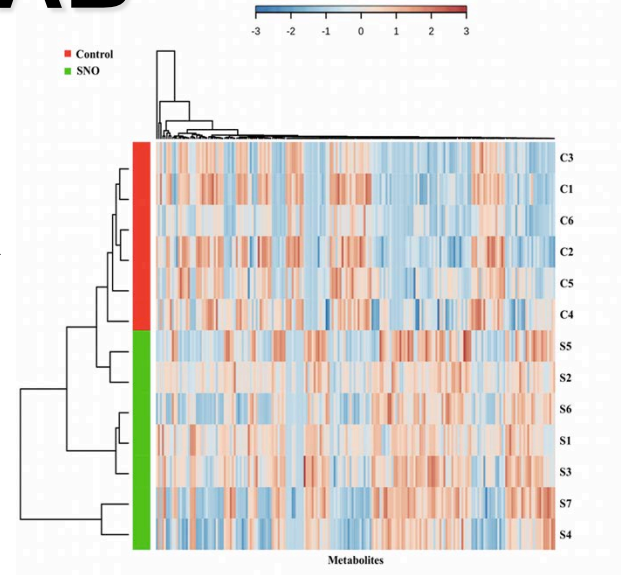
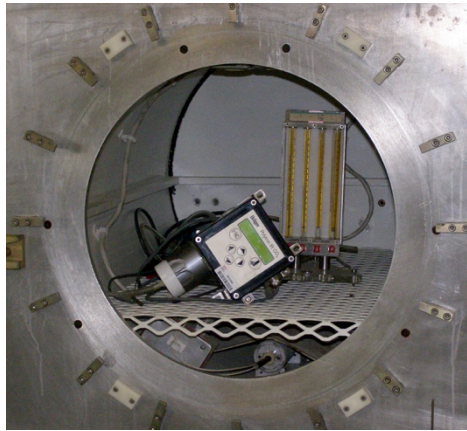


Heat map of UHPLC-MS analysis comparing 64 *Sod nulls* with 64 rescue controls.

138 of 487 metabolites differ between the genotypes – 28% of metabolome



# Flies in SNOLAB



Where to go from here?

Ultimate goal: reduce the stress

To do this we need to understand the stress