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## Introduction

Mining is a physically demanding occupation. Deep underground miners can be exposed to extreme environments, including atmospheric pressure exceeding 20% greater than surface pressure. Anecdotally, these extremes are associated with responses including fatigue, hunger, and difficulty thinking. We are investigating the molecular and biochemical basis of these changes.

## Objectives

- Quantify the biological response to working deep underground using the *Drosophila melanogaster* model system.
- In the FLies in A MinE project, FLAME, we are exploring the biology of working deep underground with an ultimate goal of improving mine worker health and safety.

## Methods

- FLAME is based in SNOLAB (Sudbury Neutrino Observatory), a particle physics clean-lab facility located 2 km underground in an active nickel mine in Sudbury, Ontario, Canada.
- Elevated physical activity is stimulated using the Flygometer 2.0, a fly exercise treadmill that uses slow rotation of fly vials along their long-axis to induce walking activity.

Fly activity:

- We quantified fly activity using a tap-down assay

Fly condition:

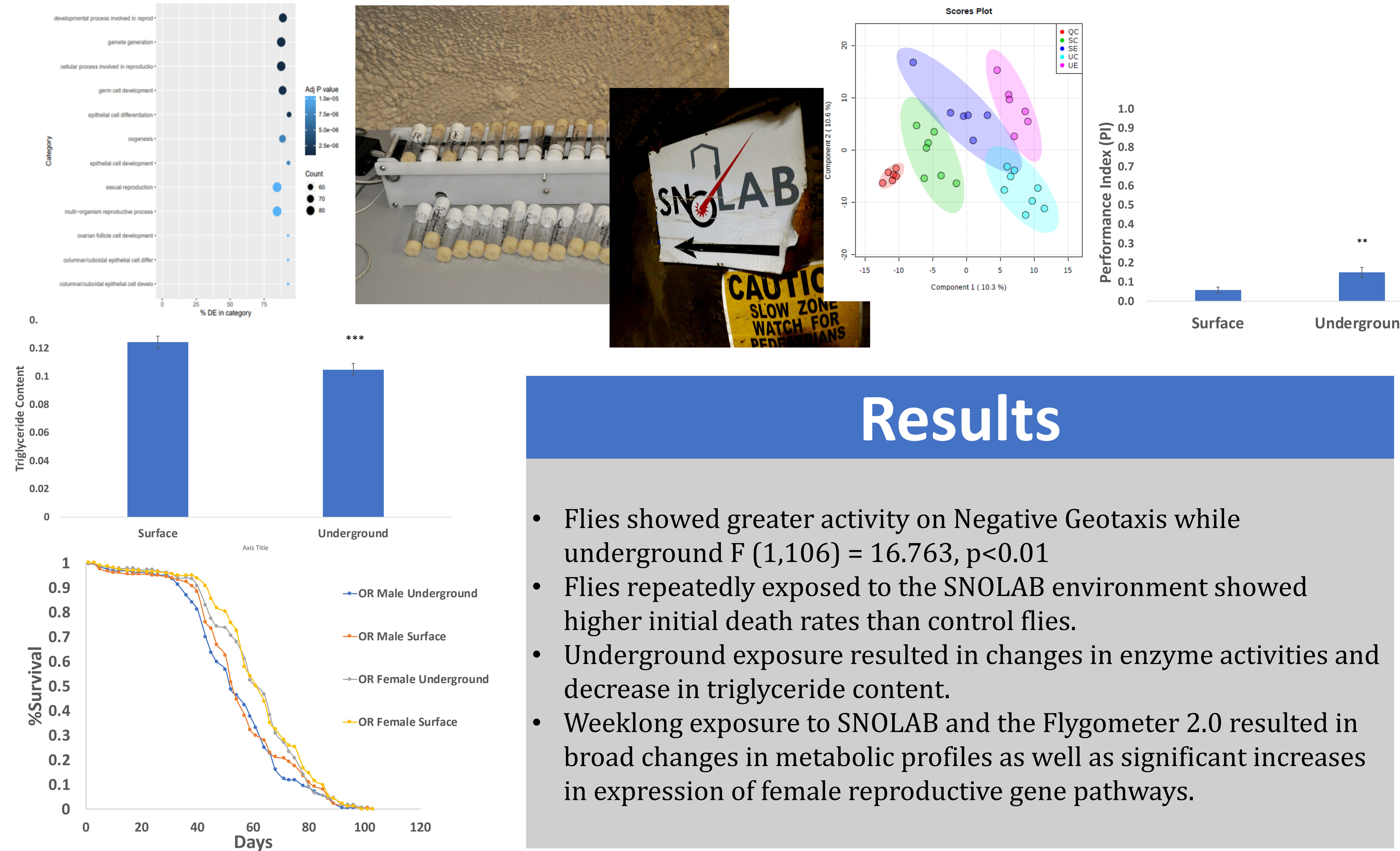
- We assayed fly metabolic condition by assaying free triglyceride content

Metabolomics and Transcriptomics:

- We used broad Spectrum metabolomics using LC/MS (uHPLC – qTOF) to identify metabolite concentrations and metabolic pathways that are changing in response to being underground and/or increased physical activity.
- We used broad-based transcriptomics to identify genes whose expression changed under these same conditions.

Longevity:

- We quantified changes in lifespan associated with life-long exposure to underground stress (daily trips in and out



## Results

- Flies showed greater activity on Negative Geotaxis while underground  $F(1,106) = 16.763, p < 0.01$
- Flies repeatedly exposed to the SNOLAB environment showed higher initial death rates than control flies.
- Underground exposure resulted in changes in enzyme activities and decrease in triglyceride content.
- Weeklong exposure to SNOLAB and the Flygometer 2.0 resulted in broad changes in metabolic profiles as well as significant increases in expression of female reproductive gene pathways.