

# Mushroom Nutrition Research: Your Questions Answered

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June 2, 2022

# Outline

History of work with The Mushroom Council

Introduction to our research

- Systematic Review
- Aim 1: metabolomics
- Aim 2: acute feeding study
- Aim 3: chronic feeding study

Questions

# History of Work with The Mushroom Council

Dr. Campbell attended the Nutrition Research Mini-summit  
→ Request for Proposals led to our ongoing research.

Systematic review on the effects of mushroom consumption on cardiometabolic disease risk factors.

Vitamin D-enriched mushrooms and immunity/inflammation (Fall '22)

2019

2020

2021

2022

1) Exploratory untargeted metabolomics of 7 different mushroom varieties. Includes ergothioneine quantification.

2) Acute feeding study: Postprandial response (whole, fresh mushrooms).

3) Chronic feeding study: 8-week RCT (full feed; whole, fresh mushrooms)

# An Assessment of Mushroom Consumption on Cardio-metabolic Disease Risk Factors and Morbidities: A Systematic Review

Parameter	Inclusion
Population	Male and female adults, age $\geq 18$
Intervention	Groups consuming mushrooms or higher amounts of mushrooms
Comparison or control	Groups not consuming mushrooms or groups consuming lower amounts of mushrooms
Outcomes	Cardio-metabolic disease risk factors and morbidities
Study design	RCTs or observational
Research question	In adults, what is the effect of mushroom consumption on cardio-metabolic disease risk factors and morbidities, compared to those not consuming mushrooms?

**Mushroom intake has mixed effects on cardio-metabolic disease risk factors in observational research.**

Evidence from experimental research suggest that daily mushroom consumption may improve **fasting blood glucose, C-reactive protein, and triglycerides**, but not other lipids, blood pressures, or measures of abdominal obesity.

**The paucity of experimental research underscore the need for future research on this topic, including data to conduct a meta-analysis.**

# Limitations of the Current Literature

Limited research overall, primarily animal studies

Mushroom intake is inconsistent (form, quantity)

Few experimental studies, zero full feed studies in this analysis

Mushroom intake not examined as *a priori* in most observational research

Limited mechanistic research



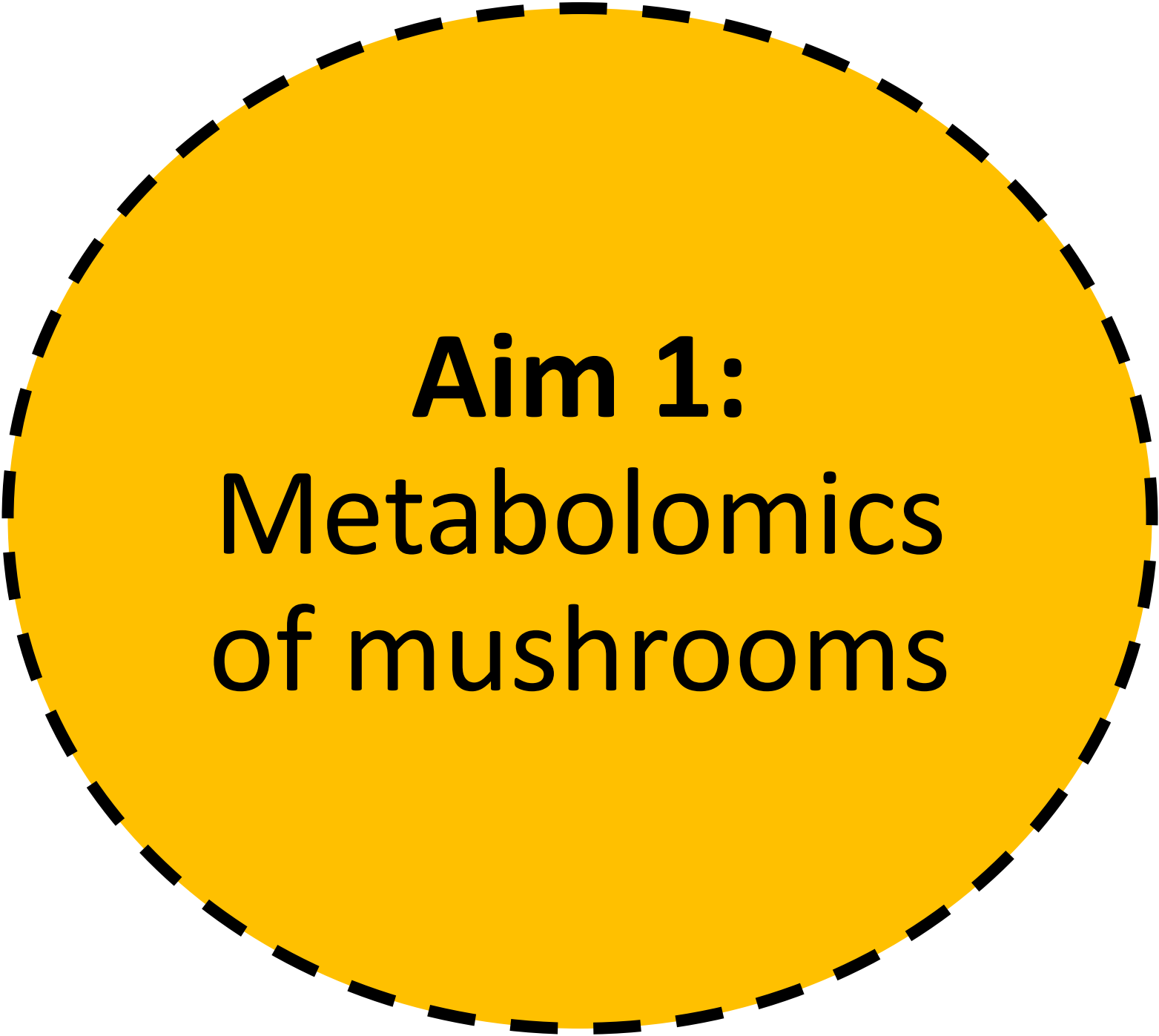
# Examining the health effects and bioactive components in *Agaricus bisporus* mushrooms: a scoping review

“Despite the growing body of evidence linking mushrooms’ nutritional uniqueness to beneficial health effects, existing narrative review have found **limited evidence in human studies.**”

“Further research is required to fully elucidate the **bioactive compounds** in mushrooms using vigorous analytical methods.”

Of the 68 eligible articles.... “15 human trials reported on consumption of *A. Bisporus* mushrooms and physical health outcomes and **none reported on mental health or cognitive function.**”

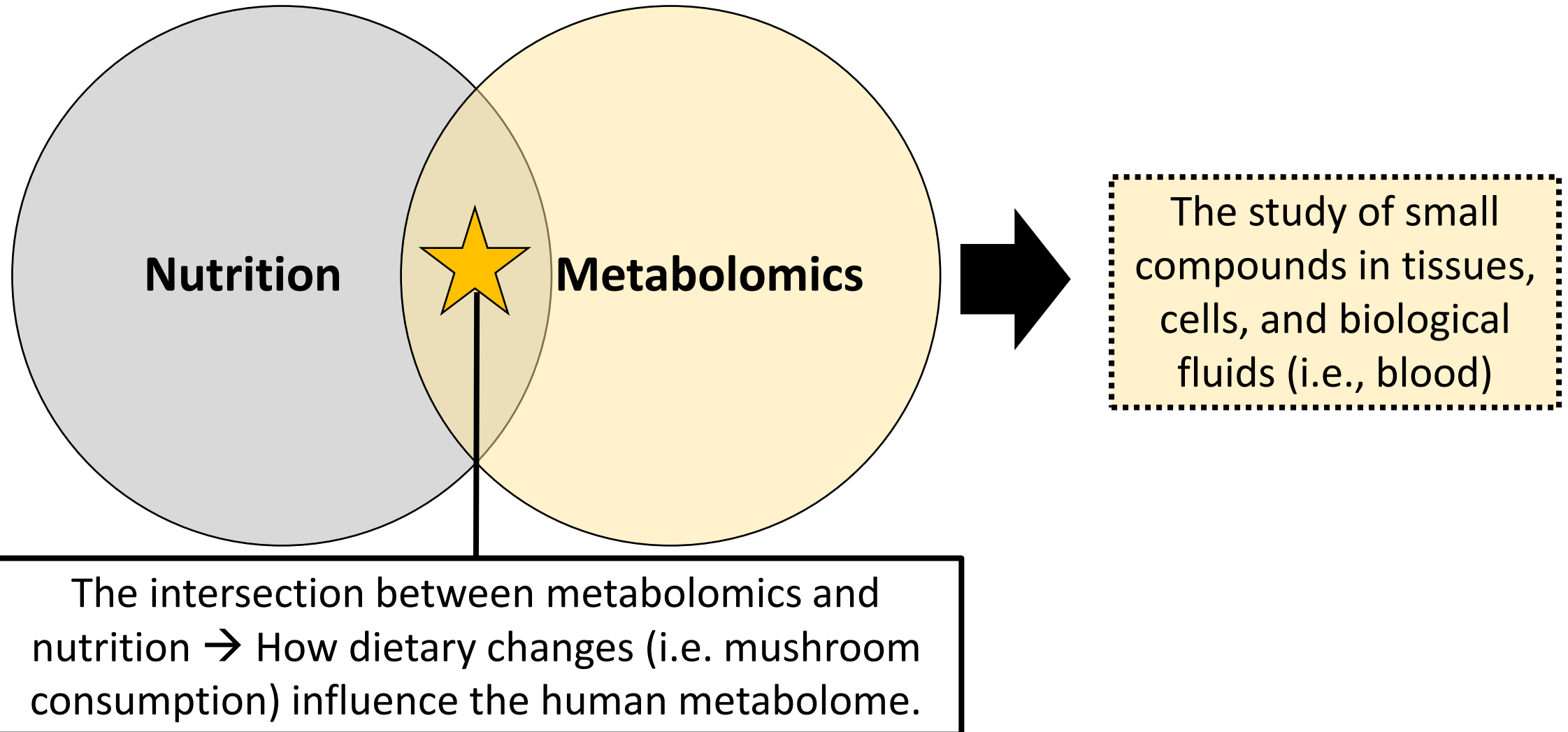
“Further research is warranted, specifically for **inflammatory and immune function** where results are promising.”



**Aim 1:**  
Metabolomics  
of mushrooms



# What is Nutrimetabolomics and why is it Important?



# Metabolomics Analysis of 7 Mushroom Types



**Maitake**



**Portabella**



**White Button**



**Shiitake**



**Oyster**



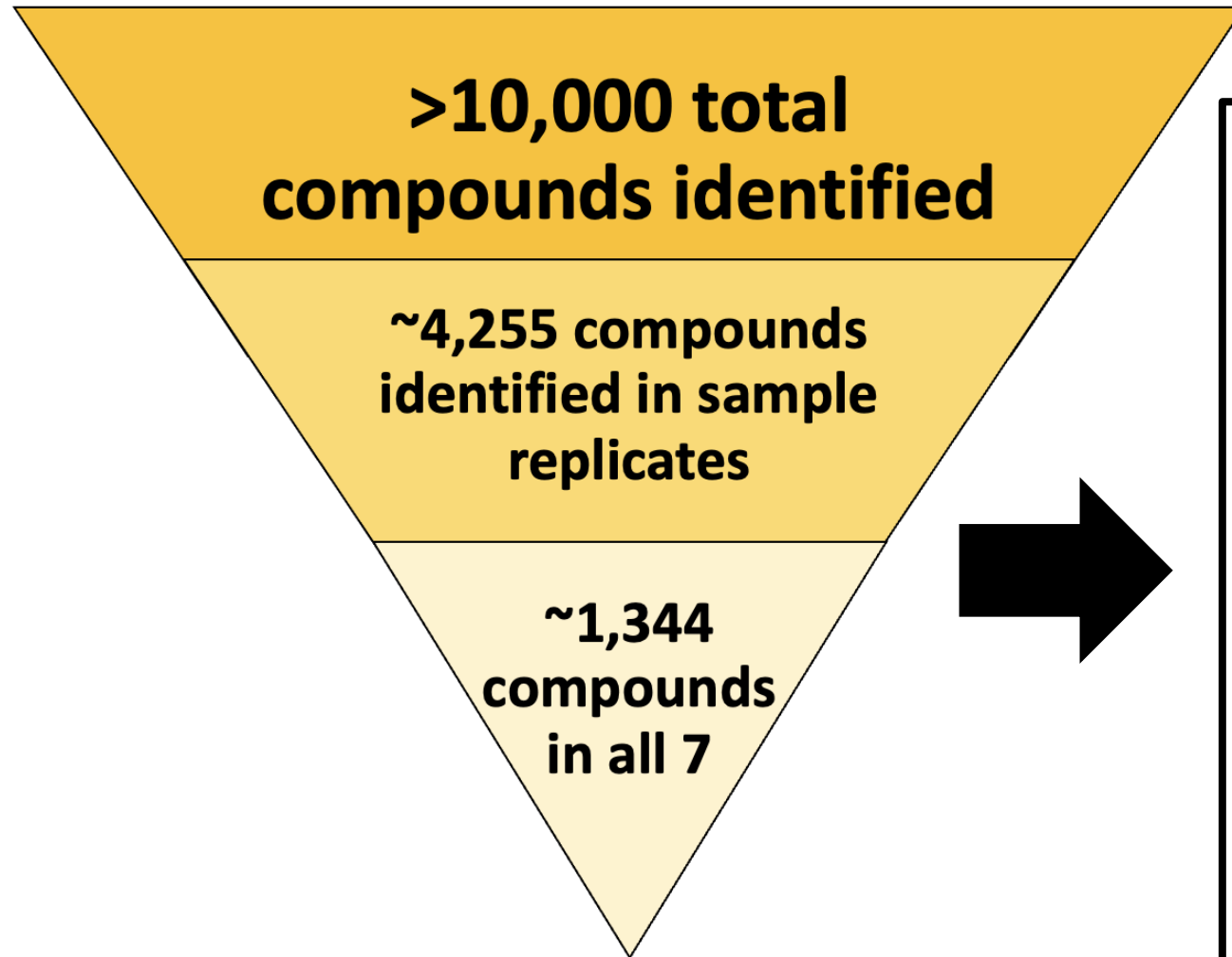
**Cremeni**



**Lion's Mane**

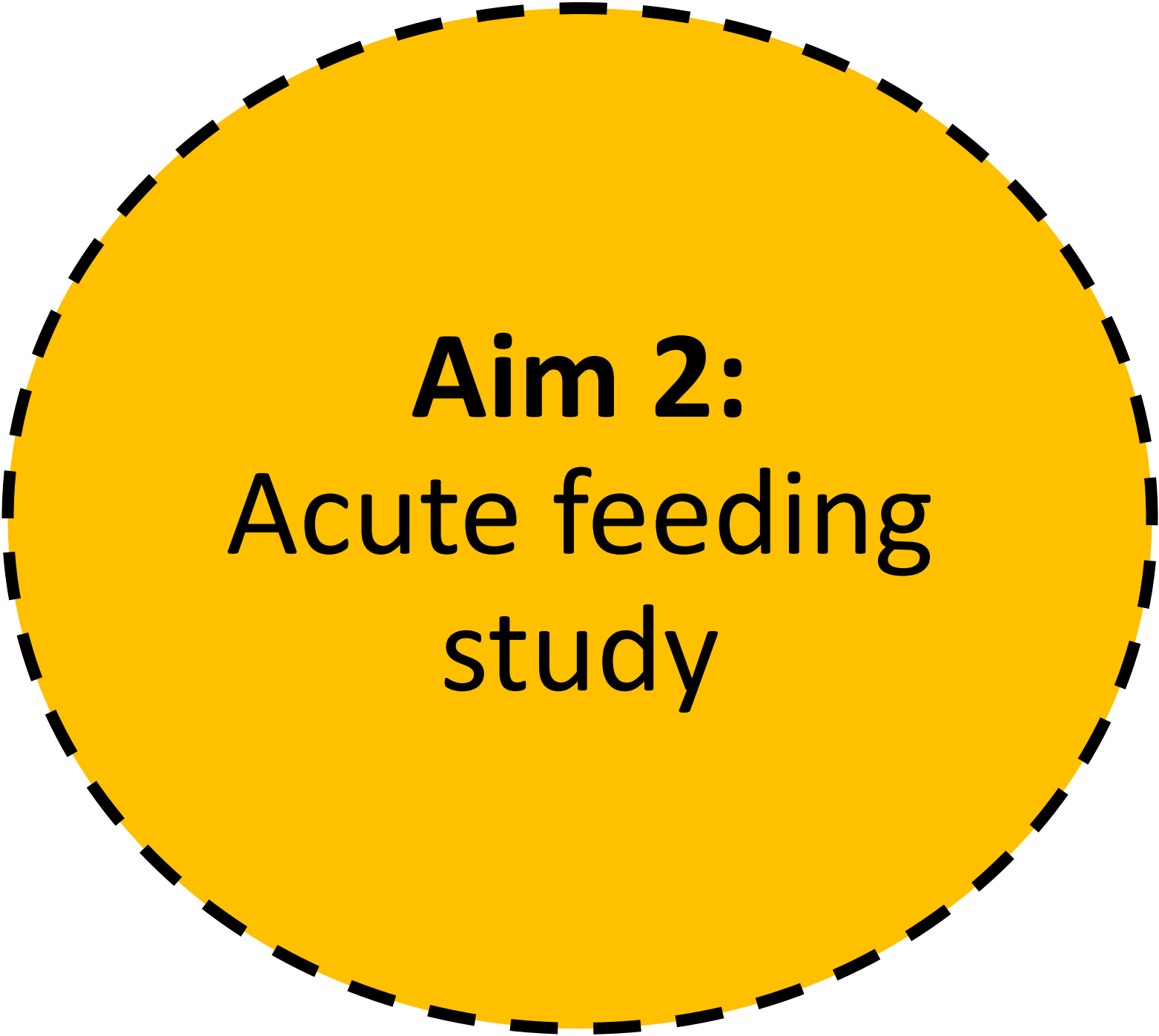
- Aim: To document the chemical composition of 7 different mushroom types.
- Experimental features: Collaborating with experts in Colorado. Analyses include untargeted (all compounds) and targeted (ergothioneine quantification) metabolomics using liquid chromatography mass spectrometry (LC-MS).
- Importance: This work will be the most comprehensive assessment of compounds in mushrooms conducted to date. It will inform future research and understanding of why mushrooms promote human health.

# Ongoing Metabolomics Research



Curation = the process of researching the individual compounds to determine whether they are:

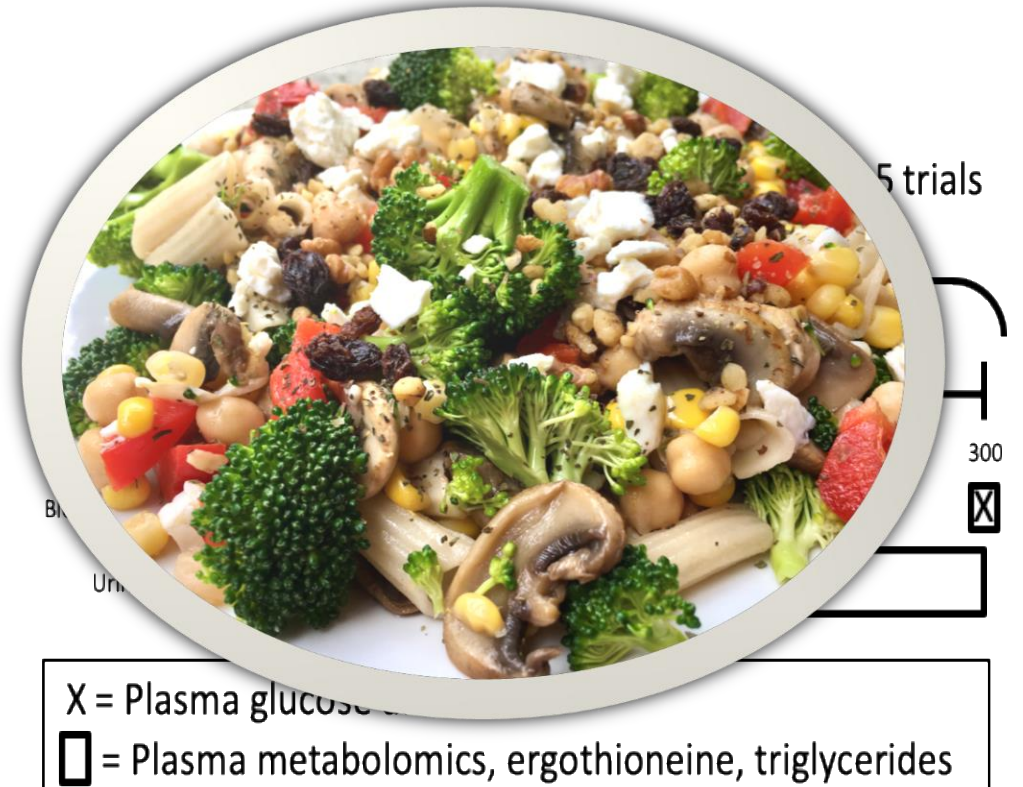
- 1) Endogenous or exogenous
- 2) Unique to a specific mushroom type
- 3) Previously documented or known to have impacts on health




**Aim 2:**  
Acute feeding  
study

# Acute Feeding Study

- Aim: To assess the effects of consuming different types and amounts of mushrooms on postprandial changes in plasma insulin, glucose and triglycerides.
- Experimental features: Titration study design, fresh mushrooms.
- Importance: This study will tell us if the compounds in mushrooms are measurable in the blood and urine after mushroom consumption.



- Status: Completed data collection on 7 participants. Samples are currently being analyzed.



**Aim 3:**  
Chronic  
feeding study

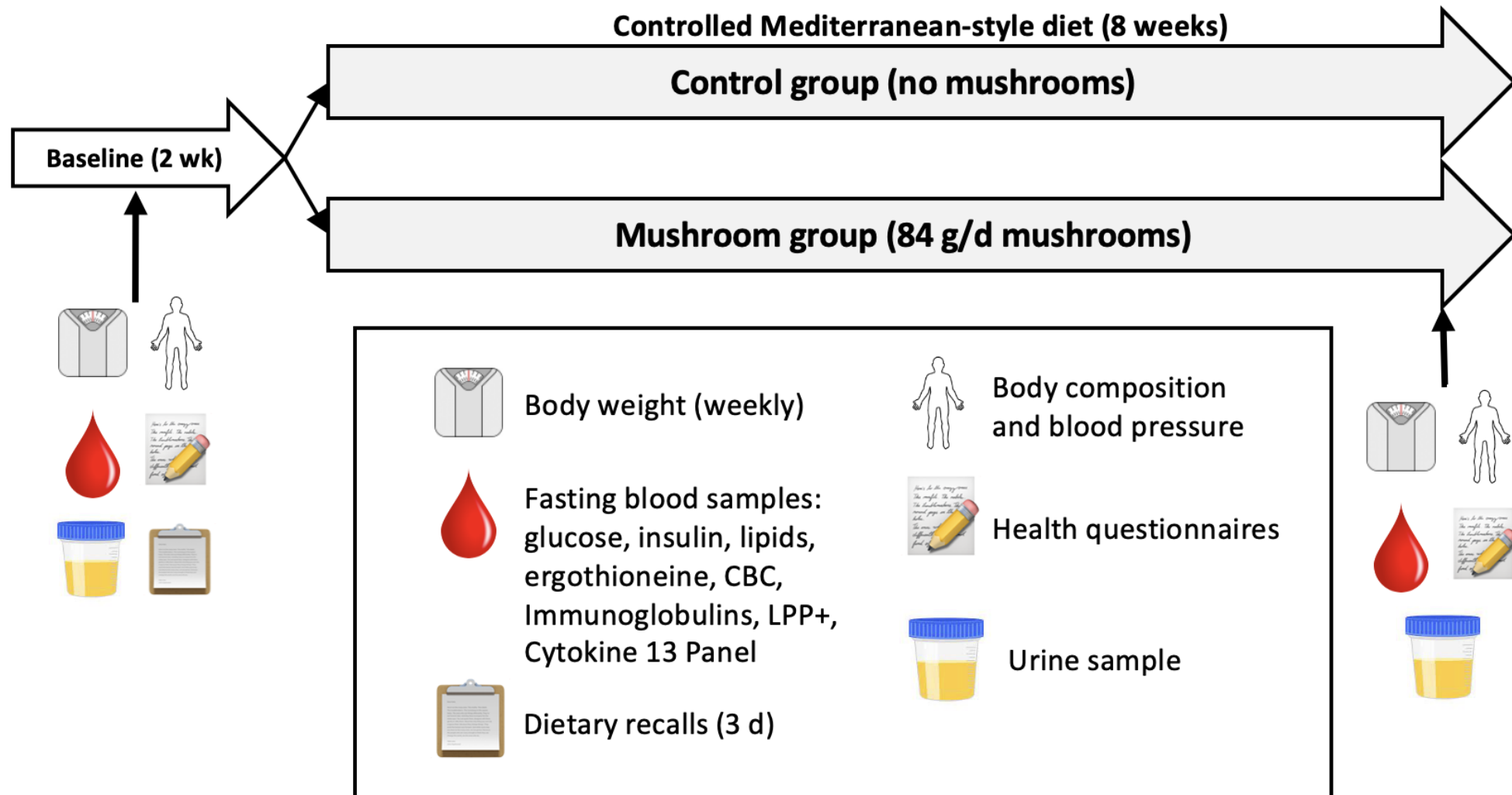
# Chronic Feeding Study

- Aim: To assess the effects of including mushrooms as part of a healthy Mediterranean-style eating pattern on indices of perceived mental health/anxiety/depression, risk factors for cardiovascular disease and type 2 diabetes, and blood markers of immunity and inflammation.
- Dietary features: Fresh white button and oyster mushrooms, all food provided.
- Importance: This study will tell us if chronic mushroom consumption augments improvements in health outcomes compared to a healthy eating pattern alone.





# What's it like to be a Participant?



# What do the Health Questionnaires look like?

- **Repeatable Battery for the Assessment of Neuropsychological Status**

- Immediate Memory
  - list learning, story memory
- Visuospatial/constructional
  - Figure copy, line orientation
- Language
  - Picture naming, semantic fluency (F&V, zoo animals)
- Attention
  - Digit span, coding
- Delayed memory
  - List recall/recognition, story recall, figure recall

- **Beck's Depression Inventory**
- **General Anxiety Disorder-7**
- **Patient Health Questionnaire**
- **Profile of Mood States**
- **SF-36 Questionnaire**

## Beck's Depression Inventory

This depression inventory can be self-scored. The scoring scale is at the end of the questionnaire.

1.
  - 0 I do not feel sad.
  - 1 I feel sad
  - 2 I am sad all the time and I can't snap out of it.
  - 3 I am so sad and unhappy that I can't stand it.
2.
  - 0 I am not particularly discouraged about the future.
  - 1 I feel discouraged about the future.
  - 2 I feel I have nothing to look forward to.
  - 3 I feel the future is hopeless and that things cannot improve.
3.
  - 0 I do not feel like a failure.
  - 1 I feel I have failed more than the average person.
  - 2 As I look back on my life, all I can see is a lot of failures.
  - 3 I feel I am a complete failure as a person.
4.
  - 0 I get as much satisfaction out of things as I used to.
  - 1 I don't enjoy things the way I used to.
  - 2 I don't get real satisfaction out of anything anymore.
  - 3 I am dissatisfied or bored with everything.
5.
  - 0 I don't feel particularly guilty
  - 1 I feel guilty a good part of the time.
  - 2 I feel quite guilty most of the time.
  - 3 I feel guilty all of the time.





What does the diet look like?

# Trial Status and Ongoing Work

Participant Status (n= 60)	#
Completed the intervention	36
Enrolled in the study	10
Baseline testing scheduled	4

## Ongoing work:

- Recruitment and testing
- Data entry: health questionnaires, dietary compliance, bloodwork, etc.
- Immunity/inflammation sample analysis for the first 20 completers.



**Thank you!**

**Questions?**