

The Power of Your Gut: How the Microbiome Shapes Healthy Aging



About WIHA

- **Mission:** To improve the health and well-being of all people as we age by disseminating evidence-based programs and practices and by engaging in collaborative public health strategies in Wisconsin and beyond.
- <https://wihealthyaging.org>
- **Age Well Newsletter**



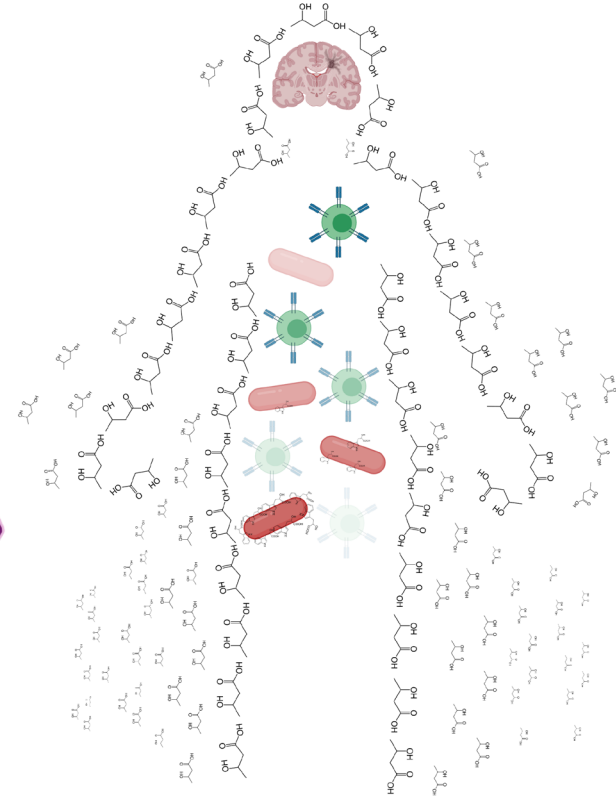
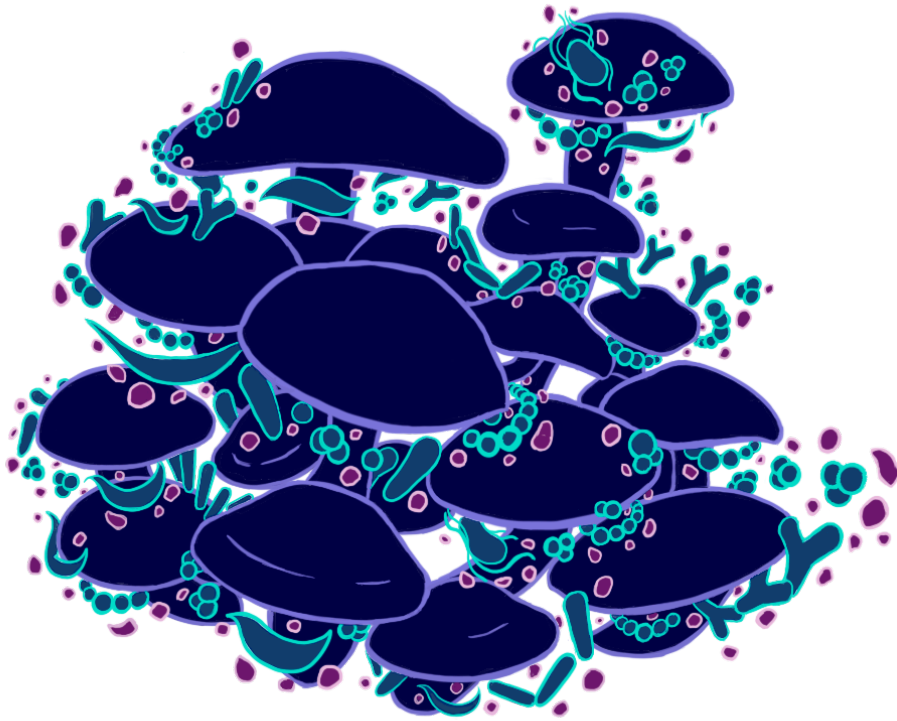
Introduction to Speaker



Dr. Margaret Alexander

Assistant Professor
University of WI - Madison

The Power of Your Gut: How the Microbiome Shapes Healthy Aging



gy and Immunology

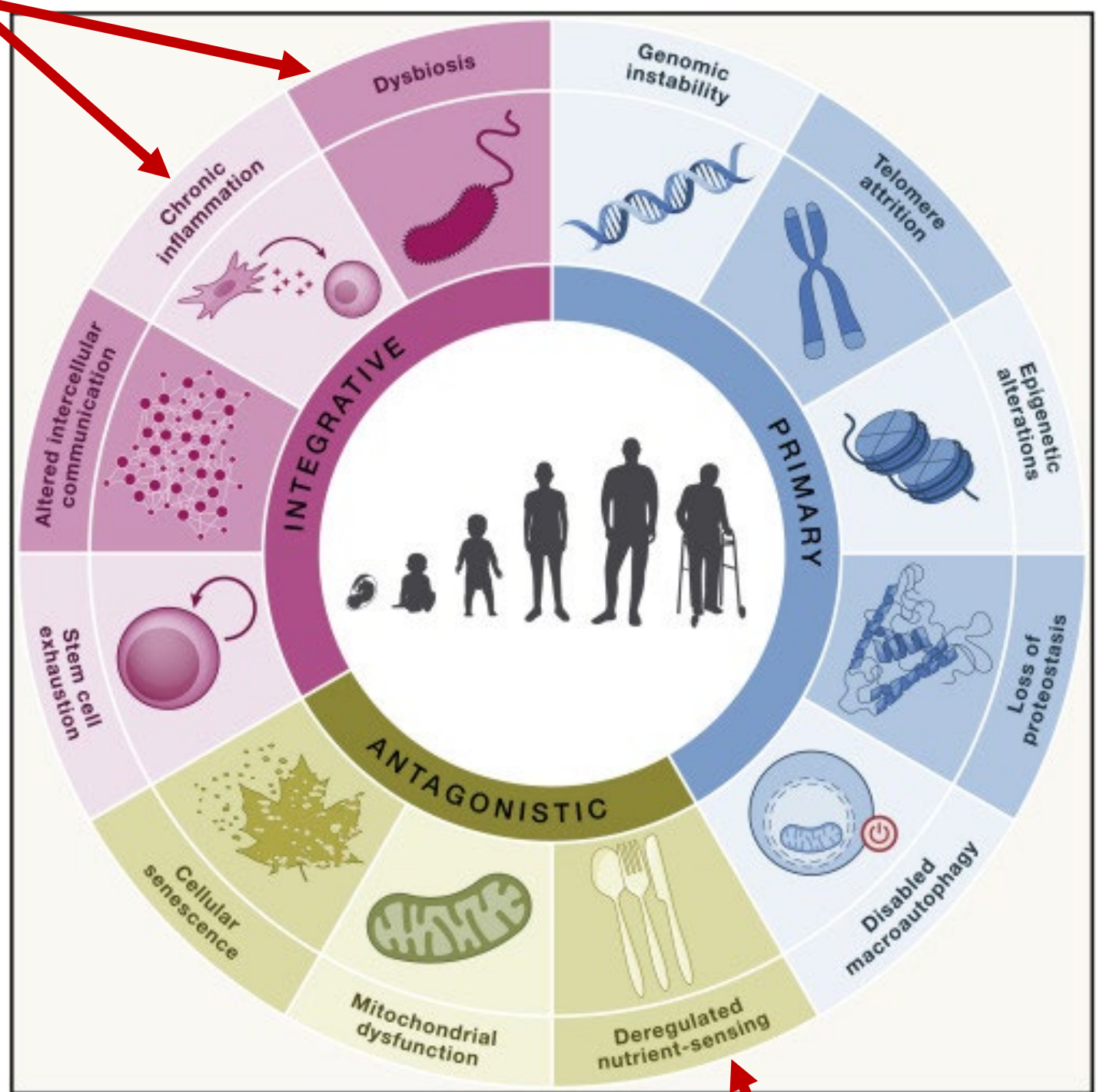
Margaret Alexander
Assistant Professor
University of Wisconsin – Madison

Art by: Rachel Rock and Biorender

Overview

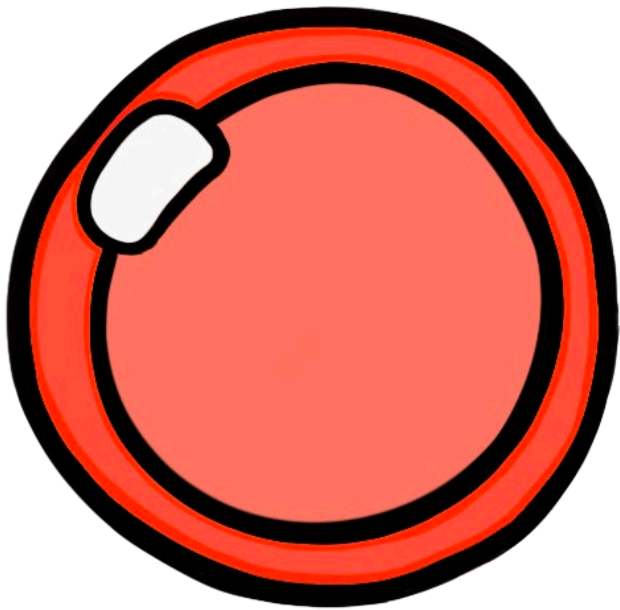
- Chronic inflammation and aging
- Diet, nutrient sensing and aging
- Microbiota and aging
- Connections between microbiota, diet, immune responses and autoimmune/chronic inflammatory diseases.
 - Case study from our lab's research in the context of autoimmunity
- End with how this connects to aging and broader implications for aging

Hallmarks of Aging



Let's meet the stars of our talk today

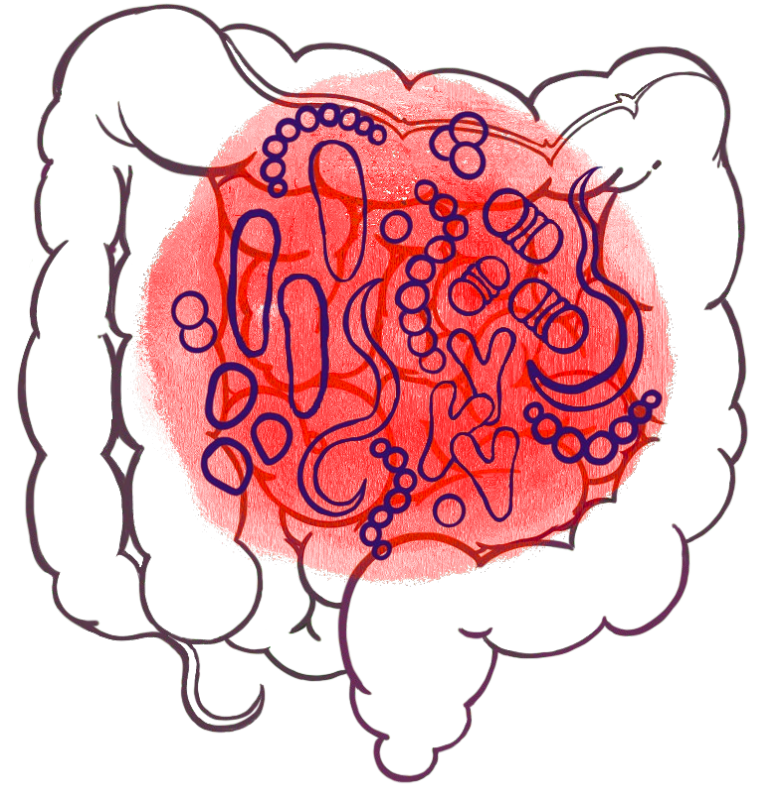
Immune Response



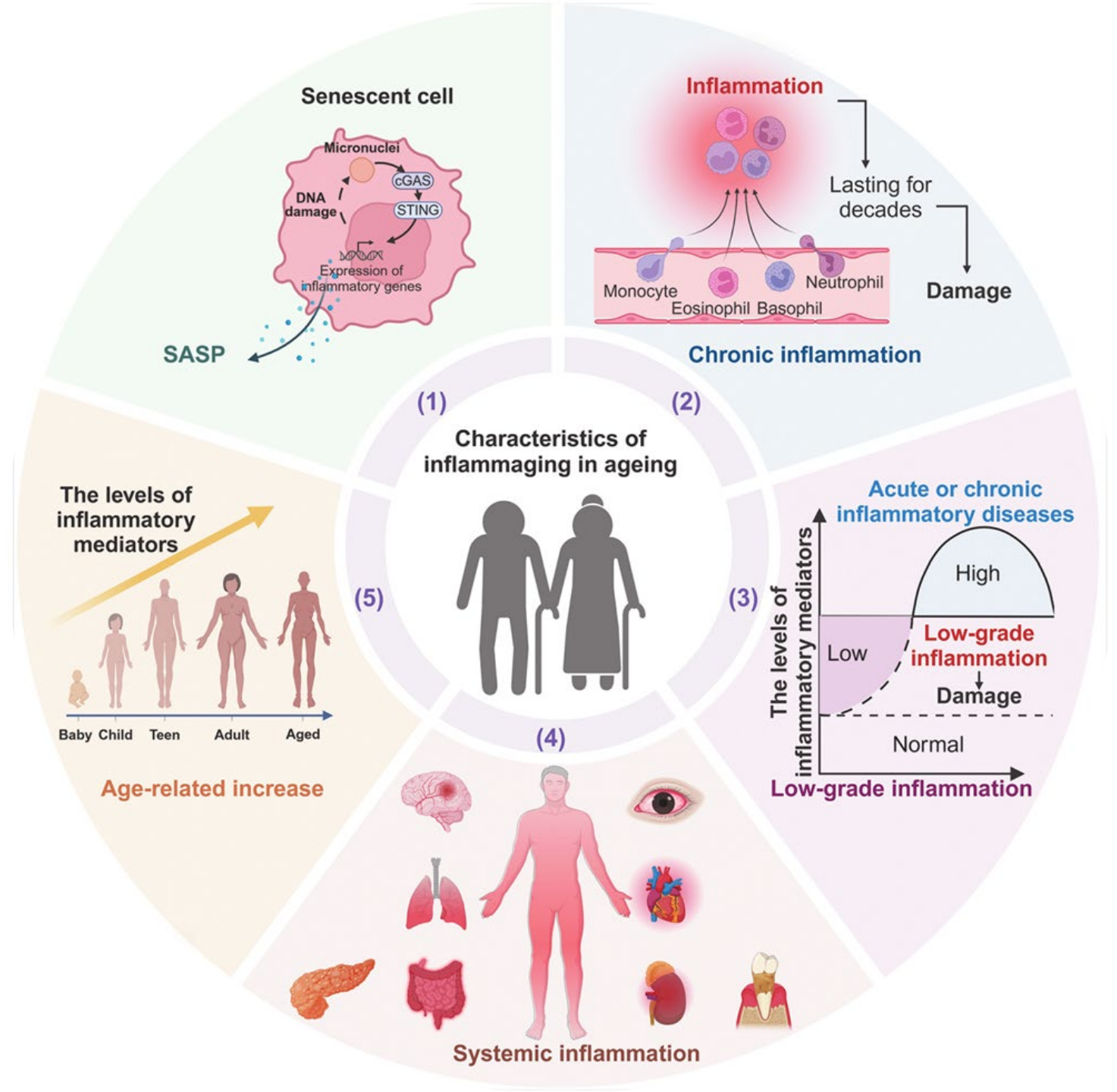
Diet



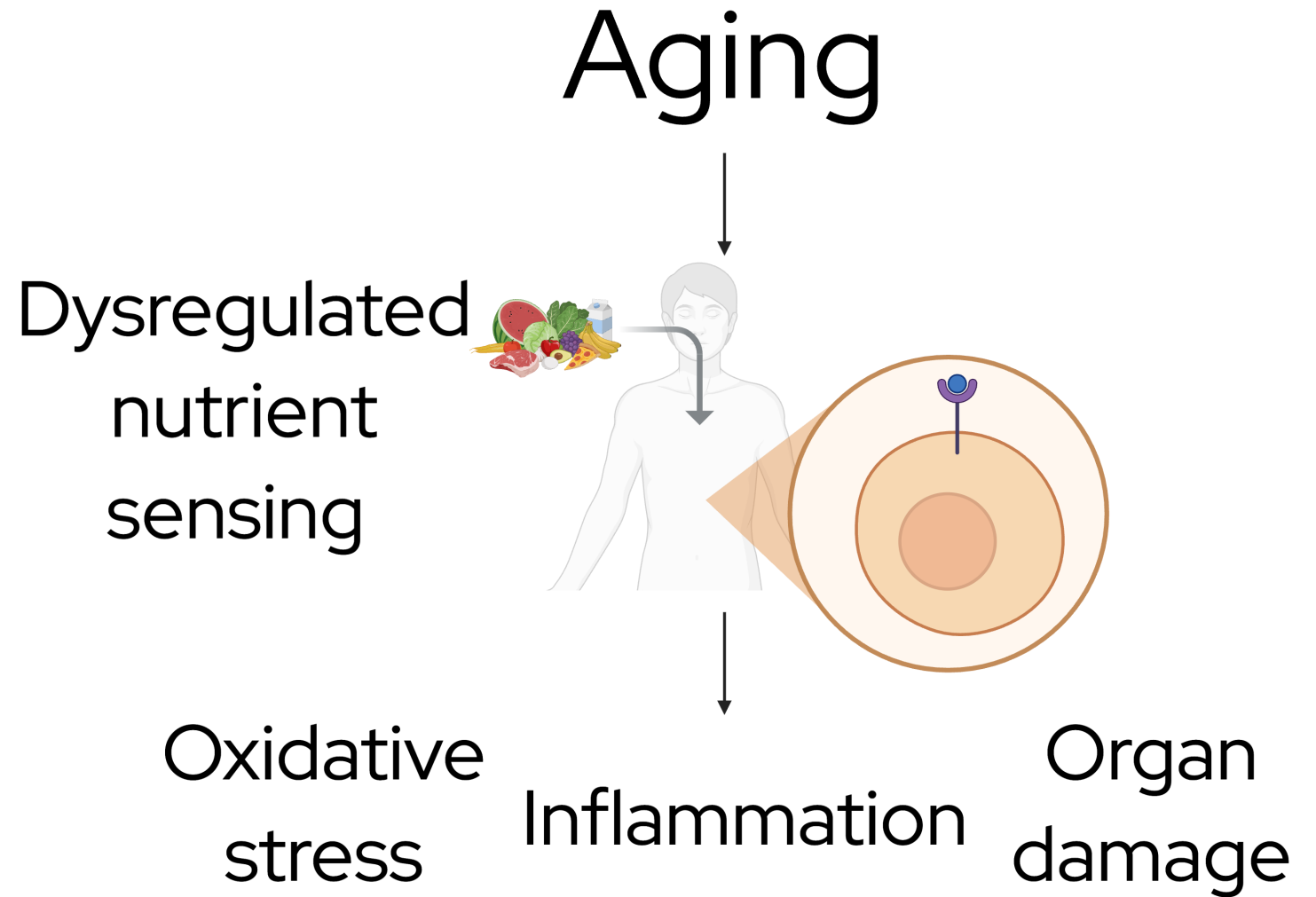
Gut Microbiota



Chronic Inflammation and Aging



Diet, Nutrient Sensing, and Aging



So many of us!

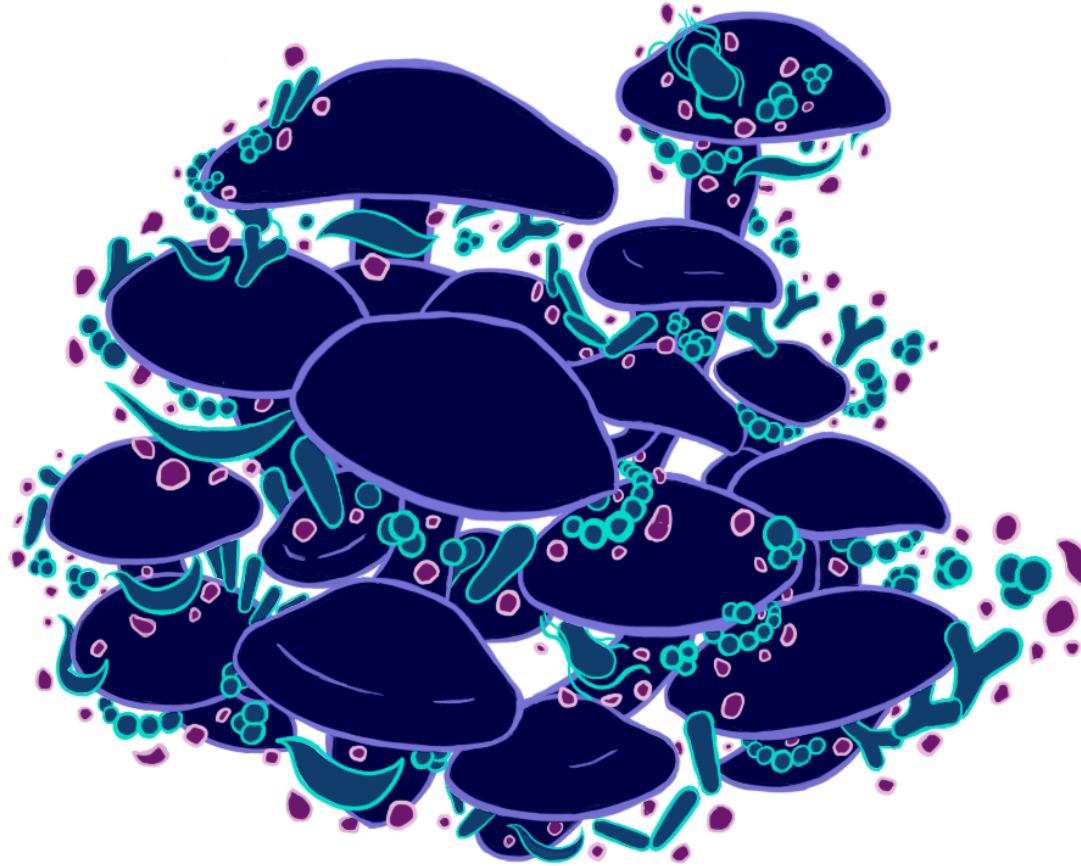
Nobody sees us,
Stops us, betrays us;
The small grains make
room...

We
Diet on water,
On crumbs of shadow,
Bland-mannered, asking

Little or nothing.
So many of us!
So many of us!

- Sylvia Plath

Mushrooms Excerpt

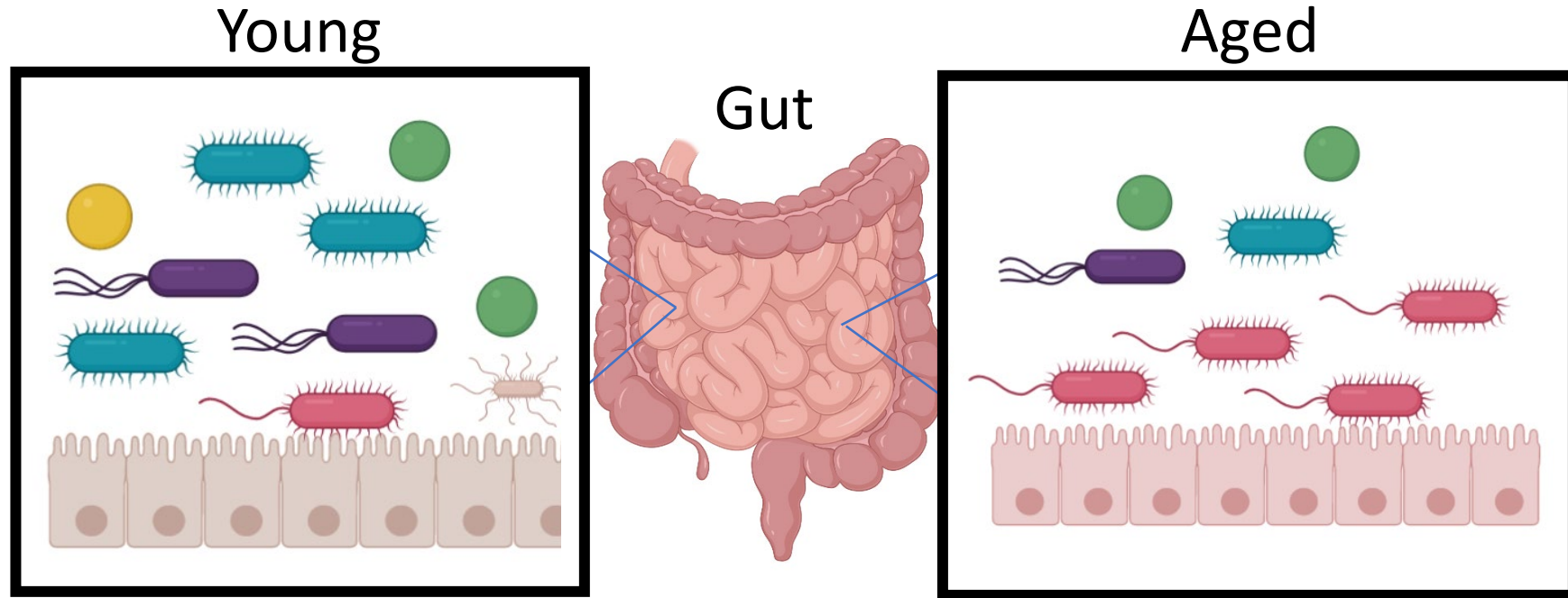


What is the gut
microbiota?

- Over 1 trillion microbes
- Who:
 - Bacteria
 - Viruses
 - Fungi
 - Multicellular eukaryotes
- What are they doing?
 - Help with digestion
 - Train immune responses
 - Prevent infections

Illustration by Rachel Rock

Microbiota and Aging



Is this a cause,
consequence, or
contributor to aging?

How can we study this beyond associations between microbiota and aging?

We love bubbles!



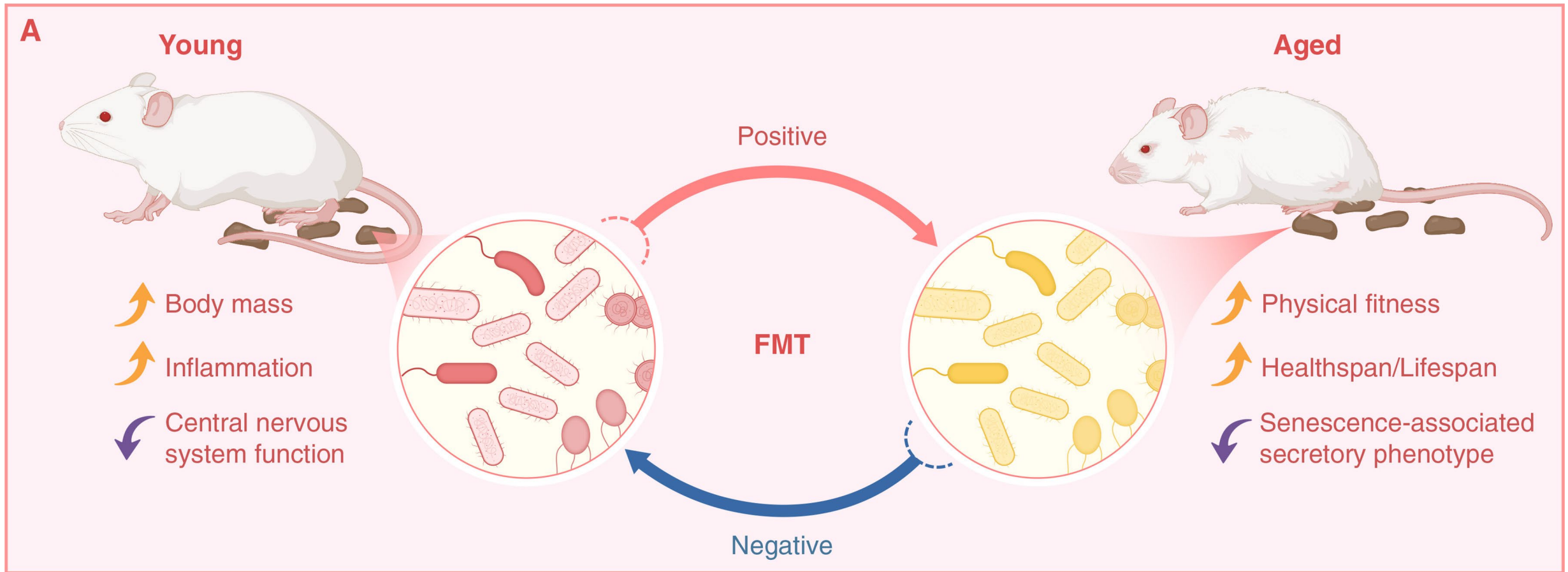
Germ free – no microbes!



Anaerobic chamber – no oxygen!

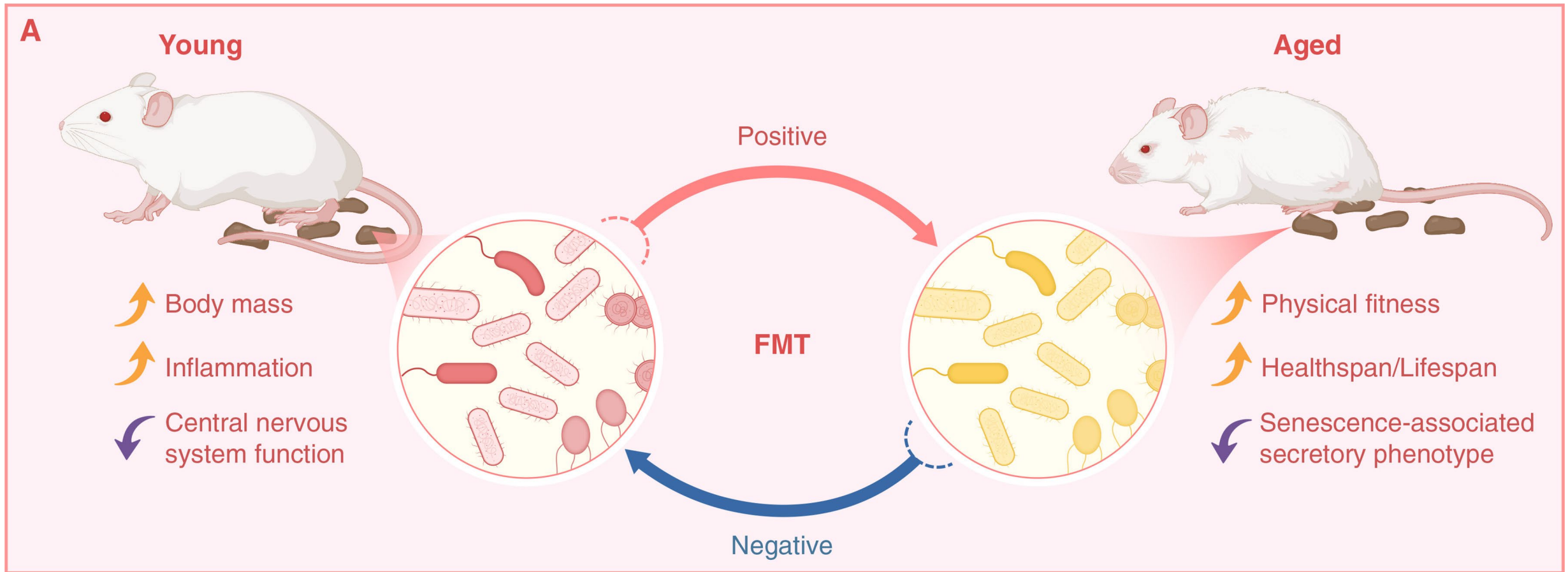
Lab quote from student learning to work in the Anaerobic chamber:
"I'm used to air!"

Microbiota and Aging



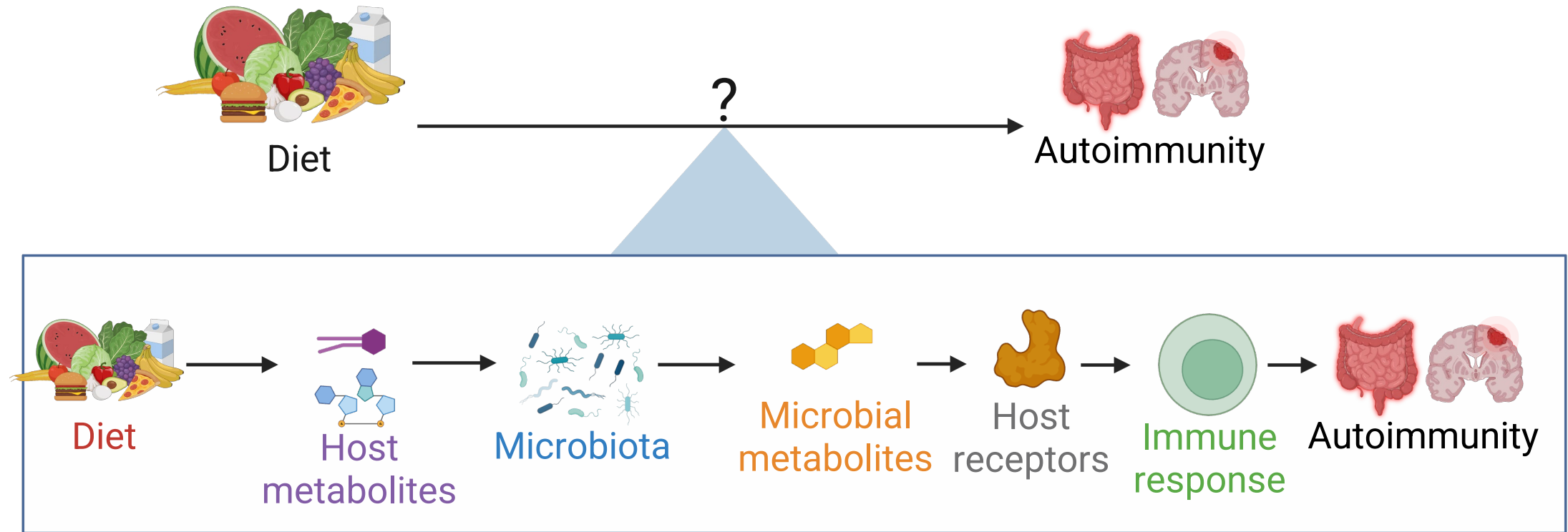
Young mice exhibited accelerated aging phenotypes when they received the gut microbiota from aged mice. In contrast, aged mice that received gut microbiota from young mice exhibited delayed aging phenotypes.

Microbiota and Aging



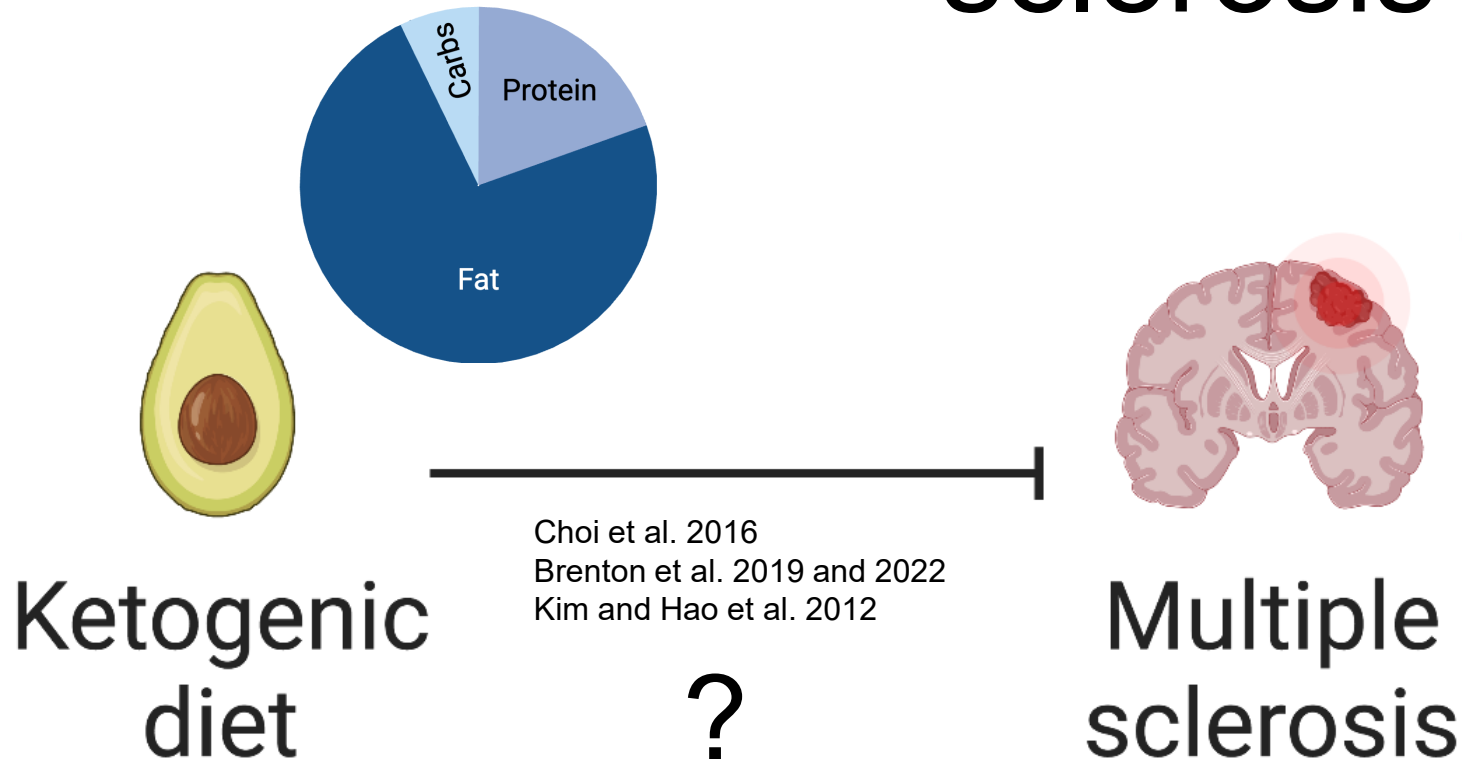
Discussion point: How does the microbiota influence inflammation?

Connections Between Microbiota, Immune Responses and Diet



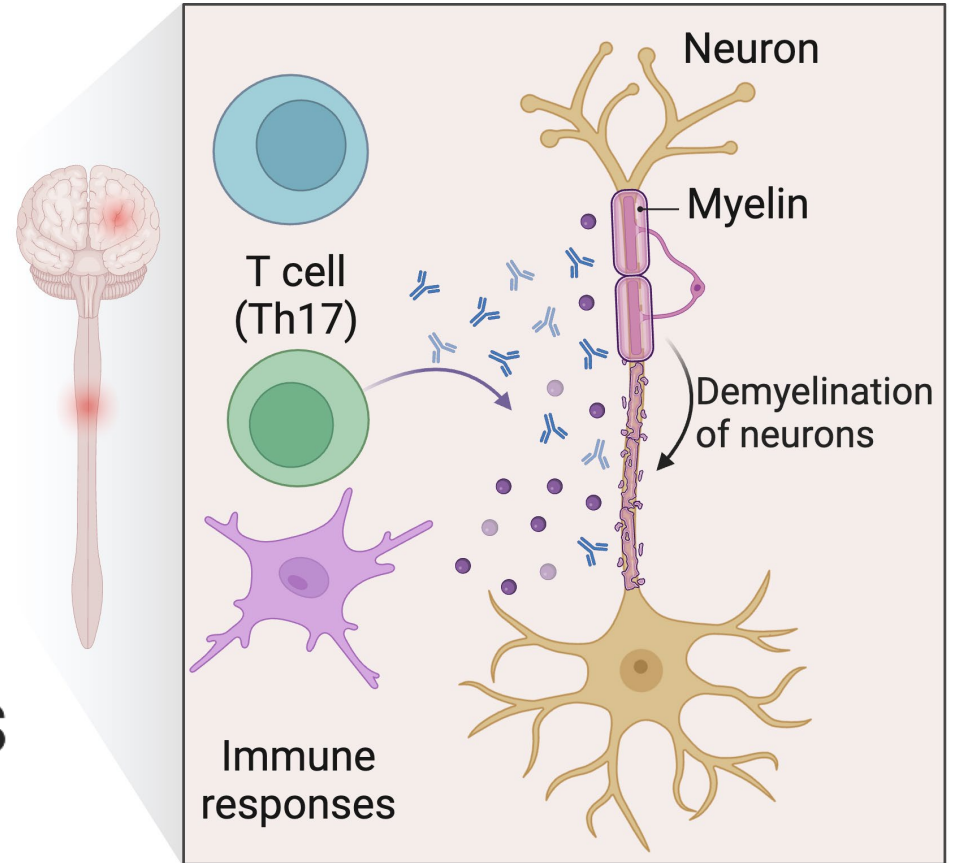
- Case study from our lab's research in the context of autoimmunity
- End with how this connects to aging and broader implications for aging

Model: Ketogenic diet and multiple sclerosis

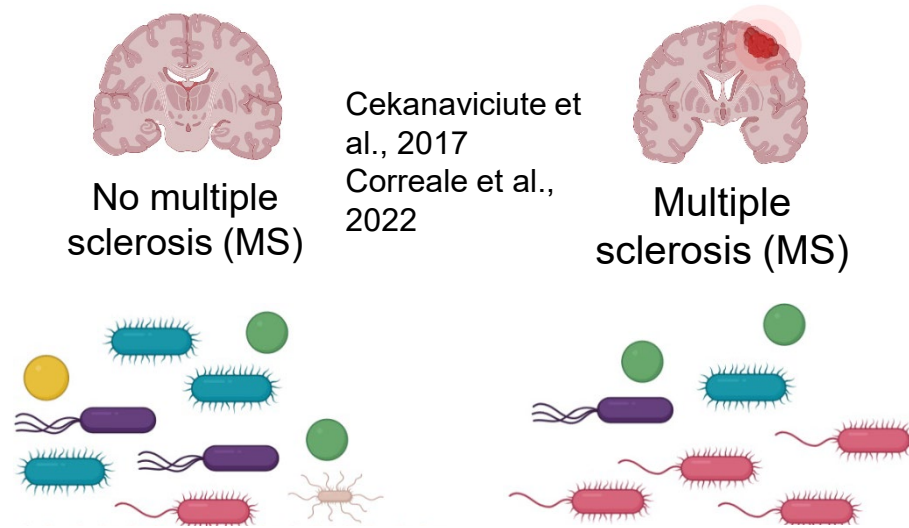


Choi et al. 2016
Brenton et al. 2019 and 2022
Kim and Hao et al. 2012

- Barriers:
1. Responsiveness
 2. Adherence
 3. Multifactorial impacts



Connections between microbiota and multiple sclerosis

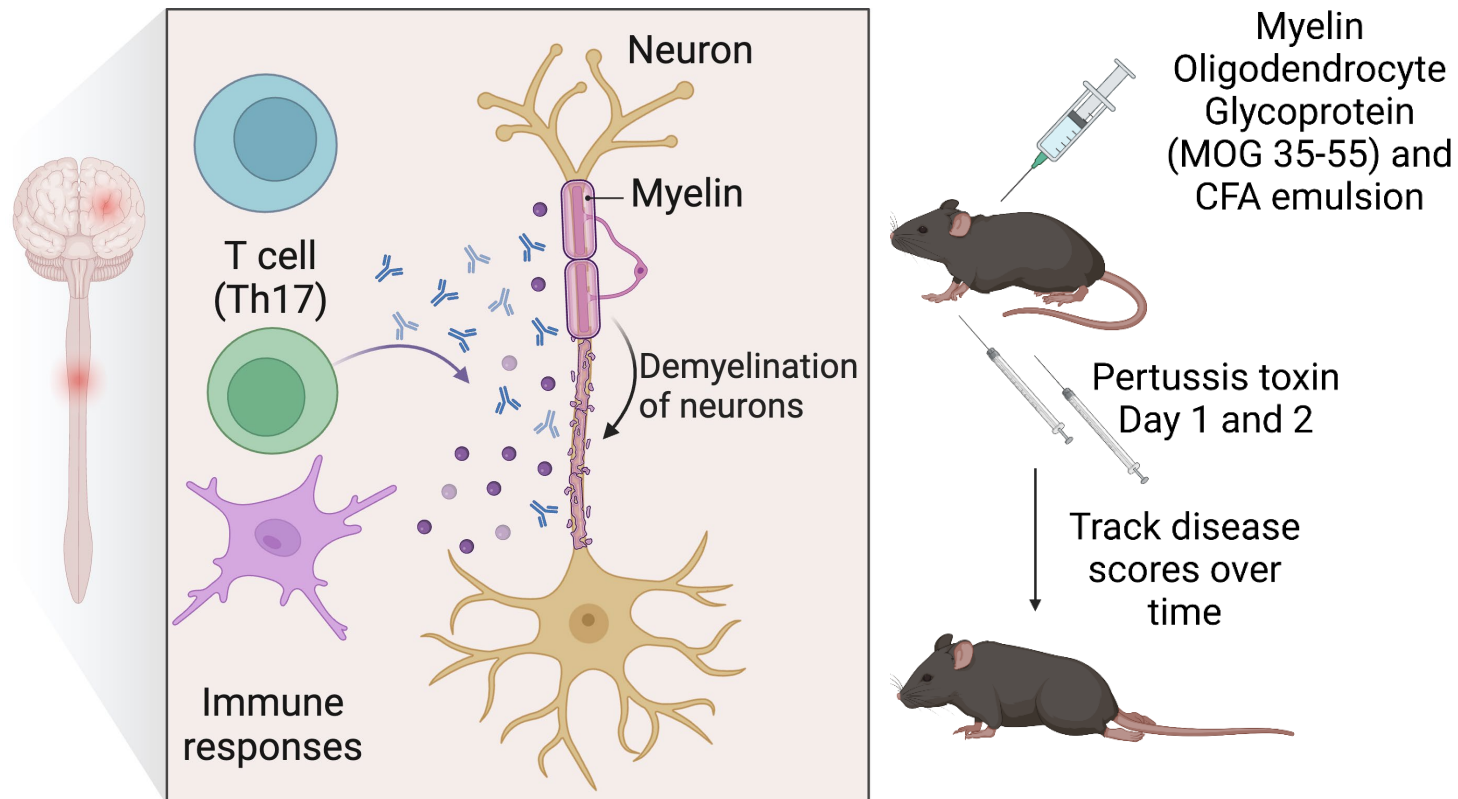


People with MS have different gut microbiota compositions

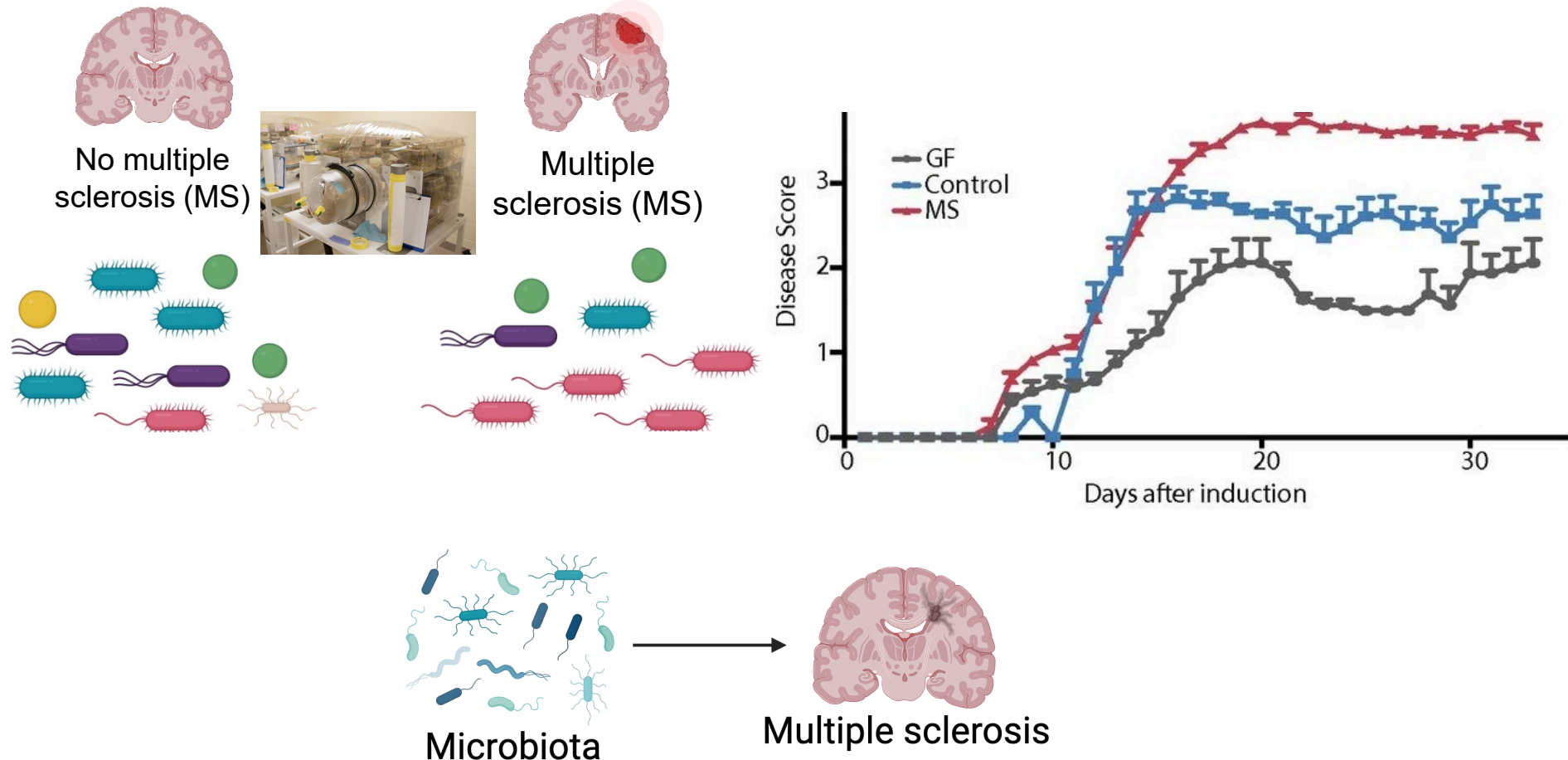
Is this a cause,
consequence, or contributor
to disease?

How can we study this beyond associations between microbiota and multiple sclerosis?

Mouse model of MS: Experimental Autoimmune Encephalomyelitis (EAE)

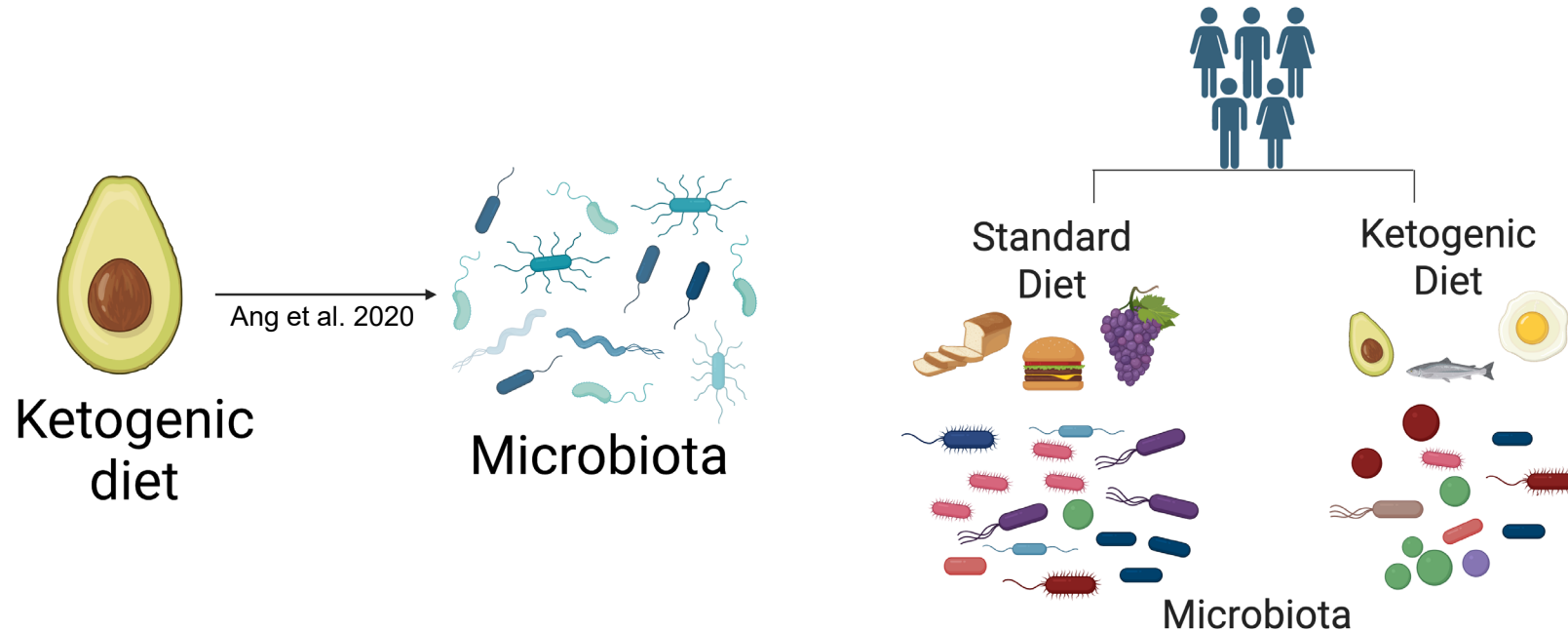


Causal link between microbiota and multiple sclerosis



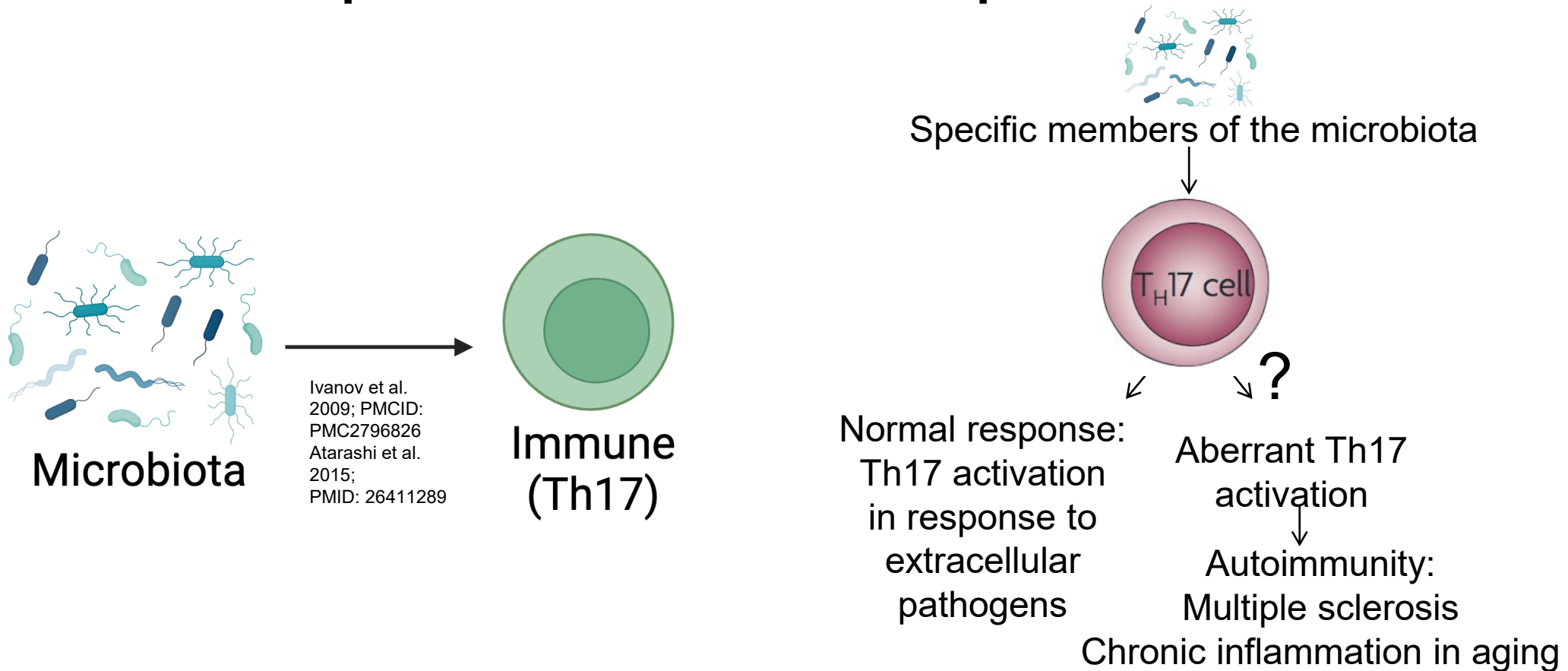
An MS-associated microbiota is sufficient to drive worsened disease outcomes

A ketogenic diet changes the microbiota



Ketogenic diets alter the composition of the microbiota

Connections between microbiota, immune responses, and multiple sclerosis

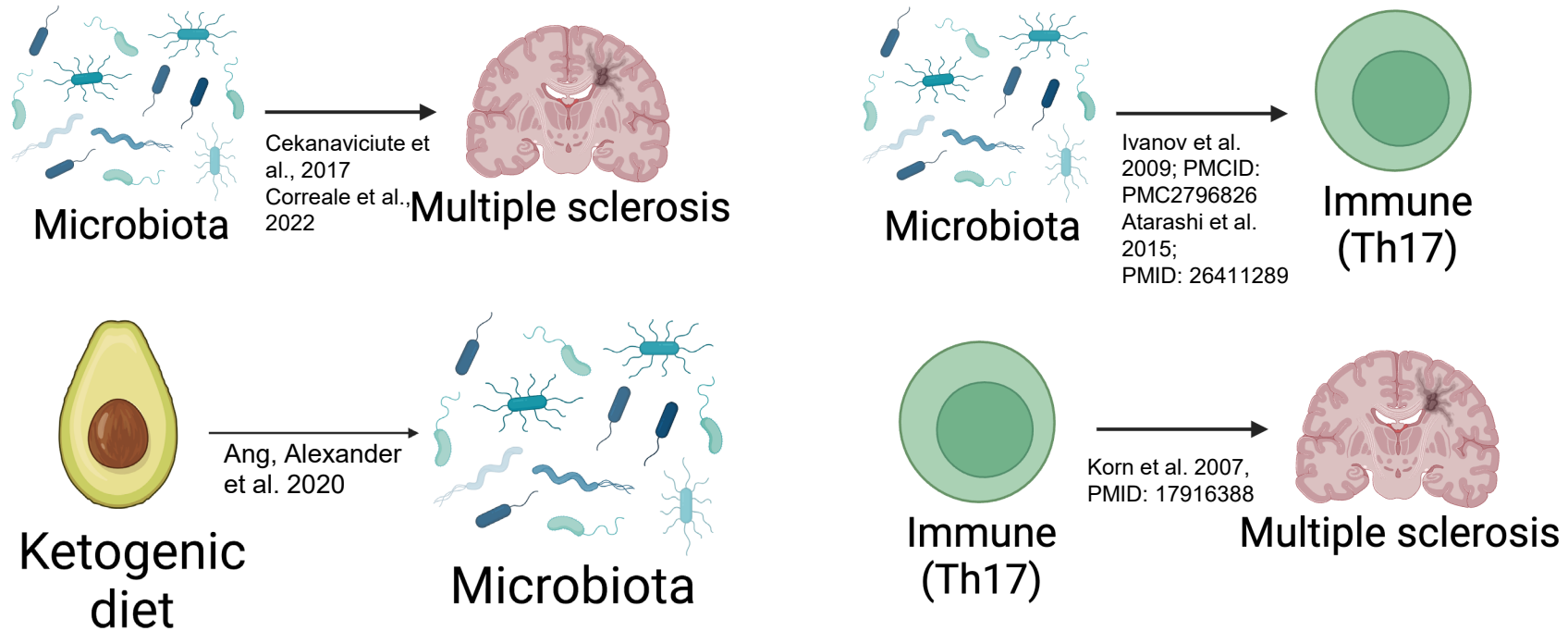


Keep in mind!

While we're talking about autoimmunity, think about how these findings may be involved in chronic inflammation in aging

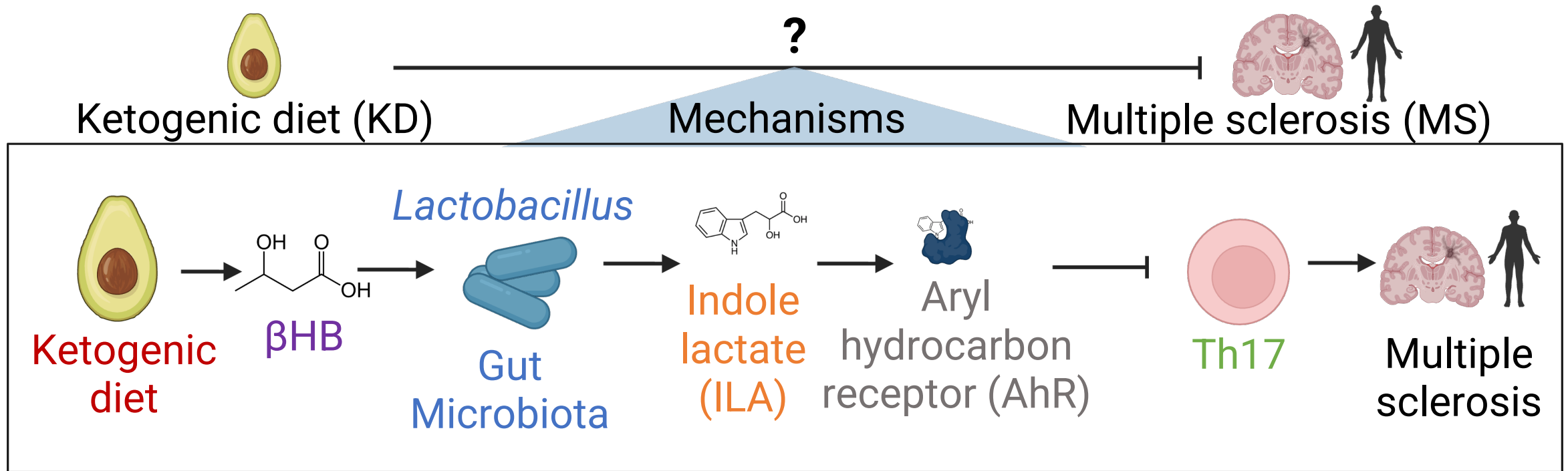
Putting it all together!

Connections between microbiota, diet, immune responses and multiple sclerosis



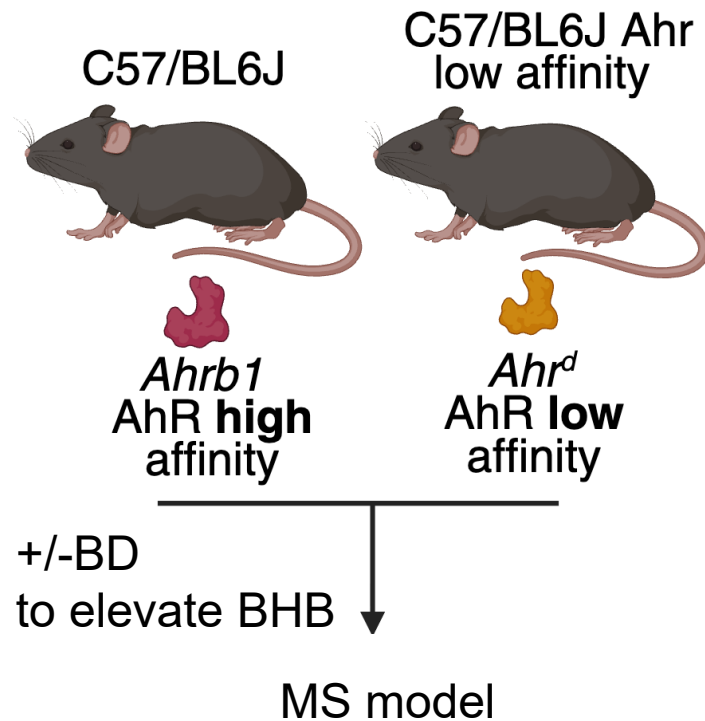
How do these interactions play out to mediate MS disease protection by a ketogenic diet?

How is a ketogenic diet protective during multiple sclerosis?



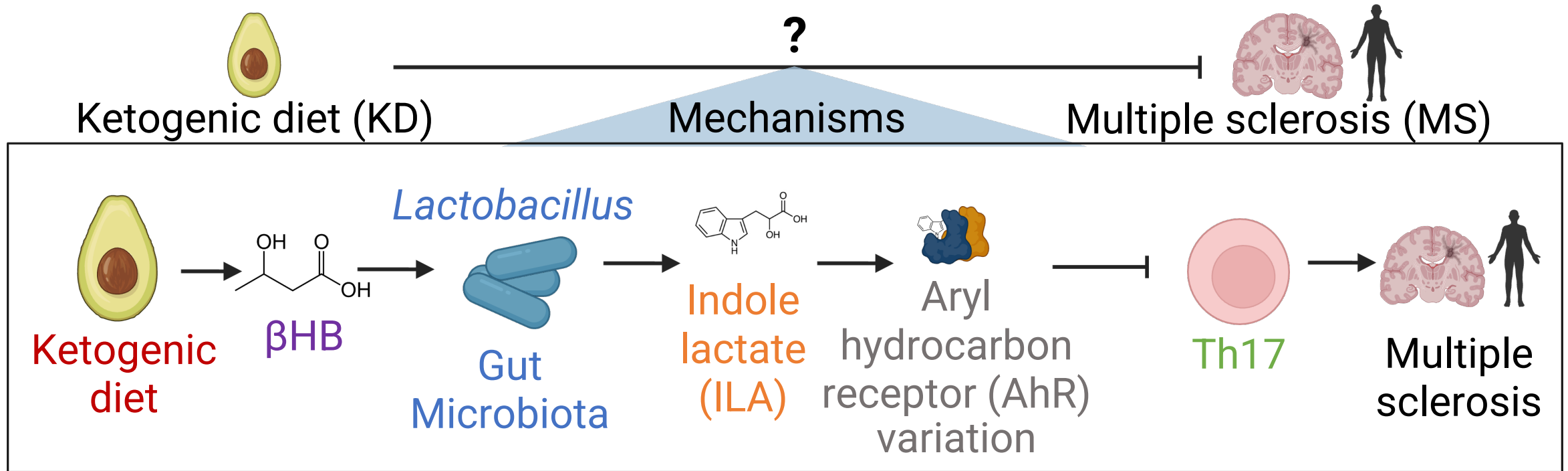
Does host genetic variation alter how immune cells interpret diet to impact disease outcomes?

Does genetic variation in *Ahr* alter EAE disease response to elevated BHB?



Data suggest that AhR affinity determines disease response to elevated BHB

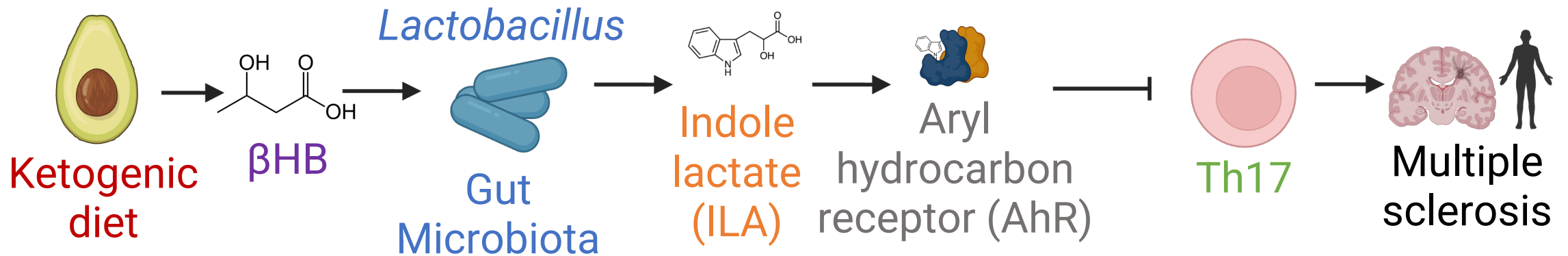
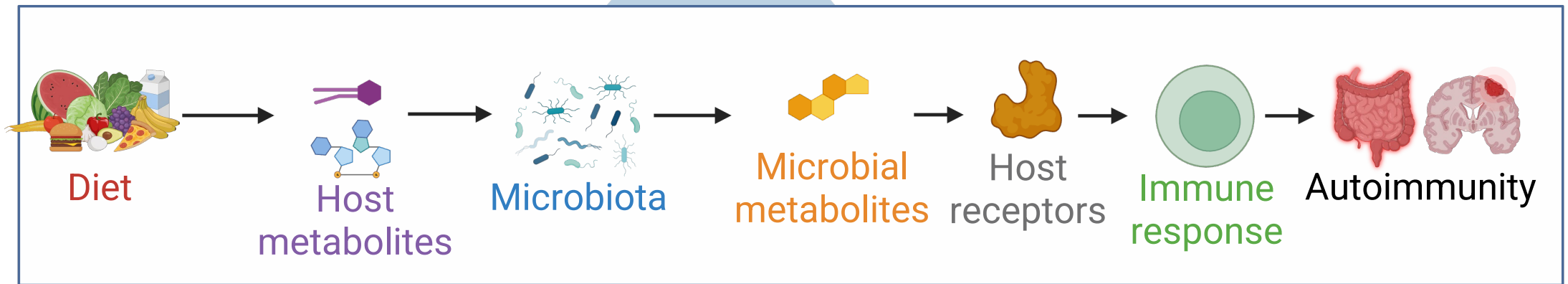
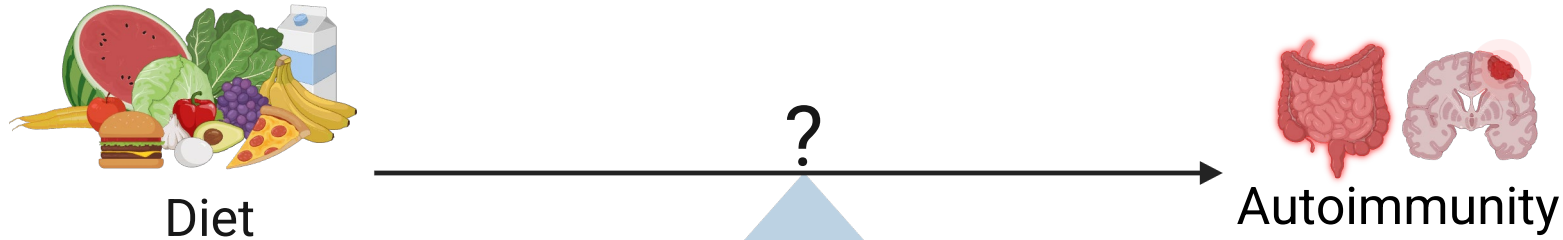
How is a ketogenic diet protective during multiple sclerosis?



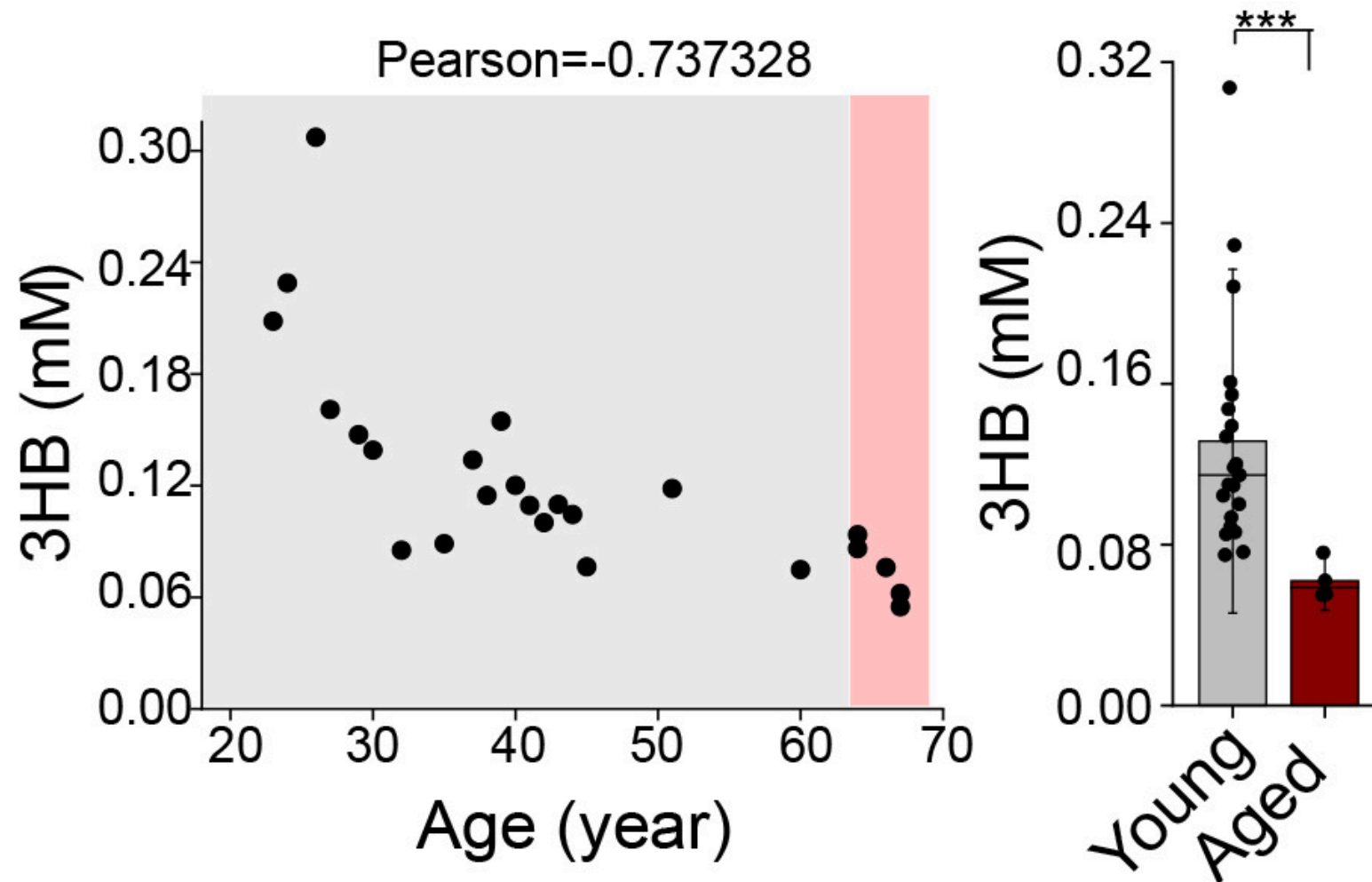
Challenge!

Can you think how these findings might connect to aging?

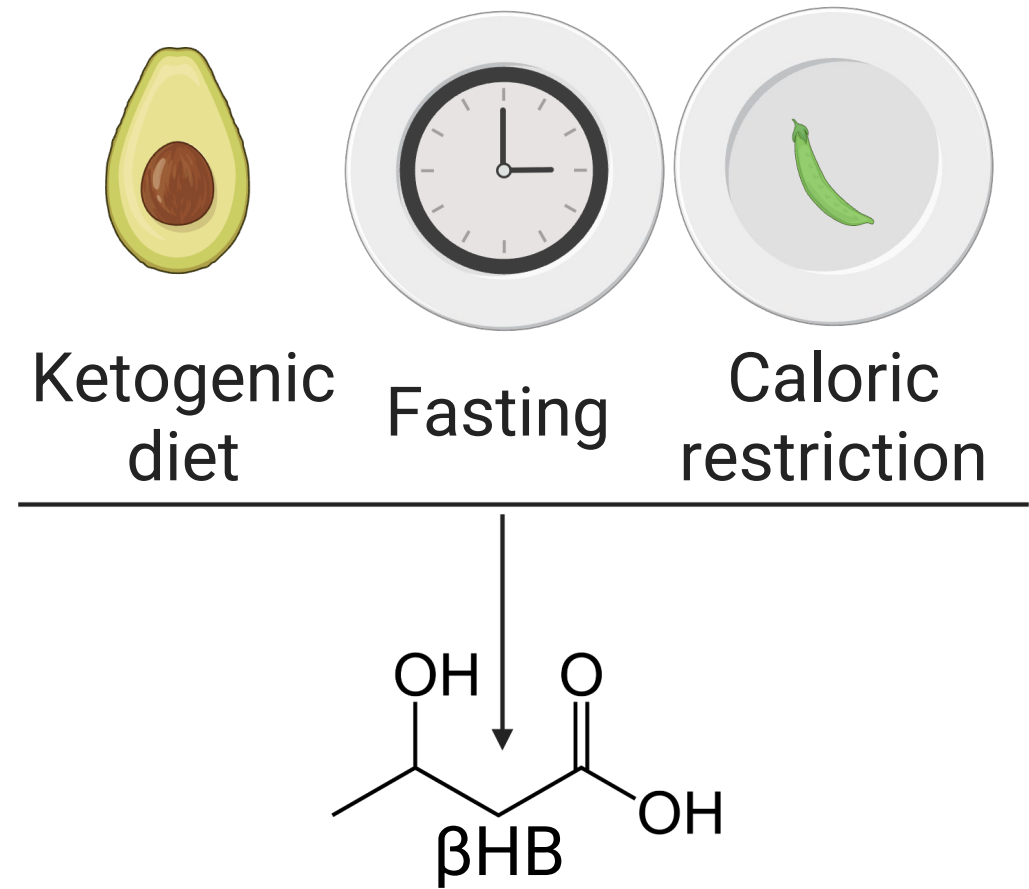
Broader themes



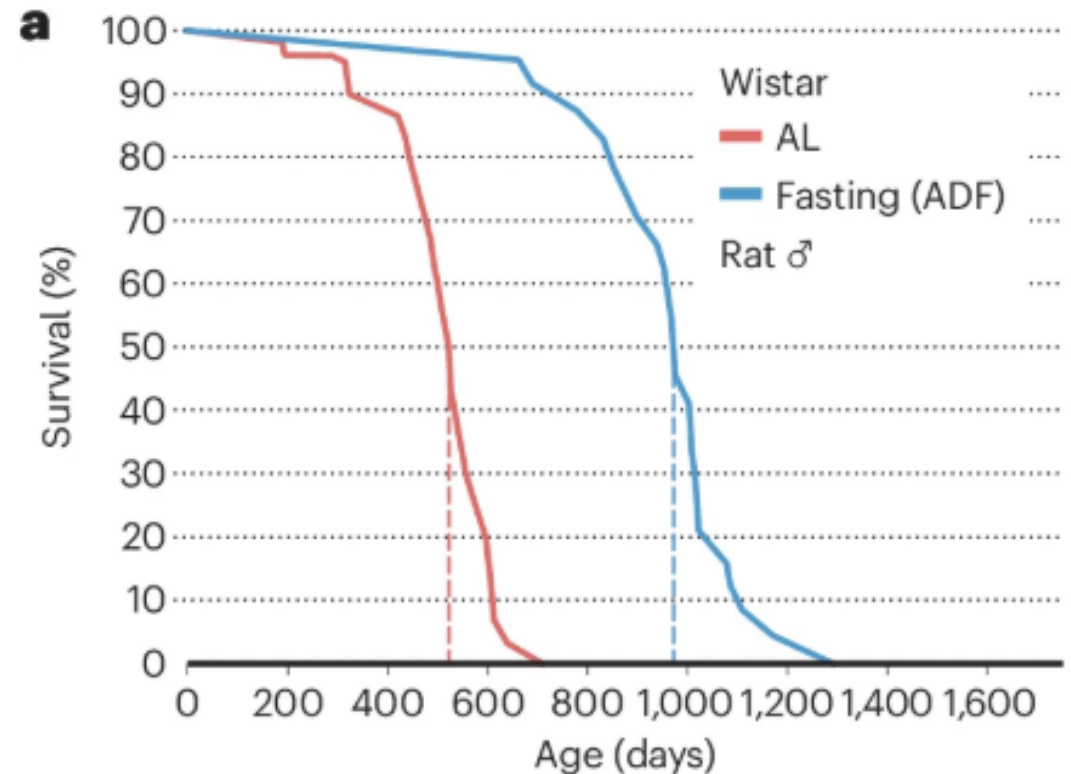
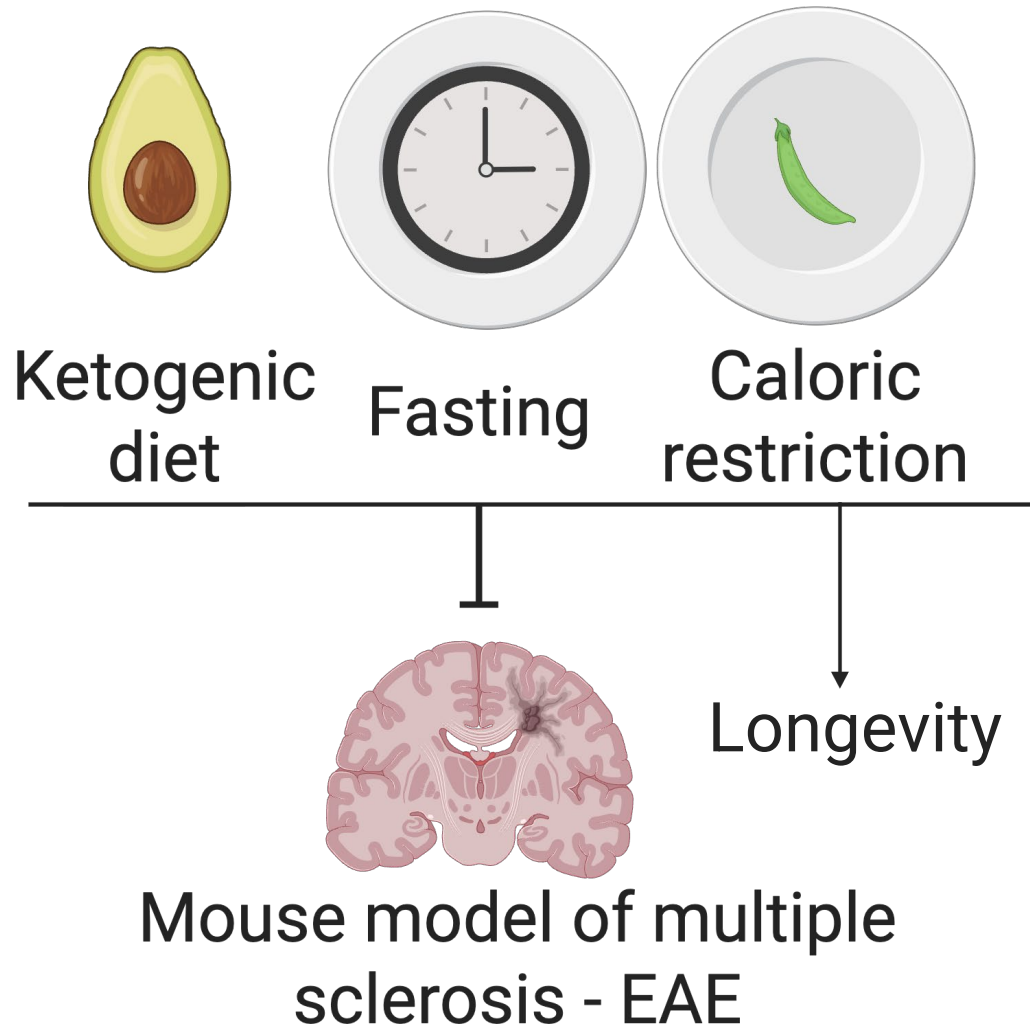
Ketone body BHB is decreased with age



Ketone body BHB
is increased with
diet interventions



Diets that increase BHB protect against MS models and... Increase lifespan

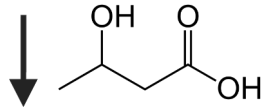


Schmauck-Medina et al 2026

<https://www.nature.com/articles/s43587-026-01091-5>

Putting it together

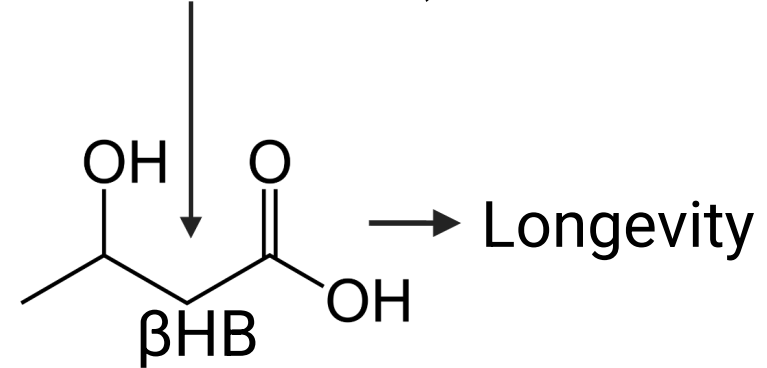
Older
individuals



β HB

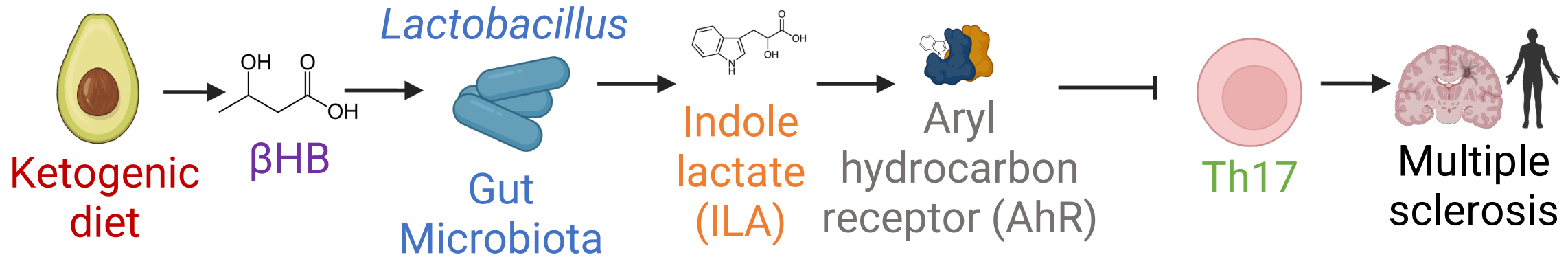


Diet (Eg. Ketogenic, Fasting,
caloric restriction)



1. BHB levels are decreased with age
2. Diets that elevate BHB increase lifespan

Putting it together



1. BHB levels are decreased with age
2. Diets that elevate BHB increase lifespan
3. BHB acts via the microbiota to decrease Th17 immune responses that drive MS and chronic inflammation

Challenge!

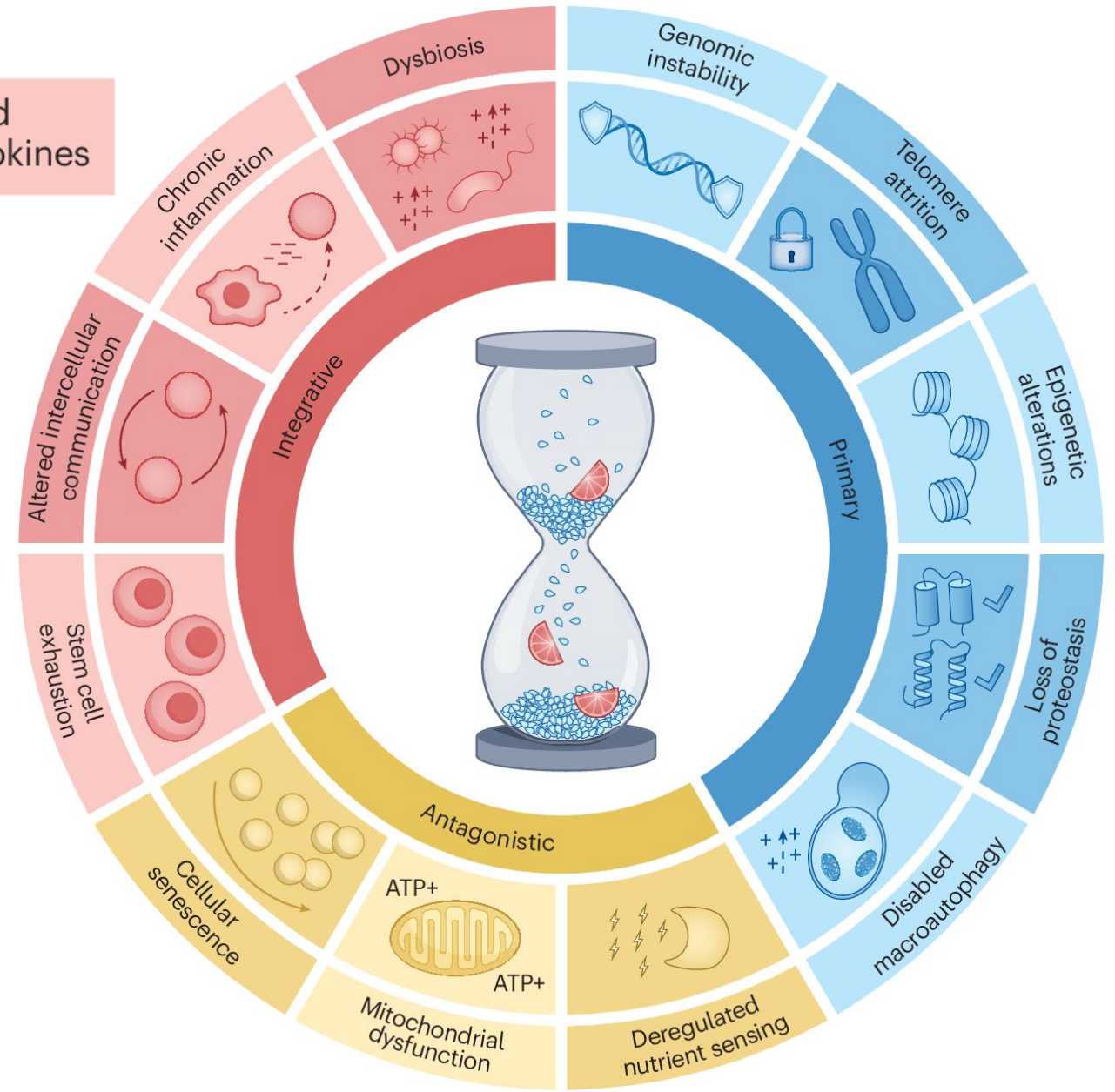
Can you think how these findings might connect to aging?

Propose a research direction

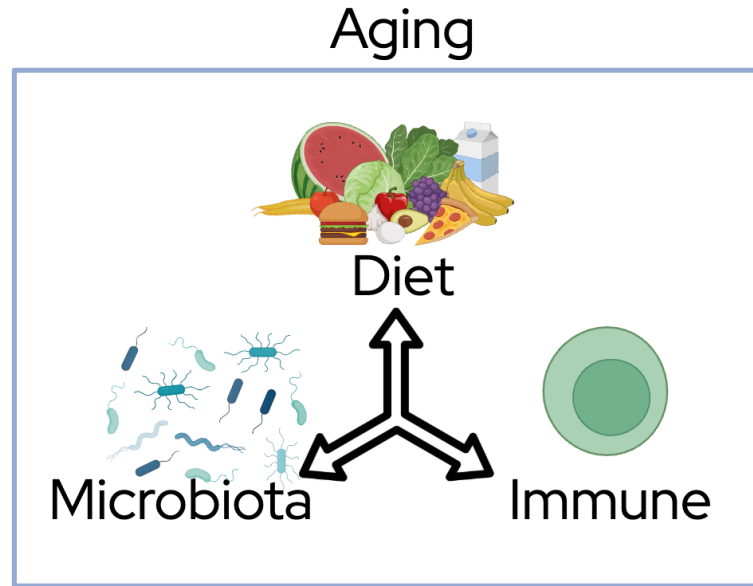
Diet restriction impact on chronic inflammation microbiota in aging

Microbiota transplanted from CR animals causes systemic health improvements

CR can attenuate the age-related increase in cytokines and chemokines

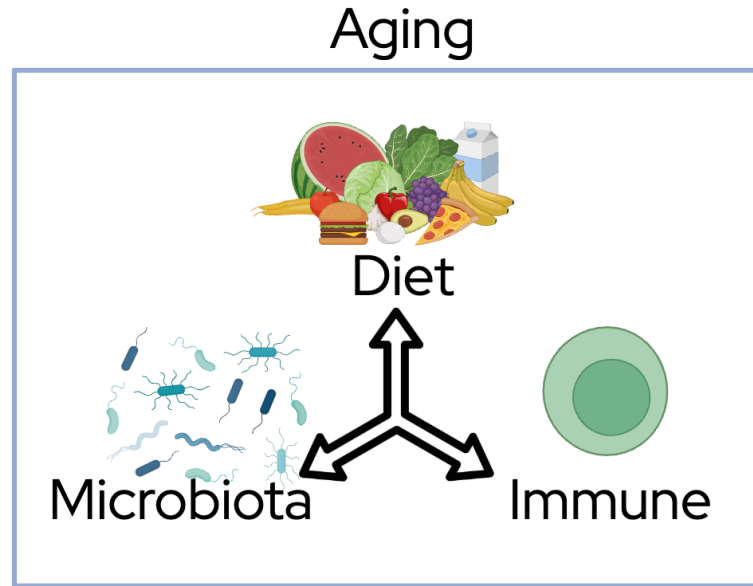


Zooming out: diet-microbiota-immune interactions in aging and where we're going



Discussion point: Based on what we discussed today can you think of ways to use what we know about diet, microbiota, and immune interactions to promote healthy aging?

Zooming out: diet-microbiota-immune interactions in aging and where we're going



Can we:

- Identify specific dietary components, host metabolites, microbial metabolites, specific microbes, diets that enrich or deplete specific microbes that alter immune responses?
- Leverage these insight to promote healthy aging?
- Understand who will respond (genetics?)?

Feedback

- Upon zoom exit
- Share your thoughts

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Learn how to prevent falls with this 7-week multi-factorial fall prevention program.

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Learn skills and strategies to better manage your health and help you to age well in this 6-week program.

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Learn skills and strategies to better manage your diabetes in this 6-week program.

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This 6-week walking program helps you to become more active, reduce pain from arthritis, and live better.

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Next for Age Well Series



Everyday Connections, Lasting Impact

Simple ways to build relationships
and strengthen our communities

Relationships are built through everyday moments—a conversation, a check-in, an invitation, a shared experience, or simply making someone feel welcome.

Join us during Social Connection Awareness Week as we explore how building relationships and creating opportunities for connection can strengthen individuals, organizations, and communities.

We'll explore how we can build relationships as individuals, how organizations can create opportunities for connection, and how stronger relationships can help create more connected communities.

Join us to learn, share ideas, and discover simple ways we can all build relationships and create lasting impacts.



Presenters:

Dr. Dessie Levy

Health Outreach and Prevention
Education (HOPE)

Harvey Padek

Milwaukee Area Health Education
Center

November 10
9:00-10:00am

[Register Here](#)



Next for Age Well Series



The way we think and talk about aging can shape how we experience it. Research shows that people with a positive view of aging live, on average, 7.5 years longer. In this engaging presentation, we'll explore how our beliefs, expectations, and attitudes about aging can influence our health, well-being, behaviors, and experiences as we grow older. We'll also look at how the messages we hear and share about aging can shape the way we see ourselves and others. Most importantly, we'll learn about **Reframing Aging**—a simple approach to challenging our assumptions and changing the way we think and talk about aging to create more positive possibilities for ourselves, our relationships, and our communities.



Presenter:
Jill Renken, Executive Director
Wisconsin Institute for
Healthy Aging

December 16
1:00-2:00pm

[Register Here](#)



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Q&A

